


Abduction as an Aspect of Retroduction



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The Commens Encyclopedia
The Digital Encyclopedia of Peirce Studies
New Edition

Edited by Mats Bergman and João Queiroz

URL <http://www.commens.org/encyclopedia/article/chiasson-phyllis-abduction-aspect-retroduction>
Retrieved 09.08.2022
ISSN 2342-4257
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Abstract:

One of the most intriguing mysteries in American philosophy falls under the question: "Just what does Charles Sanders Peirce's concept of abductive reasoning comprise?" Peirce used the terms "abduction" and "retroduction" interchangeably as names for a distinct form of logical inference, as well as for the method by which hypotheses are engendered. He considered his theory of abduction essential to (and even overarching of) his theory of pragmatism (Fann, 1970, p.47). Yet nearly a century after his death, Peirce's concept of abduction is still poorly understood. This entry will explore the two distinct meanings of the intertwined concepts that Peirce variously called "abduction" and "retroduction." One meaning refers to a distinct form of logical inference; the other, to the form of a deliberate and overarching logical method which incorporates abduction, deduction, and induction for its full performance. If modern researchers were to accept this proposed separation of Peirce's terminology (abduction and retroduction) to identify these different levels of concepts within his notion of abduction, we could finally begin the task of developing effective operational definitions for abduction and retroduction. These definitions would take us a long way toward solving the "mystery" about what Peirce meant by his concept of abduction and toward making "right reasoning" a teachable skill.

Keywords: Abduction, Retroduction, Methodetic, Aesthetics, Musement, Psychological

The Problem

Peirce used the terms: abduction and retroduction interchangeably for two concepts—one overarching the other. He conceived abduction/retroduction as one of three distinct forms of logical inference. Yet, at the same time, he described abduction/retroduction as comprising one entire branch of logic. Thus in practical terms, the abduction/retroduction dilemma has two parts each of which stem from several dichotomous descriptions. Four of these apparently dichotomous descriptions follow:

- In one sense, Peirce tells us that an abductive inference is a response to an anomalous fact that results in a guess (or explanatory hunch) about the probable cause of that fact. (Peirce, 1896/1955, "Abduction and Induction", p. 151)
- Elsewhere, Peirce describes abduction as the aesthetic process of *musement*, which must follow no rules except "the very law of liberty." (Peirce, 1908/1958, A Neglected Argument

for the Reality of God, p. 360)

- Another sense of the term abduction (which fits Peirce's contention that abduction belongs within the category of normative science), seems to entirely contradict the first two senses. For Peirce tells us that an abductive inference cannot be in any way psychological, and is "deduced mathematically from the categories." (Peirce, 1902, "Memoir 24")
- In a fourth apparent contradiction, Peirce tells us that methodetic, the third category of logic (and which is the logic of scientific method), is "nothing but heurctic and concerns abduction alone." (Peirce, 1902, "Memoir 27")

Adding to the confusion is Peirce's identification of logic as one of three branches of normative science (aesthetics and ethics are the other two), meaning that the category of logic provides the norms (standards, rules, methods) by which each of the methods of reasoning are to be performed. (Peirce, 1903/1955, *A Syllabus of Certain Topics of Logic*, presented as "Philosophy and the Sciences: A Classification," pp. 60-62). In addition, Peirce insists that reasoning is a form of deliberate conduct, and is therefore subject to praise and blame—making logic a form of ethical behavior and thus subject to the rules of right conduct. (Peirce, 1905/1955, "What Pragmatism Is", presented as "Essentials of Pragmatism", p. 258). In addition, Peirce placed ethics into a subordinate relationship to aesthetics (the science of the ideal), saying that ethics must be informed by aesthetics. (Peirce, 1903/1955, "A Syllabus of Certain Topics of Logic", p. 62)

Part one of the abduction dilemma involves reconciling the first three senses of abduction:

- How can noticing a "surprising" fact and the making of a "guess" be subject to norms (that is: have rules and standards)? Can there be a "norm" for what is "surprising" or not?
- "How can an aesthetic process undergone by musing—which requires obeying only the "very law of liberty" yet still operate within a logical norm? And how can one obey only the "very law of liberty," yet be circumscribed by ethical norms (as Peirce claimed logic must be)?
- How can either of the first two senses of abduction be reconciled with Peirce's contention that abduction cannot be in anyway psychological? Aren't "surprises," "guesses," and "musing" dependent upon psychological processes?

Part two of the abduction dilemma brings up only one question here, but that question provides the strongest basis for separating the concepts of "abduction" and "retroduction." This second part of the abduction dilemma arises from Peirce's

statement that methodetic (which is "nothing but heurctic") "concerns abduction alone."

- How can the logic of scientific method "concern abduction alone," if abduction is only one of three forms of logical inference? Aren't the other two forms of logical inference (deduction and induction) required for the proper performance of scientific method?

