

*The Cambridge Companion to*  
**PEIRCE**

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# 1 Charles Sanders Peirce (1839–1914)

## I. INTRODUCTION

Charles Sanders Peirce was the founder of pragmatism – the view that our theories must be linked to experience or practice. His work is staggering in its breadth and much of it lies in a huge bulk of manuscripts and scraps. His few published papers include those of the 1870s series in *Popular Science Monthly* called “Illustrations of the Logic of Science,” most notably “How to Make Our Ideas Clear” and “The Fixation of Belief.” His Lowell Lectures in 1898 and 1903 and his Harvard Pragmatism Lectures in 1903 also contain essential material. But much of what is important is only now being published in the definitive chronological edition: *The Writings of Charles Sanders Peirce*.

Peirce was a difficult man and this was no doubt partly responsible for his being frozen out of what he most desired: a permanent academic position.<sup>1</sup> He worked instead for the U.S. Coast Survey – his scientific and mathematical endeavors there had a significant influence on his logic, on his work in statistical inference, and on his epistemology and metaphysics. He is perhaps best known today for his theory of truth and his semeiotics, as well as for his influence on William James and John Dewey. But because of the scattered nature of his work and because he was always out of the academic mainstream, many of his contributions are just now coming to light.

As Philstrom’s essay in this volume makes clear, one of the most important influences on Peirce was Kant. There is also a strong gust of medieval philosophy blowing throughout his writing. It is from here that Peirce gets his Scholastic realism, which is

set against the nominalism of the British empiricists. (See Boler's contribution to this volume.) But there are also clear affinities between Peirce and the British empiricists. For instance, Peirce credits Berkeley's arguments that all meaningful language should be matched with sensory experience as the precursor of pragmatism:

Berkeley on the whole has more right to be considered the introducer of pragmatism into philosophy than any other one man, though I was more explicit in enunciating it.<sup>2</sup>

It has seemed to many that, despite Peirce's claims to be putting together a grand 'architectonic' system, there are substantial tensions in his work. Gouge (1950) declared that there were two incompatible Peirces. One is a hard-headed epistemologist/philosopher of science and the other is a soft-headed religious thinker prone to metaphysical speculation. Misak and Anderson argue in this volume that the two Peirces can and ought to be brought together.

Whether or not Peirce's work can be brought into a harmonious whole, the reader of this collection will be struck by the enormous range of debates to which Peirce was a serious contributor. In this introductory essay, a whirlwind tour of those contributions will be conducted.<sup>3</sup>

## 2. THE PRAGMATIC MAXIM

Peirce took the 'spirit' of pragmatism to be captured in the following maxim: "we must look to the upshot of our concepts in order rightly to apprehend them" (CP 5.4). There is a connection between understanding a concept and knowing what to expect if sentences containing the concept were true or false. If a concept has no such consequences, then it lacks an important dimension which we would have had to get right were we to fully understand it.

This criterion of legitimacy lies at the heart of Peirce's work. Not only does he criticise certain philosophical positions as pragmatically spurious, but he arrives at many of his own views by focussing on the consequences of, say, "*P* is true" or "*x* is real." The pragmatic maxim, that is, serves both as a standard for determining which expressions are empty and as a methodological principle for formulating philosophical theories of truth, reality, etc.

In “How to Make Our Ideas Clear,” Peirce publically unveils pragmatism and sets out the maxim as follows:

Consider what effects, which might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these is the whole of our conception of the object. (W 3, 266)

Peirce suggests in this paper that knowing the meaning of an expression is exhausted by knowing its “practical” effects, which he characterizes as “effects, direct or indirect, upon our senses” (W 3, 266). These effects can be described by conditionals of the sort: if you were to do A, you would observe B. He says:

We come down to what is tangible and practical, as the root of every real distinction of thought, no matter how subtle it may be; and there is no distinction of meaning so fine as to consist in anything but a possible difference of practice. (W 3, 265)

As an example of how the pragmatic maxim operates, Peirce examines the meaning of “this diamond is hard.” He says that it means that if you try to scratch it, you will find that “it will not be scratched by many other substances” (W 3, 266).

