


Peirce on Causality and Causation



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Abstract:

In this article a distinction is made between *causation*, or the *production* of an effect by its cause(s), and *causality*, or the *relationship* between cause and effect. Though Peirce never explicitly made this distinction, he clearly did so implicitly by severely criticizing the principle of causality, and by elaborating a constructive (proto-) theory of *causation*.

Peirce observed that the concept of 'cause' has at least three different and incompatible meanings. He argued, moreover, that the variety and increasing complexity of nature cannot be explained on the basis of the so-called principle of causality. Cause-effect relationships therefore cannot be determined by deterministic laws, but must instead be determined by probabilistic laws. This entails that cause-effect relationships are irreversible and that causes precede their effects in time.

Peirce maintained that cause and effect are *facts* within an epistemological context (or context of causality), while they are *events* within an ontological context (or context of causation).

The relationship between Peircean events and Peircean processes is discussed, and it is argued that Peircean processes differ from Peircean events inasmuch as only the formers are characterized by complexity, teleology, and coherence. Furthermore, it is argued that Peirce's conception of causation is characterized by a triple interdependence of final causation, efficient causation and chance.

Keywords: Causation, Causality

Introduction

The objective of this article is to give an account of (1) Peirce's critique of the principle of causality and (2) of Peirce's constructive theory of causation.

The terms 'causation' and 'causality' are often used as synonyms. Moreover, causality or causation is usually described as the relation between cause and effect, or as the act of bringing about an effect. Though the concept of causation has been recognized throughout the history of Western thought as being of fundamental philosophical importance, until now, no satisfactory analysis of it has been given. Though this lack of clarity has been pointed out by some contemporary authors (e.g. Kim 1995, p.112), it was Peirce's merit to have stated the problem exactly:

Those who make causality one of the original *uralt* elements in the universe or one of the

fundamental categories of thought, - of whom you will find that I am not one, - have one very awkward fact to explain away. It is that men's conceptions of a cause are in different stages of scientific culture entirely different and inconsistent. The great principle of causation which, we are told, it is absolutely impossible not to believe, has been one proposition at one period in history and an entirely disparate one [at] another and is still a third one for the modern physicist. The only thing about it which has stood [...] is the *name* of it. (RLT 197, 1898)

This confusion is at least partly due to the complex evolution of the concept of cause. The modern concept of cause is the result of the interplay between the Aristotelian-Scholastic Conception - according to which causes are *active initiators of a change*, and the Scientific Conception - according to which causes are the *inactive nodes in a law-like implication chain*. Most discussions of modern philosophers have failed to see the basic incongruity of these two ingredients (Hulswit & Sowa, 2001).

Though the Aristotelian Conception has remained an unmistakable aspect of our common sense idea of 'cause,' the received view unashamedly subscribes to the Scientific Conception of cause. According to the latter view, causation means some sort of law-like *relation* between cause and effect, rather than the *production* of an effect by its cause.

For reasons of clarity, I shall strictly distinguish *causation* from *causality*. I use the term *causation* exclusively for the *production* of an effect by a cause, and restrict my use of the term *causality* to the *relation* between cause and effect. Breaking a leg is something quite different from the relationship between the cause of the broken leg and the broken leg. If correct, the distinction has far reaching consequences.

In this article, I will show that, though Peirce nowhere explicitly made the distinction between *causality* and *causation*, he clearly did so implicitly. And though Peirce never explicitly formulated a theory of causation, there are a number of places (especially in his so-called cosmological papers) where he severely criticized the principle of *causality*. Moreover, in 1902, within the general context of a discussion of natural classes, Peirce gave a highly perceptive analysis of the problem of teleology, in which he exposed some remarkable insights regarding *causation*.

The structure of this article is as follows: in the first section, I will discuss Peirce's critique of the principle of causality. It will be seen that Peirce proposed to strictly distinguish the concept of *cause* from the concept of *force*. He reserved the former term for the whole of human experience and of nature, and he restricted the latter to the formal laws of physics. Whereas 'cause' pertains to irreversible processes, 'force' deals with reversible processes; whereas the former term deals with concrete reality, the

latter deals only with abstractions.