Because the two parts of the abduction/retroduction dilemma are so intertwined, we will not be dealing with them separately as "part one" and "part two." Instead, we will examine together clues and contradictions which point up these two parts of the dilemma, and which will lead us to the basis for rescuing the terms "abduction" and "retroduction" from their mistaken synonymy and place them into service appropriately.

Definition of Terms

Despite the risk of temporarily violating Peirce's "terminological ethics," let us begin by examining the terminological basis for identifying abduction and retroduction by distinct meanings. This "terminological" violation is only temporary, since Peirce, by selecting the terms "abduction" and "retroduction," provided us with a terminological justification for applying these terms to distinguish between two levels of concepts. Since he was so precise in his use of definitive language, the rationale for separating the meanings in this way should begin with an examination of the root meanings of the words "retroduction," "abduction" (and, while we are at it, for "deduction," and "induction" as well).

Retroduction:

The prefix "retro," occurs in loanwords from Latin having to do with going backward. Yet, the prefix "retro" provides an implication of deliberateness—of deliberately "choosing" to go backward for a purpose. Thus "retroactive" means choosing to go back to an earlier date and make something operative as of that date. "Retrofit" means choosing to go back and modify an earlier model of something with an improvement of some sort. The combination of the prefix "retro" (as deliberately "going backward") with the suffix "ductive" from the Latin *ducere* (to lead) places the meaning of retroduction as "deliberately leading backward." This implies that retroduction is intended to be a deliberate and recursive process involving more than the making of an abductive inference. Its Latin roots indicate that "retroduction" refers, not only to the apprehension of a "surprising fact," and an ensuing hunch, but also that the hunch, once formed, is deliberately and recursively taken "backward" for analysis and adjustment (requiring deduction and induction), before it is engendered into a hypothesis worthy of

extensive testing.

Abduction:

The prefix "ab" appears in loanwords from Latin where it meant "away from." Thus we have words like "abdicate" and "abolition"-going "away from" the throne and from slavery, respectively. Thus, when the prefix "ab" (away from) is combined with the suffix "ductive" (from the Latin *ducere*, meaning to lead) we have the meaning of abduction as "leading away from." The term "abduction" fits well with the concept of abduction as moving "away from" a particular course or topic, as one would when responding to an anomaly, or a "surprising fact." The Latin root for "abduction" does not fit with the idea of going backward to explicate and evaluate an idea. Rather, this root indicates that the outward movement of an abductive inference allows the result of such an inference to be left as a completion, or used as the sole means for further exploration of possibilities-as in the arts.

Deduction:

The prefix "de" from Latin loanwords refers to separation, removal, and negation. When we combine the prefix "de" (to separate) with the suffix "ductive" (to lead), we have the meaning of deduction as "leading to separation, removal, or negation," which are the goals and consequences of deductive reasoning.

Induction:

The prefix "in," also from the Latin has to do with inclusion. Thus, the prefix "in" (to include) combined with the suffix "ductive" means "leading into" (or including), as one would do when reaching a conclusion by estimating from a sample, or generalizing from a number of instances.

Therefore, based upon their Latin derivations (to which Peirce was partial, as he was for Greek roots) our four terms have the following meanings:

- Retroduction = deliberately leading backward.
- Abduction = leading away from
- Deduction = leading to separation, removal, or negation.
- Induction = "leading into" (or including).

Abduction and Retroduction are not Interchangeable Terms

A big question (one which this writer cannot answer) is why would Peirce, who was otherwise meticulous in his use of terminology, apply the terms "retroduction" (which

according to its Latin roots should mean deliberately "leading backward") and "abduction" (which should mean "leading away from") interchangeably? It could be that the answer to this question resides in some of Peirce's later writings and existential graphs, which are not yet generally available. In any case, there are some signs that, toward the end of his life, he had begun thinking of the two concepts as intertwined, but distinct.

In 1911, just three years before his death, Peirce wrote:

I am just now trying to get a small book written in which I positively prove just what the justification of each of the three types of reasoning consists in...and showing the real nature of Retroduction.
(Fann, 1970, p. 60)

Since Peirce never completed this "small book," we cannot be entirely certain of what he exactly meant by the third of these "types of reasoning" (the other two are deduction and induction), or by his comment about "the real nature of Retroduction." However, although he never completed the book proposed in 1911, Peirce did publish an essay in 1908 that seems to have heuristically fulfilled that goal. This essay provides strong support for a different set of meanings for the terms "abduction" and "retroduction" (although there he applied the term "retroduction" for both meanings). In "A Neglected Argument for the Reality of God," (Peirce, 1908/1958, pp. 358-379) Peirce describes a process (musement, see "Abduction as Aesthetic Method, in <http://www.davisnelson.com>) that neatly corresponds to the process of abduction as "leading away from" a point of interest into "*a petite bouchée* with the Universes" of experience. There, he provides a detailed description of how the abductive process (as *musement*) engages within and among the three categories (Peirce 1903/1955b, "A Syllabus of Certain Topics of Logic", pp. 60-62). Then Peirce tells us that:

Every inquiry whatsoever takes its rise in the observation, in one or another of the three Universes (Chiasson, 2001, p. 206), as some surprising phenomenon, some experience which either disappoints an expectation, or breaks in upon some habit of expectation.... The whole series of mental performances between the notice of the wonderful phenomenon and the acceptance of the hypothesis, during which the usually docile understanding seems to hold the bit between its teeth and to have us at its mercy, the search for pertinent circumstances and the laying hold of them, the dark laboring, the bursting out of startling conjecture, the remarking of its smooth fitting to the anomaly, as it is turned back and forth like a key in a lock, and the final estimation of its Plausibility, I reckon as composing the First Stage of Inquiry (Peirce, 1908/1958, "A Neglected Argument for the Reality of God", p. 368).

The "First Stage" of inquiry that Peirce is referring to above is the stage of hypothesis

construction. The "Second Stage" of inquiry is explication and demonstration of the hypothesis (by means of deduction) and the "Third Stage" is comprised of classification, testing, and evaluation. However, in actual practice, the reasoning forms of deduction and induction are not just applied during their specific stages. The chasm Peirce describes above between the noticing of an anomaly and the "acceptance of the hypothesis" cannot be bridged by the making of abductive inferences alone, but rather by the recursive interplay of abduction, deduction, and induction. For, Peirce said that "the whole series of mental performances between the notice of the wonderful phenomenon and the acceptance of the hypothesis...compos[es] the First Stage of Inquiry." He did not say that merely the "noticing of an anomaly" and "the getting of a hunch" composes the First Stage of inquiry. For, within the full process of "engendering a hypothesis (which is a *retroductive* process)," resides the subordinate process of noticing an anomaly and getting an explanatory hunch (by means of *abduction*). Thus, for the "first stage" of reasoning to occur by means of retroduction, abduction must operate in recursive interplay with the other reasoning forms (deduction and induction) to engender a hypothesis worthy of acceptance and scientific inquiry.

"Retroduction," Peirce then states, "does not afford security. The proposition must be tested (Peirce, 1908/1958, p. 368). He follows his description of *musement* with explanations of the processes and purposes of deduction and induction as well. After making this thorough description of the roles and processes of abduction as *musement* (as well as of deduction and induction), Peirce paradoxically claims that these three inferencing methods interact to engender a hypothesis (in this case, for "the Reality of God", Peirce, 1908/1958, pp. 374-375). He specifically asserts that "the N. A. [Neglected Argument] is the First Stage of scientific inquiry, resulting in a hypothesis of the very highest plausibility...." His "Neglected Argument," then, is comprised of the deliberate and recursive use of abduction, deduction, and induction, for engendering "...a hypothesis of the very highest plausibility [the hypothesis of the reality of God] whose ultimate test must lie in its value in the self-controlled growth of a man's conduct of life" (Peirce, 1908/1958, pp. 374-375). Peirce's Neglected Argument lends credibility to the proposition that one meaning of abduction (the one here referred to as "retroduction") includes the processes of deduction and induction, as well as abduction, for its performance. Peirce's claim for the requirement of the deliberate control of abduction, deduction, and induction (as described in "Neglected Argument") for ultimately engendering the "hypothesis of God," corresponds to the deliberate process of pre-and post reflection and analysis—the "backward leading" recursive analysis, which we are here defining as "retroduction."

His description of the process of *musement* in "Neglected Argument," and the implication that this process is abductive (not retroductive) brings up again the questions of the first part of our abduction dilemma:

- How can noticing a "surprising" fact and the making of a "guess" be subject to norms (that is: have rules and standards)? Can there be a "norm" for what is "surprising" or not?
- "How can an aesthetic process undergone by musing—which requires obeying only the "very law of liberty" yet still operate within a logical norm? And how can one obey only the "very law of liberty," yet also be circumscribed by ethical norms (as Peirce claimed logic must be)?"
- How can either of the first two senses of abduction be reconciled with Peirce's contention that abduction cannot be in anyway psychological? Aren't "surprises," "guesses," and "musing" dependent upon psychological processes?