Notice that the practical effect here is formulated as an indicative conditional, as a matter of what *will* happen. Peirce sees that if he formulates practical effects in this manner, it makes little sense to describe a diamond which is in fact never scratched as being hard. He seems to be content with this conclusion in “How to Make Our Ideas Clear.” But when he considers the matter later, he insists on a subjunctive formulation. He chides himself for making the nominalist suggestion that habits, dispositions, or “would-bes” are not real. A Scholastic realism about dispositions and subjunctive conditionals must be adopted: a disposition is more than the total of its realizations and a subjunctive conditional can be correct or incorrect, whether or not the antecedent is fulfilled. The practical effects which concern pragmatism are those which would occur under certain conditions, not those which will actually occur. His considered view about the unscratched diamond is that “it is a real fact that it *would* resist pressure” (CP 8.208).

This was not Peirce’s only amendment to the pragmatic maxim. In his struggle to arrive at a suitable account of understanding,

we sometimes find him suggesting something very similar to what we find later in logical positivism. The positivists' criterion effectively restricted meaning to statements about physical objects – to statements about that which is directly observable or verifiable. Statements about anything else – metaphysics or ethics for example – were literally meaningless. But, in further improvements to the pragmatic maxim, Peirce makes it clear that he is concerned to give a much more generous account of what is involved in understanding.

First, Peirce himself inclined toward metaphysics and he did not want to do away with it altogether. In metaphysics “one finds those questions that at first seem to offer no handle for reason’s clutch, but which readily yield to logical analysis” (CP 6.463). Metaphysics, “in its present condition,” is “a puny, rickety, and scrofulous science” (CP 6.6). But it need not be so, for many of its hypotheses are meaningful and important. It is the job of the pragmatic maxim to sweep “all metaphysical rubbish out of one’s house. Each abstraction is either pronounced to be gibberish or is provided with a plain, practical definition” (CP 8.191).

Second, Peirce frequently claims that the pragmatic maxim captures only *a part* of what it is to know the meaning of an expression. In order to grasp a term, he argues, a threefold competence is required. The interpreter must be able to

- (1) pick out what objects the term refers to or know the term’s denotation,
- (2) give a definition of the term or know the term’s connotation,  
and
- (3) know what to expect if hypotheses containing the term are true.

He takes these three aspects of understanding to spell out completely what someone must be able to do if she grasps a concept or knows the meaning of an expression.

A much-neglected implication of this view is that definition is not the most important project for philosophers: “Definition can no longer be regarded as the supreme mode of clear Apprehension” (MS 647, p. 2). That is, we must be alert to the fact that what Peirce arrives at when he applies the pragmatic maxim to a concept is not



a definition of the concept, but rather, a pragmatic elucidation. He examines a concept through its relations with practical endeavors. That is one route to understanding a concept, the route Peirce takes as his own contribution to debates about what it is to understand something.

Third, Peirce tries to divert the philosopher from thinking that sensory experience is all-important. A perceptual belief, he argues, is merely a belief that is compelling, surprising, impinging, unchosen, involuntary, or forceful. Such beliefs need not arise from the senses. Peirce, unlike his verificationist successors, wants all hypotheses to be exposed to the pragmatic maxim; he does not exempt formal (or “analytic”) sentences. Logical and mathematical hypotheses can meet the criterion because there is a kind of experience relevant to them – you can make manipulations in proofs or diagrams and observe unexpected results. And some metaphysical hypotheses meet the criterion as well. They must have consequences, Peirce argues, for ordinary, everyday experience. See the contributions here from Wiggins and Misak for a discussion of how mathematics and morals fit in this picture.

### 3. TRUTH AND REALITY

Peirce applies the pragmatic maxim to the debate on the nature of truth and reality. The philosopher must look to our practices and see what account of truth would be best suited for them: “We must not begin by talking of pure ideas, – vagabond thoughts that tramp the public roads without any human habitation, – but must begin with men and their conversation” (CP 8.112). As Wiggins’s essay in this volume makes so clear, the upshot is a subtle and compelling view. Peirce’s route to the concept of truth is through belief, inquiry, and deliberation: the practices linked to truth and to the seeking of truth. Peirce suggests that we concern ourselves with propositions we have arrived at, expressed, affirmed, or believed and those we shall arrive at, express, affirm, or believe.<sup>4</sup> By making this our focus, we will discover something about what it is at which we aim: truth. This does not mean that truth is an epistemological notion. Rather, this exemplifies one route to finding out something about truth: the route through our epistemological practices of believing, inquiring, and deliberating.