In section II, I will discuss the problem of the causal relata, and I will show that, according to Peirce, the causal relata may be either events or facts, depending on the context of the discussion. While Peirce insisted that the causal relata are *facts* within an epistemological context (or context of *causality*), they appear to be *events* within an ontological context (or context of *causation*).

In section III, I will discuss Peirce's conception of *causation*, according to which each act of causation involves a teleological, an efficient and a chance component. It will be shown, furthermore, that Peirce's conception of efficient cause holds a middle way between the Aristotelian Conception and the Scientific Conception of cause. In this section I will also discuss the relationship between 'Peircean processes' and 'Peircean events', and provide what I have called 'an anatomy of Peircean productive events.'

Finally, in section IV, I will briefly discuss some outstanding questions.

I. Peirce's Critique of the Principle of Causality

In his sixth and seventh lecture of his Cambridge series on *Reasoning and the Logic of Things* (1898), from which the quote at the beginning of this article was taken, and which are particularly important to the understanding of his critique of the principle of causality, Peirce discusses the concept of cause within the context of scientific, causal explanation.

Peirce observed that the history of the concept of cause reveals a discrepancy between the constancy in the use of terminology and a gradual increasing ambivalence in the conception itself. At least three different and mutually incompatible meanings may be discerned: (a) the Aristotelian conception (AC), (b) 'the modern physicist's conception' (MPC), and (c) 'the currently accepted view' (CAV) (RLT 197-202, 1898).

Peirce approached the problem of the clarification of the concept of cause from three different angles: (1) a logical analysis of the different concepts of cause, (2) an analysis of scientific knowledge of natural processes, and (3) an analysis of mental processes. Each of these will be discussed separately.

I.1. THREE CONCEPTS OF CAUSE

The concept of cause was first explicitly formulated by Aristotle. According to Peirce,

The original idea of an efficient cause is that of an agent, more or less like a man. It is prior to the effect, in the sense of having come into being before the latter, but it is not transformed into the

effect. In this sense, it may happen that an event is a cause of a subsequent event; seldom, however, is it the principal cause. Far less are events the only causes (CP 6.600, 1893).

Moreover,

It is generally held that the word cause has simply been narrowed to that one of the four Aristotelian causes which was named from the circumstance that it alone produces an *effect*. But this notion that our conception of cause is that of the Aristotelian efficient cause will hardly bear examination. The efficient cause was in the first place generally a thing not an event, then something which need not do anything; its mere existence might be sufficient. Neither did the effect always necessarily follow. True when it did follow it was said to be compelled. But it was not necessary in our modern sense. That is, it was not invariable. (RLT 198, 1898)

Thus, according to Peirce, Aristotle considered an efficient cause to be (i) *an agent who compelled another agent or a thing* to behave in a certain way, (ii) *prior* to its effects, (iii) *not* transformed into its effects¹, and (iv) *not necessitating* its effects (in our modern, Millian sense of being a concurrence of antecedents to which a given phenomenon is invariably and unconditionally consequent).

AC differs in at least two respects from "our conception of cause" (CAV and MPC): (1) Aristotelian efficient causes are usually things or substances rather than events, and (2) there is no necessary (invariable) relation between certain types of causes and certain types of effects.

According to CAV, a cause is "an instantaneous state of things perfectly determinative of every subsequent state" (CP 6.600, 1893). More precisely, the commonly accepted view of 'the great principle of causation' - which had its origin in Stoic philosophy (EP I: 299, 1892) - involves three propositions:

- (1) The state of things at any one instant is completely and exactly determined by the state of things at *one* other instant.
- (2) The cause or determining state of things *precedes* the effect or determined state of things in time.
- (3) No fact determines a fact *preceding* it in time in the same sense in which it determines a fact *following* it in time. (RLT 198-99, 1898)

MPC, on the other hand, concerns those phenomena that are governed by the Law of the Conservation of Energy, in which the future determines the past in precisely the same way in which the past determines the future. MPC involves the following three propositions:

(1) The state of things at any one instant is completely and exactly determined by the state at two other instants.