Perhaps the first two questions above can be answered together. For a "surprising fact" to be noticed and for a subsequent "guess" as to its cause to be made according to normative principles (without any reference to psychology), there must be a normative category which (though *seeming* psychological) is dependent upon mathematics, as are all of the normative sciences. Since the category of aesthetics fits that description, we can explore the apparent paradox of norming the apprehension of a "surprise" and the making of "guesses" by addressing the aesthetic process which Peirce called "musing." Peirce borrowed the term "musement" from Friedrich Von Schiller's 1794 book *Letters Upon The Aesthetic Education of a Young Man* (Schiller, 1794). Peirce studied Schiller intently in his early twenties, then put aside this work for many years (Ketner, 1998, pp. 136-139). Yet, one cannot help wonder at Schiller's influence upon the emergence of Peirce's concept of abduction. For late in life, Peirce returned to Schiller's aesthetic concept of *musement* as a heuristic device for explaining the way in which new possibilities are discovered and explored—the same process which he elsewhere refers to variously as abduction and retroduction. Many scholars have addressed this apparent relation of abduction to aesthetics (Parret, 1994), even in the face of Peirce's insistence that abduction is a distinct logical form subject to the strictures of ethical norms.

In "Neglected Argument," Peirce emphasizes that "musement" (the state from which an abductive inference is generated) must be an entirely unfettered process—following only the laws of "Pure Play." "Now Play, as we all know," wrote Peirce, "is a lively exercise of one's powers. Pure Play has no rules, except this very law of liberty. It bloweth where it listeth. It has no purpose, unless recreation..." (Peirce, 1908/1958, A Neglected

Argument for the Reality of God, p. 360). Peirce even ventures so far as to insist that pessimists cannot properly perform abductive reasoning, since pessimism closes off entire categories of possibilities and is thus a hindrance to obeying the "law of liberty" (Chiasson, 2000a).

On the other hand, Peirce insisted that logic is not only a normative science (as are aesthetics and ethics), it is also a "mirror of ethics" (the science of conduct) and, thus, subject to standards by which one should properly conduct rational thought. In his 1905 essay "What Pragmatism Is," Peirce wrote:

Now, thinking is a species of conduct which is largely subject to self-control. In all their features (which there is no room to describe here), logical self-control is a perfect mirror of ethical self-control-unless it be a species under that genus.(Peirce, 1905/1955, What Pragmatism Is, p. 258)

Let us take a closer look now at the apparent contradiction between Peirce's notion of abduction as deriving from the unfettered activity of Pure Play and his insistence that logic is a species of conduct.

- "Logical self-control is a perfect mirror of ethical self-control...."
- "Pure Play [from which abductive inferences may result] has no rules, except the very law of liberty."

Therein lies the dilemma. Peirce claims abduction as the crown jewel of logic. He insists that logic is a normative science, dependent upon ethics-meaning that it must follow certain standards of right conduct for its proper performance. Yet, how can abduction be subject to self-control (as are ethics and logic according to Peirce) if its performance must have no rules, "except the very law of liberty?" Can there be self-control without norms (or rules) from which to deliberately control oneself-from which to make deliberate choices? If abductive inferences result from the entirely unfettered process of "Pure Play," and if "logical self-control is a perfect mirror of ethical self-control," how can abductive inferences be made while logic is "fettered" by the standards (rules or norms) of "ethical self-control?"

By turning to Peirce's Classification of the Sciences, we can begin to get a view of Peirce's "big picture" concerning all of theoretical science and its sub-branch, the "science of discovery," within which logic dwells. Perhaps from this larger view, we can see how his concepts of abduction/retroduction should fit in. Peirce tells us that each division in his classification of the sciences depends upon the one which precedes it.¹

The "first" science of discovery, according to Peirce, is mathematics-which studies

"what is and is not logically possible, without making itself responsible for its actual existence"(Peirce, 1903/1955b, "A Syllabus of Certain Topics of Logic", p. 60). Philosophy (which is the second branch of the science of discovery and, thus, dependent upon mathematics ²) is comprised of three branches: phenomenology, normative science, and metaphysics. Phenomenology studies the sorts of "elements universally present" in phenomena (meaning the elements universally present in whatever is present in the mind at anytime in anyway). Peirce writes that:

Normative science "distinguishes what ought to be from what ought not to be.... Metaphysics "seeks to give an account of the universe of mind and matter. Normative science rests largely on phenomenology and on mathematics; metaphysics on phenomenology and on normative science" (Peirce, 1903/1955, "A Syllabus of Certain Topics of Logic", p. 61).