The correspondence theory, Peirce argues, can have no consequences for our practices. It holds that a true hypothesis is one which is in agreement with an unknowable “thing-in-itself.” But:

You only puzzle yourself by talking of this metaphysical “truth” and metaphysical “falsity” that you know nothing about. All you have any dealings with are your doubts and beliefs. . . . If your terms “truth” and “falsity” are taken in such senses as to be definable in terms of doubt and belief and the course of experience. . . . well and good: in that case, you are only talking about doubt and belief. But if by truth and falsity you mean something not definable in terms of doubt and belief in any way, then you are talking of entities of whose existence you can know nothing, and which Ockham’s razor would clean shave off. Your problems would be greatly simplified, if, instead of saying that you want to know the “Truth,” you were simply to say that you want to attain a state of belief unassailable by doubt. (CP 5.416)

Peirce’s thought here is that if one offered an account of “*P* is true” in terms of its consequences for doubt, belief, and perceptual disappointment, one would be offering a pragmatic elucidation of truth. That, if it were a correct specification of the consequences, would tell us something about truth. But a definition of truth which makes no reference to belief, doubt, and experience is empty. It is a mere definition – useful only to those who have never encountered the notion of truth.

Peirce sometimes states this objection to the correspondence theory by labeling it a “transcendental” account of truth (CP 5.572). Such accounts regard truth “as the subject of metaphysics exclusively” – spurious metaphysics, not pragmatically legitimate metaphysics. On the correspondence definition, truth transcends (and thus has no consequences for) belief, experience, and inquiry. He says:

The *Ding an sich* . . . can neither be indicated nor found. Consequently, no proposition can refer to it, and nothing true or false can be predicated of it. Therefore, all references to it must be thrown out as meaningless surplusage. (CP 5.525)

The correspondence theory has it that there is an unbridgeable gap between a belief which is supported by experience and a belief that corresponds to reality. We could have the best possible evidence for a hypothesis and yet that hypothesis might fail to be true. The

correspondence theory does not tell us what we can expect of a true hypothesis and so it is not capable of guiding us in our actions and inquiries. If truth is the aim of inquiry, then the correspondence theory leaves inquirers completely in the dark as to how they should conduct their investigations. The aim is not, Peirce says, “readily comprehensible” (CP 1.578). How could anyone aim for a sort of truth that transcends experience? How could an inquirer come up with a means for achieving that aim?

In anticipation of certain kinds of minimalist accounts of truth, Peirce focuses on what he thinks the transcendentalist has lost sight of – the unseverable link between truth on the one hand and assertion (and belief) on the other. To assert *P* is to assert that *P* is true and to assert that *P* is true is to assert *P*. (Alternatively, to believe *P* is to believe that *P* is true and to believe that *P* is true is to believe *P*.) The notion of truth is bound up with the notions of assertion and belief. But Peirce takes a step further than the minimalist. Once we see the internal connection between truth and assertion/belief, we must look to the practice of assertion/belief and to the commitments incurred in it, so that we can say something more. What we know about truth is that it is what we aim at when we assert, believe, or deliberate. Were we to forever achieve all of our local aims in assertion, belief, and deliberation (prediction, explanatory power, and so on), then the belief in question would be true. There is nothing over and above the fulfillment of those local aims, nothing metaphysical, to which we aspire. Were we to get a belief which would be as good as it could be, that would be a true belief.

Peirce sums up the matter thus: “A true proposition is a proposition belief in which would never lead to . . . disappointment” (CP 5.569). This is an account of what we can expect of a true belief: if we were to inquire into *P*, we would find that *P* would encounter no recalcitrant experience. We can predict that if we were diligently to inquire, it would not, in the end, be overturned by experience or argument. An alternative way of making the point is to say that we would expect the following: if inquiry with respect to *P* were to be pursued as far as it could fruitfully go (i.e., far enough so that the hypothesis would no longer be improved upon), *P* would be believed. A true belief is a permanently settled or indefeasible belief.

Peirce’s view of reality is connected to his view of truth in that he often says that reality is the “object” of true beliefs – it is what

true beliefs are about. Chris Hookway has recently improved our understanding of how Peirce saw this connection and the reader is advised to turn to his contribution to this volume for a summary of that new understanding.