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(2) Cause and effect are *simultaneous*.

(3) The positions at the two later instants determine the position at the earliest instant in *precisely the same way* in which the two positions at the two earlier instants determine the position at the latest instant. (RLT 198-202; 1898)

Thus, according to Peirce, there is a flat contradiction between the basic propositions of CAV and those of MPC. CAV and MPC are therefore irreconcilable concepts of cause. Moreover, both are incompatible with AC.

I.2 ANALYSIS OF NATURAL PROCESSES

In his "The Doctrine of Necessity Examined" (1892) Peirce offered a complex, multi-layered argument against the 'doctrine of necessity,' which was usually regarded as a postulate of scientific reasoning. According to Peirce, the doctrine of necessity is the idea that "the state of things at any time, together with certain immutable laws, completely determines the state of things at every other time" (EP I: 299, 1892).

One of Peirce's main arguments against this postulate was that the variety and increasing complexity of nature cannot be explained solely on the basis of "the rule of mechanical necessity." The operation of mechanical law cannot create diversity where there was no diversity before. Under given circumstances, "mechanical law describes one determinate result" (CP 1.161, 1897). Since "variety can spring only from spontaneity," the laws of nature must be probabilistic rather than deterministic:

By thus admitting pure spontaneity as a character of the universe, acting always and everywhere though restrained within narrow bounds by law, producing infinitesimal departures from law continually, and great ones with infinite frequency, I account for all the variety and diversity of the universe, in the only sense in which the really *sui generis* and new can be said to be accounted for (EP I: 308, 1892).

Peirce insists that the doctrine of necessity is incompatible with the simple fact that wherever we look - be it in geology, astronomy, biological evolution, the history of institutions, languages or ideas - "everywhere the main fact is growth and increasing complexity" (EP I: 308, 1892). "Now, the essential of growth is that it takes place in one determinate direction, which is *not* reversed. Boys grow into men, but not men into boys. It is thus an immediate corollary from the doctrine of the conservation of energy

that growth is not an effect of force alone" (CP 6.555, 1887).

The fact that an aspect of irreducible novelty or objective chance characterizes each event (see section III.1) makes natural processes *irreversible*. And because natural processes consist of causally linked events, cause-effect relationships too must be irreversible. Thus Peirce accepts the third proposition of CAV. Further on we will see that (on the basis of an analysis of mental phenomena) he also accepts CAV's second proposition: causes precede their effects in time.

On the other hand, Peirce rejects all three propositions of MPC on account of the irreversibility of all natural processes. This irreversibility extends not only to processes that are inexplicable by the Law of the Conservation of Energy (such as birth, growth, life, conduction of heat, combustion) but even to seemingly reversible physical processes. Though so-called mechanical processes approach the laws of mechanics to a degree, they never do so perfectly.

Thus, Peirce held that our scientific study of natural processes forces us to accept the view that (i) cause-effect relationships are irreversible, (ii) causes only partially determine their effects (there is always an aspect of indeterminateness or chance involved), (iii) cause-effect relationships are determined by probabilistic laws.

I.3 ANALYSIS OF MENTAL PROCESSES

It was already pointed out that Peirce likes to distinguish causation from force, a term which he reserves for mechanistic causes. Accordingly, causation is not only "a real, and fundamental, and vital element [...] in the outer world," but it is also at work in the inner world (RLT 220, 1898). Indeed, "the very conception of causality has its origin in our tendency to seek relations in nature analogous to intellectual relations" (MS 963, 2, c.1893). Given Peirce's attention to the original meanings of concepts,³ and given his view that causality is an anthropomorphic conception, he may have held the view that the analysis of mental processes is the very best way to study causality. Whether or not he actually did so, he surely accepted all the conclusions regarding causality of his analysis of mental processes.