Peirce's division of normative science is comprised of aesthetics, ethics, and logic (in that order), with ethics dependent upon aesthetics for its ideals, and logic dependent upon ethics for its principles of conduct. Logic, in turn, consists of three categories: speculative grammar (which is the general theory of the nature of signs and their meanings), critic (which is usually considered as "formal logic"), and methodeutic (the logic of scientific method). As with each of his classifications, a particular division is always dependent upon all of those which precede it. Peirce further claimed that there is no room for the psychological in critical logic:

[N]o...psychological doctrine can be admitted into critical logic. The true doctrine is deduced mathematically from the categories. The justification of abduction follows from it; and from this in turn follow the rules of abduction.(Peirce, 1902, MS 175.176-178)

So, with the above in mind, where does the concept of abduction as *musement* fit in? Remember, *musement* is a sort of speculation that arises during Pure Play—the activity that "has no rules, except this very law of liberty. It bloweth where it listeth. It has no purpose, unless recreation...." Can we have a norm for a form of logic which depends upon mathematics and ethics, but "has no rules, except this very law of liberty?" Or, is the abduction of *musement* of another sort than the abduction of critical logic? In his memoir of methodeutic, Peirce wrote:

"I here consider precisely what methodeutic is. I show that it is here permissible to resort to certain methods not admissible in [speculative grammar] or in critic. Primarily, methodeutic is nothing but heuretic and concerns abduction alone..."(Peirce, 1902, MS 175.329-330)

So, we now are back to the two parts of our abduction/retroduction dilemma, for we have two claims for abduction:

- first, that it is not psychological because "no such doctrine can be admitted into critical logic," and
- second, that methodetic logic (which is the logic of scientific method) is nothing but heuritic; that it concerns abduction alone; and that this form of logic may resort "to certain methods not admissible in" speculative grammar or critical logic.(Peirce, 1902, MS 175.329-330)

Thus in one sense, Peirce's notion of abduction is the aesthetic activity of musement. In another sense, abduction is a type of inference which is mathematically deduced from the categories and cannot be psychological. And, in yet another sense, abduction is a method of reasoning that comprises the entirety of the branch of logic (methodetic), which is "nothing but heuritic." Peirce's use of the term "heuritic" here is a noun form which means the art of discovery or invention."(Ketner, 12-27-2000, private correspondence). The more familiar form of this word is the adjective, "heuristic." A heuristic device is a tool (often an analytical tool in the form of a diagram, model, analogy, or metaphor) which helps to show how the qualities and relations of qualities are to be sought for a particular purpose. Thus if methodetic logic is "nothing but" the art of discovery or invention, then it is likely comprised of the qualities, and patterns of relations among qualities, by which this "art of discovery" should be undergone.

So, let us take up the latter assertion first. By saying that methodetic logic is nothing but heuritic, Peirce is saying that his methodetic is nothing but a device for demonstrating how the qualities and relations of qualities of (or by) "abduction alone" are to be sought in "the art of discovery or invention." He also tells us that methodetic logic may resort "to certain methods not admissible in" critical logic. From this we might infer that "psychological factors" (such as "surprise," "value," and other modes dependent upon sense or affect) might be employable as *heuristic* devices for explaining abduction, while not actually *belonging* to abduction, to mathematics, or to any of the sciences of discovery. We might also suspect that the deliberate form of recursive analysis (the interplay of abduction, deduction, and induction), which we are referring to as "retroduction," might provide the qualities and relations of qualities by which the individual processes within it (abduction, deduction, and induction) can be tested. Additionally, we might also reasonably suspect that, when taken as a whole, Peirce's methodetic, which is ("nothing but heuritic and concerns abduction alone") might provide the method by which the recursive analytical process of "retroduction" can itself be tested.

If any or all of the above is so, it would not mean that the logic of methodetic (or of abduction as musing, guessing, or responding to surprise) cannot be represented mathematically. It would only mean that, *in addition to* mathematical representations, other means "not admissible in critical logic" are available to this branch of logic for representing qualities and the relations of qualities of the normative sciences—including aesthetics, ethics, and logic. For, such psychological attitudes as "musement," "guessing," or "surprise," would be heuristic devices for representing the qualities of abduction. And, in the same way, certain "practical" applications of Peirce's methodetic (or of any of the components of that method) could also be considered as heuristic devices representing the qualities and relations of qualities of retroduction.

Abduction, then, would not actually BE musement, or BE the reaction to a surprising fact and an ensuing hunch. Rather, abduction would be "the qualities and relations among qualities" of abduction which can be ascertained to some degree by extracting these from heuristic representations of these qualities. Such representations could provide forms and models from which to construct and test hypotheses concerning both abduction as musement and retroduction as methodetic. For methodetic, as the logic of scientific method, norms the logical methods which the construction and testing of hypotheses should occur. For Peirce, "'testing" (not mathematics) provides the sole logical proof of any question concerning Real objects."(Peirce, 1958, p. 358)³ Thus, the "less strict" rules of methodetic logic allows us to develop a variety of ways to demonstrate and evaluate the development, explication, and testing of hypotheses-(including any hypothesis about the method for developing hypotheses). Peirce wrote:

[S]ince the whole business of heuritic, so far as its theory goes, falls under methodetic, there is no kind of argumentation that methodetic can pass over without notice. Nor is methodetic confined to the consideration of arguments. On the contrary, its special subjects have always been understood to be the definition and division of terms. The formation of systems of propositions, although it has been neglected, should also evidently be included in methodetic. In its method, methodetic is less strict than critic.(Peirce, 1902, "Memoir 27")