#### 4. SEMEIOTICS

Peirce was a pioneer in semeiotics. Not only is he responsible for the distinction between type ('human' as a general term) and token ('human' as applied to various individuals), but he developed a complex map of sixty-six kinds of signs, from which sprout 59,049 varieties. The details of this map are still of great interest to semeioticians, but they will not concern me here. Short's and Skagedsted's papers in this volume convey many of the important points. Short shows how Peirce eventually abandoned his early theory of signs and substituted for it a much less paradoxical one and Skagedsted shows how Peirce's theory of signs connects to issues about intentionality and the philosophy of mind.

It is important to notice for this broad overview of Peirce's work that his theory of signs has interpretation at its center. Peirce holds that the sign-referent relation is not able, on its own, to sustain a complete account of representation. Representation is triadic: it involves a sign, an object, and an interpreter. Each aspect of this representation relation corresponds to one of the elements in Peirce's division of signs into icons, indices, and symbols. And in each of these, one or another aspect of the linguistic competence alluded to in Section 2 is most prominent.

Icons are signs that exhibit their objects by virtue of similarity or resemblance. A portrait is an icon of the person it portrays and a map is an icon of a certain geographical area. Peirce argues that the meaning of iconic signs lies mostly in their connotation: what makes a painting or a map an icon is that its qualities or attributes resemble the qualities or attributes of its object.

Indices are signs that indicate their objects in a causal manner: an index "signifies its object solely by virtue of being really connected with it" (CP 3.360). A symptom is an index of a disease and smoke is an index of fire. The essential quality of an index is its ability to compel attention. A pointing finger, a knock on the door, or a

demonstrative pronoun, such as ‘there’ or ‘that,’ draws attention to its object by getting the interpreter to focus on the object. So an index, by being object-directed, has its denotation or extension as its “most prominent feature” (CP 8.119). An index picks out or indicates its object; it points to ‘that, that, and that’ as its extension.

A symbol is a word, hypothesis, or argument which depends on a conventional or habitual rule: a symbol is a sign “because it is used and understood as such” (CP 2.307). Symbols have “principle” or pragmatic meaning; they have “intellectual purport.”

Peirce contrasts pragmatic meaning with “internal” meaning (which he relates to icons and connotation) and with “external” meaning (which he relates to indices and denotation). He suggests that the pragmatic meaning of symbols has to do with a “purpose” (CP 8.119). A symbol has pragmatic meaning because if the utterer knows how interpreters habitually interpret a sign, she can use the sign to cause a specific effect in the interpreter. And Peirce calls this effect the “interpretant” of the sign. If, for instance, I write ‘dog,’ I intend the sign to cause a certain effect in the interpreter (perhaps I want the interpreter to think of a dog), whereas if I write ‘odg,’ I do not, as ‘odg’ is not a conventional sign. Or if I assert ‘That bridge has a loose plank,’ I might want the interpreter to be careful when crossing the bridge. Peirce characterizes an assertion as the attempt to produce a disposition in an interpreter; it is “the deliberate exercise, in uttering the proposition, of a force tending to determine a belief in it in the mind of an interpreter” (NE 4, 249).

Notice that if pragmatic meaning is about this sort of effect (having an effect on the beliefs of the interpreter), it is no longer about “effects, direct or indirect, upon our senses.” Pragmatic meaning, rather, involves consequences for action or thought. In 1905 we find Peirce offering this version of the pragmatic maxim:

The entire intellectual purport of any symbol consists in the total of all general modes of rational conduct which, conditionally upon all the possible different circumstances and desires, would ensue upon the acceptance of the symbol. (CP 5.438)

Peirce thinks that “rational conduct” will eventually manifest itself in a modification of the interpreter’s disposition to behave. And “rational conduct” includes the conduct of one’s thought.

This twist in the pragmatic maxim – that the acceptance of a hypothesis must have effects on an interpreter’s train of thought – coincides with a development in the early 1900s in Peirce’s theory of signs. Here Peirce arrived at a complex theory of interpretants and he locates pragmatic meaning within this theory.