For Peirce, there is not the slightest evidence that the doctrine of necessity holds in the domain of the mental. That is to say, "from the state of feeling of any instant, there is no reason to suppose the states of feeling at all other instants are thus exactly calculable" (EP I: 309, 1892). Ideas seem to suggest other ideas, rather than to necessitate them:

... no mental action seems to be necessary or invariable in its character. In whatever manner the

mind has reacted under a given sensation, in that manner it is the more likely to react again; were this, however, an absolute necessity, habits would become wooden and ineradicable, and no room being left for the formation of new habits, intellectual life would come to a speedy close. Thus, the uncertainty of the mental law is no mere defect of it, but is on the contrary of its essence. The truth is that mind is not subject to "law," in the same rigid sense that matter is. It only experiences gentle forces which merely render it more likely to act in a given way than it otherwise would be. There always remains a certain amount of arbitrary spontaneity in its action, without which it would be dead. (EP I: 329, 1893)

Thus, Peirce concludes that the attempt to explain away the variety and apparent arbitrariness of mental action in favor of absolute determinism, does not agree with the observed facts (EP I: 329-30).

Moreover, none of the three propositions of MPC applies to the realm of our mental experience. Here it is appropriate to quote Peirce at length:

... when from the world of physical force we turn to the psychical world all is entirely different. Here we find no evident trace of any state of mind depending in opposite ways upon *two* previous states of mind. Every state of mind acting under an overruling association produces another state of mind. Or if different states of mind contribute to producing another, they simply act concurrently, and not in opposite ways, as the two earlier positions of a particle of matter do, in determining a third position. I come down in the morning; and the sight of the newspaper makes me think of the Maine, the breakfast is brought in, and the sight of something I like puts me into a state of cheerful appetite; and so it goes all day long. Moreover, the effect is not simultaneous with the cause. I do not think of the explosion of the Maine simultaneously with seeing the newspaper, but after seeing it, though the interval be but a thirtieth of a second. Furthermore, the relations of the present to the past and to the future, instead of being the same, as in the domain of the Law of Energy, are utterly unlike. I *remember* the past, but I have absolutely no slightest approach to such knowledge of the future. On the other hand I have considerable *power* over the future, but nobody ... imagines that they can change the past by much or by little. Thus all three propositions of the law of causation [MPC] are here fully borne out. (RLT 201-02, 1898)

Thus, *Peirce's analysis of our mental experience confirms his analysis of our scientific experience of the outer world in all respects: (i) cause-effect relationships are irreversible, (ii) causes only partially determine their effects, and (iii) cause-effect relationships are determined by the laws of association, which are in some sense analogous to the probabilistic laws of nature.⁴ Moreover, (iv) on the basis of his analysis of mental phenomena Peirce concluded that causes precede their effects in time.*

Though Peirce preferred to use the term 'force' within the realm of pure physics, and to

restrict the term "causational action" to pure psychics, he felt that Occam's razor compels us to *hope* that the one mode of action be somehow reducible to the other (RLT 237-38, 1898). Peirce's solution is that, both from an ontological and from an evolutionary point of view, causal action is primary, not only in the inner world but also in the outer world.

Causal action is ontologically more fundamental than force, since all natural processes are irreversible, and therefore causal. Thus so-called purely mechanical processes too must be causal. Moreover, according to Peirce's grand cosmological hypothesis, causal action is also primary from an evolutionary point of view. For cosmic evolution is characterized by a creative advance from pure arbitrariness or chaos toward "an absolutely perfect, rational and symmetrical system" in the infinitely distant future, though at any time in this asymptotic approach toward complete order "an element of pure chance survives" (EP I: 297, 1891).

One can understand why Peirce, in spite of his recognition of the importance of causality, refused to reckon *cause* as a philosophical word. He simply thought the term was too ambiguous. Thus, when he did use it, he tried to reduce its ambiguity by the distinction between the terms *cause*, *force*, and *explanation*. *Cause* was to be taken in its original, albeit crude, Aristotelian sense, while he reserved *force* for the context of dynamics, and *explanation* for a more general, logical context (CP 6.600, 1893).