For methodetic to "concern abduction alone" and still be the logic of scientific reasoning, the term "abduction" (when Peirce says that "methodetic concerns abduction alone") should really be termed "retroduction." Since it is the logic of scientific method, methodetic logic cannot possibly refer only to the noticing of an anomaly and the forming of a hunch. Thus, methodetic concerned with "abduction alone" really means that it is concerned with "retroduction alone"-for Peirce's

methodeutic is the form of deliberate, recursive analysis which involves the interplay of abduction, deduction, and induction for the development, explication, and (at the least) preliminary testing of hypotheses. As such, "retroduction" as methodeutic is Peirce's method of "right reasoning." Right reasoning, according to Peirce, can only occur by individuals adhering to the norms of logic that is informed by ethics and guided by the "science of the ideal" when engaged in scientific inquiry.

Now, let us examine Peirce's suggestion that abduction is the aesthetic activity of musing as this contrasts with to his assertions that:

- abduction is a type of inference mathematically deduced from the categories,
- abduction is (like all of logic) subject to the norms of ethics, and
- abduction is entirely non-psychological.

That, for Peirce, the normative sciences of aesthetics, ethics, and logic are interdependent (as are each of the three types of logical reasoning) is an important concept to keep in mind when considering the "notion of abduction." Such interdependence is an especially important concept when reconciling abduction as *musement* with the recursive analytical method of retroduction. For, as you will see, the key to the "normative" nature of Peirce's notion of abduction resides in the category of aesthetics.

Although normative, Peirce placed aesthetics in the position of firstness, overarching (informing) both ethics and logic. Thus, the category of aesthetics as a "normative" science is (like abduction as musing) not subject to ethical norms, but rather to the norming of norms—the exploration and discovery of that which is the "ideal" (and which should therefore, as the ideal, inform both ethics and logic). For Peirce, the "the morally [ethically] good appears as a particular species of the esthetically good," (Parret, 1994) and logic is a "species under the genus" (Peirce, 1905/1955, *What Pragmatism Is*, p. 258) of ethical conduct. He wrote:

I regard Logic as the Ethics of the Intellect—that is, in the sense in which Ethics is the science of the method of bringing Self-control to bear to gain our Satisfactions.... As to what one ought to desire, it is...what he will desire if he sufficiently considers it, and that will be able to make his life beautiful, admirable. Now the science of the Admirable is true Esthetics. Thus, the Freedom of the Will, such as it is, is a one-sided affair, it is freedom to become Beautiful.... There is no Freedom to be or do anything else. Nor is there any freedom to do right if one has neglected the proper discipline....(Peirce, 1908/1958, *Letters to Lady Welby*, p. 415)

For Peirce, aesthetic denotes a qualitative state—within which one has the "freedom of

the will" (as a one-sided affair) only to strive for the ideal (that which will make one's life beautiful and admirable). The aesthetic is a state of potentiality from which we respond to and select among qualities and values, based upon the relations among the qualities themselves for achieving the aesthetic ideal—rather than upon their value in the production of outcomes (Chiasson, 2000b). Thus the aesthetic provides the "norm" (as the "admirable" ideal) for other norms and, as such, is the only "norm" that can be obeyed at the same time as obeying the "very law of liberty" (or "freedom of the will"). From its position of "firstness," the category of aesthetics (science of the ideal) provides the normative *force* (as feeling, energy, value, purpose, being) from which the very "law of liberty" *should* be obeyed—such is its "norm." And, since abduction is the method by which qualities as potentialities are noticed, related, and formed into meaningful relationships, abduction must at least *begin* with the aesthetic norm—for it is the method by which the aesthetic ideal is expressed. In other words, abductive reasoning (as a properly performed form of logic) must at some point have an intimate relationship with the aesthetic.⁴

Of course, even if we accept this aesthetic-abduction connection, the second aspect to the abduction/retroduction dilemma, which we discussed earlier, arises from Peirce's statement that methodetic (which is "nothing but heurctic") "concerns abduction alone." The category of methodetic is supposed to provide the norms for scientific investigation—norms which must include the norms for other forms of inference (deduction and induction) as well as for abduction. Indeed, after laying out his "Neglected Argument for the Reality of God" (an argument which includes explanations of the roles of deduction and induction as well as "musement" as abduction), Peirce declares that this *argument* comprises the "First Stage of scientific inquiry." Thus (according to Neglected Argument at least), it is not abduction as musement, but rather the recursive interplay among abduction, deduction, and induction that comprises the "first stage of a scientific inquiry," which is, of course, the development of a hypothesis. Therefore, all three inferencing methods interact during the engendering of a hypothesis—not abduction alone. So, when Peirce tells us that the normative logic of methodetic is "concerned with abduction alone," it is likely that the concept he means is the recursive analytical process that we have been referring to as "retroduction." And when he tells us that abduction is a logical method for responding to a "surprising fact," for developing a "hunch," and for "musing" he is referring to the aesthetic norm for seeking the beautiful and the admirable (which, for Peirce, was the ultimate aim and end of Truth).