He distinguishes three types of interpretants. The “immediate” interpretant is the fitness of a sign to be understood in a certain way; the “dynamical” interpretant is the actual effect a sign has on an interpreter; and the “final” interpretant is the effect which eventually would be decided to be the correct interpretation. Pragmatic meaning, Peirce says, lies in a kind of dynamical interpretant: the “ultimate logical interpretant”. A sign, Peirce argues, sparks a subsequent sign (an interpretant) in the mind of the interpreter, and since an interpretant is itself a sign, an infinite chain of interpretation, development, or thought is begun. Peirce stops the regress by introducing the notion of an “ultimate logical interpretant” or a “habit-change”. He follows Alexander Bain in taking a belief to be a habit or a disposition to behave. And so this new habit is a belief or a modification of the interpreter’s tendencies towards action. The pragmatic meaning of an expression, according to Peirce’s theory of signs, is the action (which includes the action of subsequent thought, and which ends in a disposition to behave) that arises after an interpreter accepts it.

## 5. THEORY OF INQUIRY

The notion of inquiry occupies a central place in Peirce’s thought. Philosophy, he insisted, must get along with other branches of inquiry. Indeed, the following motto “deserves to be inscribed upon every wall of the city of philosophy: Do not block the path of inquiry” (CP 1.135).

In “The Fixation of Belief,” Peirce characterizes inquiry as the struggle to rid ourselves of doubt and achieve a state of belief. An inquirer has a body of settled beliefs – beliefs which are, in fact, not doubted. These beliefs, however, are susceptible to doubt, if it is prompted by some “positive reason,” such as a surprising experience (CP 5.51). We have seen that Peirce takes experience to be that which impinges upon us – experience, he says, teaches us “by practical

jokes, mostly cruel" (CP 5.51). When experience conflicts with an inquirer's belief, doubt is immediately sparked. And doubt "essentially involves a struggle to escape" (CP 5.372n2). Inquiry is that struggle to regain belief. The path of inquiry is as follows: belief – surprise – doubt – inquiry – belief.

Peirce does not take these points to be mere observations about human psychology; he thinks that psychology should be kept out of logic and the theory of inquiry. Doubt and belief, although they do have psychological aspects, such as making the inquirer feel comfortable or uncomfortable, are best thought of in terms of habits. A "belief-habit" manifests itself in an expectation: if we believe *P*, then we habitually expect the consequences or the predictions we derive from *P* to come about when the appropriate occasion arises. Inquirers are thrown into doubt when a recalcitrant experience upsets or disrupts a belief or expectation.

There are three stances an inquirer may have with respect to a hypothesis: believe it, believe its negation, or consider the matter open to inquiry. Only in the third stance are we left without a habit of expectation and thus it is agnosticism, which is the undesirable state. That is, doubting whether a hypothesis is true is not equivalent to believing that it is false – rather, doubting is not knowing what to believe. What is wrong with this state is that it leads to paralysis of action. An inquirer has some end in view, and two different and inconsistent lines of action present themselves, bringing the inquirer to a halt: "he waits at the fork for an indication, and kicks his heels . . . A true doubt is accordingly a doubt which really interferes with the smooth working of the belief-habit" (CP 5.510). Doubt is not knowing how to act. And action, for Peirce, includes action in diagrammatic and thought experiments.

Peirce's theory of inquiry has a certain kind of empiricism at its core. Inquirers aim for beliefs that fit with experience, in Peirce's broad sense of that word. When we replace a belief which has come into doubt, that new belief stands up to experience better than the old one. So we accept it, act on it, and think for the time being that it is true. But we know very well that it eventually might be overthrown and shown by experience to be false. Peirce adds the more contentious claim that what we aim for is permanently settled belief. When we have a belief that would forever withstand the tests

of experience and argument, he argues that there is no point of refusing to confer upon it the title "true." Only a spurious desire for transcendental metaphysics will make one want to distinguish perfectly good beliefs from true beliefs.

But in "The Fixation of Belief" Peirce says that a permanently fixed belief, *no matter how it is fixed*, is true. A problem of course looms large here. If beliefs could be settled by a religious authority, or by a charismatic guru, or by astrology, so that they were permanently resistant to doubt, his account would give us no reason for criticising them. Peirce tries to solve this problem by considering various methods of fixing belief and arguing that it is hard *really* to end the irritation of doubt.

The method of tenacity, or holding on to your beliefs come what may, will not work, he says, because doubt will be sparked when one notices that the opinions of others differ from one's own. Beliefs produced by the method of authority (fixing beliefs according to the dictates of a state or religion) will similarly be subject to doubt when one notices that those in other states or religions believe different things. Beliefs produced by the a priori method (adopting beliefs which are agreeable to reason) will eventually be doubted when it is seen that what we take as being agreeable to reason shifts like a pendulum and is really a matter of intellectual taste. None of these methods will produce permanently settled belief because they have a self-destructive design: the beliefs settled by them eventually would be assailed by doubt.