However, despite Peirce's original intention to stick to the Aristotelian conception of efficient cause, some ten years later, in 1902, he developed what might be called a proto-theory of causation, which - though it was Aristotelian in its reliance on the mutual interdependence of final and efficient causation - deviated in some significant respects from Aristotle's conception. Undoubtedly the most important difference is that it was closer to Peirce's categoreal scheme, which involves an event ontology in the strictest sense of the word, than to Aristotle's categoreal scheme, which involves a substance ontology. However, before explaining Peirce's 1902 conception of causation, I will first discuss Peirce's account of the causal *relata*.

II. Causality and Causation: Facts versus Events

One of Peirce's main points of critique of the principle of causality concerns the problem of the causal *relata*. I discuss it separately, not only because the issue is very important for the understanding of Peirce's approach to causality and causation, but also because Peirce's observations are at first glance ambiguous, and might therefore easily be misunderstood.

The later Peirce (from 1893 onwards) insisted that the causal relata are *facts* rather than events. He went as far as stating that no one will ever understand the problem of causality unless he sees that both the cause and its effect are *facts* (MS 647:00010, 1910). In a discussion of the nature of the causal relata, Peirce gave the following description of fact:

A *Fact* [...] is so much of the Real Universe as can be represented in a Proposition, and instead of being, like an Occurrence, a *slice* of the Universe, it is rather to be compared to a chemical principle *extracted* there from by the power of thought; and though it is or may be Real, yet, in its Real Existence it is inseparably combined with an infinite swarm of circumstances, which make no part of the Fact itself. (MS 647: 00010, 1910)

Thus, we must sharply distinguish events from facts, which are only such abstracted parts of an *event* as are expressible in a proposition (NEM IV: 252, 1904). In the above-quoted passage, an event is described as "a slice of the universe," while in a passage quoted below it is described as "the very objective history of the universe for a short time" (RLT 198, 1898). Thus, it would appear that Peirce meant by *event* a minimal temporal unit, or cross section, so to speak, of some actual process.

In the following passage, Peirce criticizes the idea, defended by Mill, that what is caused, the effect or *causatum*, is an *event*. Instead, he insists that it is a *fact*, which is an abstracted element of an event:

Mill's singularity is that he speaks of the cause of a singular event. Everybody else speaks of the cause of a 'fact,' which is an element of the event. But, with Mill, it is the event in its entirety which is caused. The consequence is that Mill is obliged to define the cause as the totality of all the circumstances attending the event. [...] He thus deprives the word of all utility. As everybody else but Mill and his school more or less clearly understands the word, it is a highly useful one. That which is caused, the *causatum*, is, not the entire event, but such abstracted element of an event as is expressible in a proposition, or what we call a 'fact.' The cause is another 'fact.' (EP II: 315, 1904).

In the following passage, a *cause* is described as the minor premise of a deductive argument, of which the major is the relevant law of nature and the conclusion the effect. Just like the effect, the cause is a *fact*:

So far as the conception of cause has any validity, [...] the cause and its effect are two *facts*. Now, Mill seems to have thoughtlessly or nominalistically assumed that a fact is the very objective history of the universe for a short time, in its objective state of existence in itself. But that is not what a fact is. A fact is an abstracted element of that. A fact is so much of the reality as is represented in a single *proposition*. If a proposition is true, that which it represents is a fact. If according to a true

law of nature as major premise it syllogistically follows from the truth of one proposition that another is true, then that abstracted part of the reality which the former proposition represents is the *cause* of the corresponding element of reality represented by the latter proposition. Thus, the fact that a body is moving over a rough surface is the cause of its coming to rest. It is absurd to say that its color is any part of the cause or of the effect. The color is a part of the reality; but it does not belong to those parts of the reality which constitute the two *facts* in question. (RLT 198, 1898)

Accordingly, causal propositions never refer to events in their full particularity; they refer only to such abstracted elements of events called facts. For instance, the question 'What was the cause of the eruption of that mountain?,' means "What is the *fact* from which[,] according to the principles of physics, necessarily resulted the *fact* that the mountain suddenly burst?" (MS 478: 00155-56, 1903).