Why the Two Concepts Should be Separated

We now have the complete core of our two-pronged dilemma: "How can abduction be a form of inference distinct from deduction and induction (as the "unfettered play of musement," or a response to a "surprising fact") and also be a form of recursive analysis that includes deduction and induction as well as abduction?" This manner of referring to the concept of "musement" as *abduction*, and of "recursive analysis" as *retroduction*, can eliminate much of the confusion surrounding the notion of abduction—especially as it applies to the logic of Peirce's methodetic—which, you will remember, "is nothing but heurctic and concerns abduction alone...."(Peirce, 1902, MS 175. 329-330)

Also, by taking advantage of the broader range of subjects and tools available to the unique analytical method of Peirce's methodetic it is possible to begin building a clearer understanding of what abduction as a mathematical concept (and as an aesthetic method, also dependent upon mathematical description) might be. By distinguishing between these two concepts within Peirce's methodetic (defining one as abduction and the other as retroduction), it becomes possible to observe and identify patterns of actions during the actual performance of each of the distinct inferencing processes (abduction, deduction, and induction). These patterns become especially clear as each one plays out in actually—as in the performance of an open-ended task. Because the looser "rules" of the methodetic branch of logic allow for a variety of ways to demonstrate these specific and overarching reasoning methods, it is possible to use methodetic logic to construct models for testing the patterns of action that make up each of the three types of inferences.⁵

Another good reason for separating these two concepts (abduction from retroduction) is that retroduction cannot be considered without also considering the relational patterns of (and among) all three types as inferences—as well as the relational aspects of the context for which it is being applied. The broader concept of "retroduction" as methodetic renders it much more difficult to define in terms of its qualities and their relations, since there are so many more components to consider. However, until an operational definition of abduction (as the pattern of actions distinct from deduction and induction) is available, we cannot hope to develop an operational definition for retroduction. The pattern of actions of abductive reasoning must be known and well-tested before we can effectively identify the qualities and relations among qualities of the overarching pattern of retroductive reasoning. In other words, we must know how to "abduce" before we can possibly hope to learn how to "retroduce."

How it would Work

We have discussed the possibility that Peirce's concept of abduction (at least as it refers to methodetic) has at least two meanings—one overarching the other. The overarching meaning of abduction (which I have proposed that we call "retroduction") would cover Peirce's methodetic and his whole of the concept of continuity as "an affair of thought." (Peirce 1905/1955, "What Pragmatism Is", p. 266) As such, the term "retroduction" would include:

1. bringing a new idea (or hypothesis) up from the region where "all things swim" in the continuum by means of abduction (beginning with an aesthetic inference, which by following the "form" of abduction in Peirce's critic, becomes a logical inference);
2. using deduction to explicate and demonstrate aspects of that idea,
3. using induction to evaluate and secure that idea (however temporarily).

Then, the reasoner returns to abduction and repeats that cycle as necessary. In this sense, the term "retroduction" would be reserved as a definition for the entire abductive-deductive-inductive cycle of Peirce's methodetic, saving the term "abduction" to mean a distinct type of inference that is separate and distinct from either deduction or induction.

If we were to define our terms in this way, the term "retroduction" would denote the following recursive cycle that goes into the building up of knowledge:

1. A surprising fact is noticed.
2. An aesthetic (unfettered) exploration of qualities and relationships is made.
3. Abductive reasoning is applied to make a guess that could explain the surprising fact.
4. Deductive reasoning is applied to explicate the guess and ready it for testing.
5. Once readied, inductive reasoning is applied to test and evaluate the guess.
6. Abduction or deduction is used to interpret that evaluation (or new information is produced) and the cycle begins again until a hypothesis (or "conditional purpose") has been fully engendered and is ready for formal explication and testing.

From the above perspective, then, abduction (as opposed to retroduction) is an aesthetically dependent method of logic for addressing surprising (or anomalous) facts and exploring the qualities of these. Once a surprising fact is formed into a hunch, deduction and induction interact recursively with abduction to engender a hypothesis. Once a hypothesis is formed, deduction is the method by which that idea is explicated and readied for testing. Induction is the reasoning method by which the idea is tested, evaluated, and eventually secured. So, within the activity of hypothesis construction,

both deduction and induction are needed at times. Thus, the word "retroduction" can stand as an inclusive term (overarching the three inference methods of abduction, deduction, and induction) for Peirce's methodic, defining roles of all three of the processes recursively applied for the discovery and construction of worthy hypotheses (conditional purposes).