The agent of destruction which Peirce sees in each of the specious methods seems to be a purported fact about our psychological makeup: if an inquirer believes a hypothesis, and notices that other inquirers do not believe it, that first inquirer will be thrown into doubt. This impulse, Peirce says, is "too strong in man to be suppressed, without danger of destroying the human species" (W 3, 250). If this psychological hypothesis expresses a universal fact about us, then the unsatisfactory methods will indeed prove unreliable in the long run. They will not produce permanently settled belief and we should refrain from using them.

The psychological hypothesis, however, seems to be false. I have suggested (Misak 1991) that the way to resolve this difficulty is to focus on Peirce's thought that being responsive to or answerable to something is one of the "essentials of belief, without which it would



not *be* belief" (MS 673, p. 11). The aim of inquiry is to get beliefs which are not merely fixed, but fixed in such a way that they fit with and respond to the evidence. They must be, in Peirce's words, "caused by circumstances not extraneous to the facts." Wiggins offers us here a ground-breaking analysis of this thought of Peirce's and of how it need not lead to a uniformly causal picture.<sup>5</sup> The requirement can be met by all sorts of belief.

There are two other cornerstones to Peirce's theory of inquiry: critical commonsensism and fallibilism. Critical commonsensism is a position about how we ought to regard those beliefs which are settled. It holds that there are many things which inquirers do not doubt and that inquiry must start with a background of beliefs which are not doubted. A body of settled belief is presupposed for the operation of inquiry in that there has to be something settled for surprise to stir up.

This doctrine arose as Peirce's response to his conception of Descartes' project – a systematic attempt to bring into doubt all hypotheses about which error is conceivable. Peirce argued that such doubts would be "paper" doubts. They are not genuine and they cannot motivate inquiry. The mere possibility of being mistaken with respect to what one believes is never a reason to revise those beliefs. Any of our beliefs might be false, but it would be absurd to doubt them all because of this. If we did, we would not possess a body of stable belief by which to judge new evidence and hypotheses, and hence, we would block the path of inquiry. We can doubt one belief and inquire, but we cannot doubt all of our beliefs and inquire. Peirce's point against Descartes is that if we were to set the requirements on knowledge as high as Descartes does, we would have nothing left to go on:

... there is but one state of mind from which you can "set out," namely, the very state of mind in which you actually find yourself at the time you do "set out" – a state in which you are laden with an immense mass of cognition already formed, of which you cannot divest yourself if you would ... Do you call it doubting to write down on a piece of paper that you doubt? If so, doubt has nothing to do with any serious business. (CP 5.416)

So Peirce is not concerned with sceptical questions about foundations for certainty and his arguments are not addressed to those who are.

But he is also a “contrite fallibilist,” holding that all our beliefs can be doubted; that is, that none of them are certain. There is a tension here: how can it be that all our beliefs are fallible, or subject to doubt, but nevertheless, some of our beliefs must not be doubted if inquiry is to be possible?

Peirce’s reconciliation of fallibilism with critical commonsensism is made in terms of his notion of truth. He thinks that many of our beliefs are indeed those which would survive inquiry, but since we cannot know for any given belief whether or not *it* would be indefeasible, we cannot know that it is true. That is, we do not know if the antecedent of this subjunctive conditional is fulfilled: “if inquiry were pursued as far as it could fruitfully go, then *P* would be believed.” Inquiry may or may not have been pursued far enough with respect to *P*, and so we cannot have certainty with respect to any belief.

But the uncertainty or fallibility that in principle accompanies every one of our beliefs does not mean that we should doubt our settled beliefs. “Practically speaking,” he says, many things are “substantially certain” (CP 1.152); we do not doubt them. While “it is possible that twice two is not four . . . it would be difficult to imagine a greater folly than to attach any serious importance to such a doubt” (CP 7.108).