By thus insisting that the causal relata are *facts*, Peirce makes clear that the general context of his discussion of the causal relata is *epistemological* rather than ontological. For, since a fact is defined as the correlate of a true proposition, there are no facts in and by themselves, independent of propositions. The context of facts is inherently epistemological.

Contrary to causes and effects, which are *facts*, abstracted elements of concrete reality, reality itself is purely a matter of *events*:

What is reality? Perhaps there isn't any such thing at all. As I have repeatedly insisted, it is but a retrodution, a working hypothesis [...]. But if there is any reality, then, so far as there is any reality, what that reality consists in is this: that there is in the being of things something which corresponds to the process of reasoning, that the world *lives*, and moves, and HAS ITS BEING, in [a] logic of events. (RLT 161, 1898)

Thus, while cause and effect are abstracted elements of concrete events, *events* rather than facts constitute 'the basic furniture of the world.' But contrary to the received view, Peircean events are neither changes in substances, nor do they presuppose the existence of substances. Instead, by saying that existing things are 'laws' unifying series of events, Peirce suggested that events are ontologically prior to substances:

... individual existence, in the strictest sense, only belongs to a single event which happens when and where it does and has no other being. For though we speak, for example, of Philip of Macedon as an individual, yet 'Philip drunk' and Philip sober' were different. The 'existing' thing is only individual in the sense of being a continuous law regulating and unifying events of a series of instants. (MS 478: 47-48, 1903)

Hence, it would appear that Peirce's conception of reality involves an event ontology in

the strictest sense of the word. Concrete things and concrete persons owe their genetic identity to some 'law' or final cause, which regulates and unifies a series of events. Peirce in the end dismisses the idea that an event is an adjectival, an abstracted element of something more concrete. *The most concrete or most determinate level of reality is not a substance or an enduring individual, but a momentary state or event in an ongoing process.* In the words of Charles Hartshorne, this means that "genetic identity is [just] a special strand of the causal order of the world" (Hartshorne 1970, 185).

Whereas events are continuous (inasmuch as they do not have a definite beginning and a definite end (EP I: 314-15, 1892)), only those abstracted aspects of it called facts are trivially discrete. For, while events are temporal particulars, facts are neither temporal nor particular. Only facts, therefore, can be expressed in a proposition, and only facts can be components of a deductive argument. Events in their full particularity never can.

Thus, though Peirce nowhere explicitly made the distinction between *causality* and *causation*, he clearly did so implicitly. Causality involves a relationship between facts, but causation is purely a matter of events. Talking about the relationship between discrete causal facts implies that one abstracts from a continuous process of causation. Hence, describing A as the cause of B abstracts from the aspect of continuity involved in causation; in other words, one changes his perspective from causation to causality, and thereby from events to facts. Thus, *the status of causes* (and effects) is that they are both objective and perspectival; they are facts rather than events, because they are abstractly derived aspects from the concrete, objective stream of events. As such they are not only determined by concrete reality, but also by the abstractive power of our thought.

In the next section I will pursue my discussion of Peirce's conception of causation.

III. Causation

This section consists of four sub-sections. First, I will give a general account of Peirce's conception of causation. Next, I will briefly discuss the relationship between 'Peircean processes' and 'Peircean events.' Finally, in the third sub-section, I will provide my interpretation of the nature of 'Peircean productive events.'

III.1 PEIRCE'S CONCEPTION OF CAUSATION

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In his 1902 paper "On Science and Natural Classes" (EP II, item 9; also CP 1.203-37)

and in some closely related papers (see Hulswit, 1996), Peirce developed the highly original view that each act of causation involves an efficient component, a final component, and a chance component. The efficient aspect of causation is that each event is produced by a previous event (the efficient cause). The teleological aspect is that each event is part of a chain of events with a definite tendency. The chance component is that each event has some aspect that is determined neither by the efficient nor by the final cause.