Benefits

One significant benefit that is likely to result from distinguishing between abduction and retroduction as proposed here will be an enhancement in the clarity of communication among researchers. Since even Peirce was not always talking about the same thing every time he wrote about abduction/retroduction, it is easy to understand why scholars might confuse one another when discussing abduction as well. Another significant benefit would be to enable an operational definition of abductive reasoning—one which can be delineated in critical logic with the same clarity as deduction. A side benefit of being able to define abductive reasoning in this way will be the ability to clear up the confusion between abduction and induction, allowing us to clearly delineate inductive reasoning as well.

Without an operational definition of abductive reasoning, we will never be able to develop an operational definition of retroduction (since abduction is necessary for performing a retroduction, as are deduction and induction). Constructing an operational definition of retroduction will be much more complex than constructing one for abduction. However, without a clear understanding of the abductive reasoning process of abduction and all that it entails, we will not be able to attempt an adequate operational definition of retroduction.

The greatest potential benefits from having such definitions lie in the field of education. Once we remove abduction and retroduction from the realm of vagueness and can clearly delineate these processes and their applications for all to see, we can begin to develop effective ways of teaching others how to effectively apply these reasoning processes to all sorts of situations. The greatest yet unrealized benefit of Peirce's work to humankind lies in its potential for improving the ability of those at all levels of intellect and in all walks of life to reason more effectively. Before Peirce's methods of right reasoning can be taught, however, abductive reasoning must have an effective operational definition—one that can be demonstrated and generally understood, so that all of the reasoning methods can be effectively taught and, more importantly, mastered.

Conclusion

None of us can develop the capacity to reason more effectively unless the method for reasoning abductively (the method for forming and evaluating worthy purposes) can be taught. Yet, the method of abduction cannot be taught until it is identified and defined in an operational sense. It cannot be defined operationally until we clarify some of the confusing contradictions about abductive reasoning with which Peirce left us.

Therefore, the proposal that we should use the term "abduction" for the reasoning method by which conditional purposes (hypotheses) are constructed and "retroduction" as the overarching method by which theories are engendered (by the interplay of abduction, deduction, and induction) should not be taken lightly. By clearly defining the process of abduction and placing it (along with deduction and induction) under the overarching method of "retroductive" reasoning, we are creating the possibility that all of these reasoning methods can be taught, learned, and, hopefully, mastered. Then, once these processes are mastered, individuals can learn to effectively perform and apply each of these methods appropriately for the construction, explication, and evaluation of all sorts of conditional purposes (including hypotheses)—thus mastering the skills of Peirce's concept of "right reasoning."

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Notes

1. Each classification within of the science of discovery relies upon the one that precedes it. Since mathematics is the "first science" of discovery, it depends upon no other of the sciences of discovery and informs them all. Thus mathematics informs the "second science" of philosophy and both mathematics and philosophy inform the third idioscopy (which are classificatory sciences). Philosophy in turn has three divisions: Phenomenology, normative science, and metaphysics so phenomenology informs the normative sciences, and they in turn metaphysics. Normative science has three branches: aesthetics, ethics, and logic. Aesthetics governs ethics, and ethics logic. Logic in turn has the three branches which are being discussed in this paper. ←
2. Peirce labeled the third branch of the sciences of discovery "idioscopy," placing with in this division the physical sciences (physics) and the psychic, or human, sciences (including psychology, linguistics, and history). ←
3. "Real objects," according to Peirce include anything "having Properties sufficing to identify their subject and possessing these whether they be anywise attributed to it by any single man or group of men, or not." Thus, the process of abduction, according to Peirce's definition, is, itself, a Real object since it possesses properties sufficient to identify it. Additionally, if (as Peirce contends) "testing" provides the "sole logical proof of any question concerning Real objects, then methodetic which concerns abduction alone, and which, as the logic of scientific method, provides the norms for hypothesis construction and testing must therefore also provide the norms for determining the methods for testing abduction and providing its "sole logical proof." ←
4. Peirce corresponded the aesthetic with his category of "firstness," which is a state of potentiality, beingness, impulse, quality, and value without form or action. Therefore, according to this category, there is no "method" associated with the aesthetic ideal. However, he did allow for Kant's "aesthetic judgment," "which is expressive, not cognitive" (Sheriff, 1994) and of which musing could be a sort. However, if musing produces an abductive inference, and is (per Schiller 1794) an aesthetic method, then there must be a cognitive process involved in aesthetic judgment. ←
5. One of these models (Davis's Relational Thinking Styles) has made it possible to develop a non-verbal test of the patterns of each of the inferencing types and the contexts for which the inferences are being made. This heuristic model of Peirce's reasoning forms enables us to symbolically describe the making of inferences in terms of the "patterns of actions" with which each form of inference addresses intensity, duration, and sequence (the latter as order

and direction) for interacting within each of Peirce's three categories. ←