“Substantial certainty,” however, is different from the “absolute certainty” which would result from knowing that we have permanently settled belief. We may have this settled opinion about many questions, but we must not infer that we “perfectly know when we know.” Again, we cannot know that any given hypothesis is permanently settled upon or true – we cannot have absolute certainty. Nevertheless, in every state of intellectual development and information, there are things that seem to us sure “so that even though we tell ourselves that we are not sure, we cannot clearly see how we fail of being so” (CP 4.64). Practically, we must treat some hypotheses as certain. Settled beliefs must be regarded as infallible, in the sense that the inquirer does not doubt them for the purposes of inquiry; science has “established truths” to be used as premisses in further deliberation (CP 1.635). In this sense, we do not doubt what we believe, but in another sense, each of our beliefs can, or could, be doubted.

Peirce's theory of inquiry provides the key to understanding his view of the growth of knowledge and the progress of science. His position anticipates Neurath's metaphor of building a boat at sea, replacing defective planks one by one. Science, Peirce says,

is not standing upon the bedrock of fact. It is walking upon a bog, and can only say, this ground seems to hold for the present. Here I will stay till it begins to give way. (CP 5.589)

Accepted hypotheses and theories are stable until they are upset by experience. They are as good as they can be, given the state of evidence, technology, argument, etc. Knowledge is rebuilt bit by bit when experience forces inquirers to revise their beliefs. We have some reason to believe that we are advancing or getting closer to the truth, for the new beliefs will get along with experience better than the old ones. True beliefs are those which would, in the end, get along with experience and one explanation of our beliefs achieving more and more fit with experience is that a good number of them are true. A good number of them would be permanently doubt-resistant.

But Peirce's picture is not one of placing indubitable building blocks upon each other as we progress toward the truth. Rather, the picture is one of doubt (recalcitrant experience) forcing us to inquire until we reach another tentative doubt-resistant belief. The ground upon which inquiry walks is tenuous and it is only the danger of losing our footing that makes us go forward. Doubt and uncertainty provide the motive for inquiry. All our beliefs are fallible and when someone accepts a belief, she does so with the knowledge that it might very well succumb to the surprise of further experience. But if she knows that the belief is the result of a method which takes experience seriously, then she is warranted in accepting it, asserting it, and acting upon it.

In addition, Peirce's theory of inquiry invokes two regulative hopes: assumptions, such that, without making them, the participants in a practice could make no sense of that practice. We must, Peirce says, hope or assume that the community will continue indefinitely and we must hope that there would be, if inquiry were pursued far enough, a final settled answer to "the particular questions with which our inquiries are busied" (CP 6.610). We must hope, that is,

that bivalence holds for the question at hand; we must hope that  $P$  or  $\neg P$ . He says,

A reasonable disputant disputes because he hopes, or at least, goes upon the assumption that the dispute will come to something; that is to say, that both parties will at length find themselves forced to a common belief which will be definitive and final. For otherwise, why dispute? (CP 2.29)

Inquiry is the asking of questions, and a presupposition of inquiry is that the questioner hopes for an answer. We have, Peirce says, some ground for this hope because all sorts of questions that seemed at one time to be completely resistant to resolution have been resolved.

## 6. LOGIC: DEDUCTION, INDUCTION, ABDUCTION

Peirce described himself as first and foremost a logician. He despaired of the state of philosophy in America at the turn of the last century; philosophers, he said, found formal logic too difficult. He classified inference into three types, deduction, induction, and abduction (which he also called retrodution or hypothesis) and made significant contributions to the study of each. Indeed, the very idea of abduction, what is today known as “inference to the best explanation,” is due to Peirce.

As is made clear in Dipert’s essay in this volume, Peirce’s contributions to deductive logic are most impressive, although today it is Frege, not Peirce, who is regarded as bringing modern logic into the world. Peirce developed a logic of relations and quantifiers independent of and at roughly the same time as Frege, discovered the Sheffer Stroke twenty years before Sheffer, and invented a notation (utilizing normal forms) very similar to the one still in use. In mathematics, he anticipated Dedekind on the difference between finite and infinite sets and independently developed arguments about infinity similar to Cantor’s.<sup>6</sup>

Peirce is also known for his work on induction. Some see in his writing an anticipation of Reichenbach’s probabilistic response to Hume’s scepticism about induction, while others see an anticipation of the Neyman–Pearson confidence interval approach to testing statistical hypotheses.<sup>7</sup>

What we usually think of as inductive inference (that which concludes that all  $A$ s are  $B$ s because there are no known instances to the