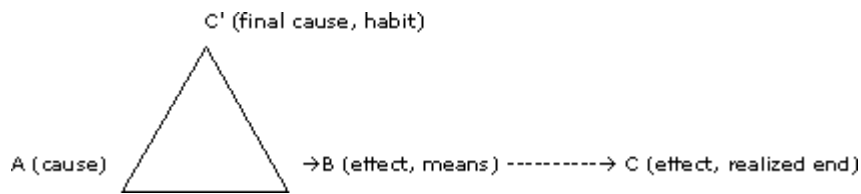
According to Peirce, *final causes* are general types that tend to realize themselves by (teleologically) determining processes of efficient causation. Final causes are basically habits: they ('habitually') direct processes toward an end state. Like human habits, habits of nature (laws of nature) too are final causes because they display tendencies toward an end state. Moreover, habits are not static 'entities' for they may evolve in the course of time. Peirce called the possible evolution of final causes "developmental teleology" (EP I: 331; 1892).

Thus final causes are not future events, but general possibilities. The end state of the process to which the act of causation belongs can be reached in different ways. Moreover, the process involved is irreversible.

The idea that *efficient causation* can only be understood within the context of final causation is absolutely central to Peirce's conception of causation. According to Peirce:

Efficient causation [...] is a compulsion determined by the particular condition of things, and is a compulsion acting to make that situation *begin* to change in a perfectly determinate way; and what the general character of the result may be in no way concerns the efficient causation. (EP II, 120; CP 1.212, 1902)

Thus, efficient causation, *considered apart from its final causal component*, is not directed toward an end in any way; it is *blind compulsion*. However, contrary to the mechanical conception according to which causes are the inactive nodes in a law-like implication chain, Peircean efficient causes are the *active initiators of a change*. Thus, 'A is the cause of B' means that B results partly from some activity or influence originating in A. Efficient causation thus considered is a dyadic relation between two concrete individual events. Final causation, on the other hand, is a triadic relation between the general final cause, the concrete efficient cause, and its concrete effect. The production of the *individual* effect (B) by the *individual* efficient cause (A) is determined, or mediated, by the *general* final cause (C'). The efficient cause functions as a *means* for the attainment of the *end*. Schematically this may be represented as follows:



The relationship between A, B and C' is triadic. At the beginning of the causal process, the concrete, realized end C does not yet exist. Yet, though the causation of B by A cannot be influenced by C (there is no backward causation), it is nevertheless determined by *possibility* C'. The individual event of a bird's dying (C) does not direct the shooting of the gun (A), but the *general* purpose of the hunter (C') does. At the moment of the shooting this purpose has not yet been realized; it is a mere idea, that is to say, a possibility.

Moreover, according to Peirce, every event (as part of a natural process) is characterized not only by an aspect of final causation and an aspect of efficient causation, but also by an aspect of *objective chance*. Each natural (and therefore teleological) process involves an aspect of irreducible novelty or objective chance at every stage of the process, which cannot be reduced to efficient or final causation. In the above given diagram, each stage of the causal process (level A-B-C) involves an aspect of objective chance. Thus even in a so-called mechanical process as the shooting of a bird, the course of the bullet is not completely determined by the efficient cause and the law (final cause); there are always at least infinitesimal departures from the law.

The sequence A→B→C represents a *continuous* sequence of (continuous) events. Thus, between any event A, apparently causing another event B, there is an innumerable series of events affecting B, which may therefore as well be called the cause of B. Describing A as *the cause* of B abstracts from the aspect of continuity involved in causation; in other words, one changes his perspective from causation toward causality (and thereby from events to facts).

From the *dynamic point of view*, the scheme represents the production of a sequence of events, in which A-B (as mediated by C') must be thought of as *one concrete, productive event*. This event is part of the continuous sequence A→B→C, which derives its unity teleologically from one and the same final cause (C'). It is only after the *one* concrete, productive event A-B has occurred, that abstraction yields A as the cause and B as its effect; for it is only after an effect has been produced, that one can speak of 'causes' and 'effects.'

Moreover, each act of causation involves two aspects that must be sharply distinguished: the fact *that* something is caused, and *what* it is that is caused. While the

former is explained by the efficient cause, the latter is explained by the final cause. Thus, the final cause does not determine *that* an event occurs; it only determines *what* type of event it will be, if the event occurs. In other words: it does not determine the action *qua* action, but it determines the general type or *form* of the action. Thus, in the example of the shooting of the bird, the fact *that* the bullet is shot, is determined by the act of pulling the trigger of the gun (efficient cause); *what* it is that is shot, is determined by the purpose of the hunter, which is reflected in the direction of the gun (final cause).

Above it was explained that Peirce's conception of causation is characterized by a triple interdependence of final causation, efficient causation, and chance. Keeping in mind that in the introduction we distinguished two mutually incompatible conceptions of cause - the *Aristotelian-scholastic Conception*, according to which causes are the active initiators of a change, and the *Scientific Conception*, according to which causes are the inactive nodes in a law-like implication chain - we may conclude now that Peirce's conception of efficient cause forms, in some sense, an ingenious middle way between these two conceptions. On the one hand, Peircean efficient causes are the active initiators of a change (rather than the inactive nodes in a law-like implication chain); 'A is the cause of B' means that B results partly from some activity or influence originating in A. On the other hand, however, Peirce held that "the action of a *cause* is essentially a case of the operation of a law, and implies a law" (MS 318: 00020, 1907). In this context, the term 'law' must be understood in the broad sense of habit, final cause, or general disposition; it involves natural laws as well as personal predispositions to act in a certain way.

Moreover, as it was shown in sections I and II, it was Peirce's view that (i) laws of nature are probabilistic rather than deterministic, (ii) cause-effect relationships are irreversible, and (iii) efficient causes precede their effects. Furthermore, (iv) depending on the context, efficient causes are either events or facts. In the next section we will discuss the relationship between Peircean events and Peircean processes.

III.2 EVENTS AND PROCESSES

Above, I described Peircean events as minimal temporal units, or cross sections of some actual processes. I also said that the most concrete level of reality is a momentary state or *event* in an ongoing *process*. This raises the question: How are Peircean events related to Peircean processes? In order to answer this question, we must first clarify what Peirce meant by *event* and by *process*.

(1) Though Peirce would not deny the reality of macro-events, such as witnessing a concert, 'Peircean events,' as we defined them, are micro-events, that is to say, minimal temporal 'slices' of an ongoing process. If my interpretation so far is correct, *Peircean events share the following characteristics: (i) temporal extension, (ii) absence of definite temporal limits, and (iii) an infinitesimal duration. Moreover, (iv) they are ontologically prior to substances.*

(2) Since Peirce never explicitly discussed the concept of process in general, the best we can do is to consider what he said about natural (that is to say, irreversible, teleological, evolutionary, etc.) processes.

Peirce held the view that each process consists of a continuous, causal sequence of events, which is regulated by some final cause by virtue of which there is order in the world. This view may be clarified by making use of Dorothy Emmet's definition of process:

... processes are changes with an internal order which distinguishes what is happening within the process from forces acting on it from outside. [...] [They have] a direction, though not necessarily a *terminus ad quem*. (Emmet 1992, p.35)

Indeed, Peircean processes too are characterized by an internal order and by directionality. In fact, the principle of the internal order of a Peircean process is its directionality, which in turn is determined by its final cause. The final cause sets the boundary conditions of the change toward an end state, which itself is, within certain limits, independent of any "forces acting on it from outside."⁶

Thus, I propose to give the following characterization of a 'Peircean process:' *a 'Peircean process' is a continuous sequence of events that derives its unity or internal order (distinguishing it from other processes) from a final cause, which directs the sequence to some end state which itself may evolve.*

(3) We are ready now to have a closer look at *the relationship between processes and events*. Because Peircean processes and Peircean events are intimately related inasmuch as each event is part of a process, while each process consists of a continuous sequence of events, processes and events differ mainly in respect of *complexity, teleology, and coherence*.

Consider the example of someone who, while driving a car from A to B, crashes the car before reaching B. While driving a car from A to B is a good example of a process, the several phases of the change involved count as an event. Driving a car is a complex action, while crashing a car is (comparatively) simple. Hence, it would appear that,

while processes are characterized by complexity, events are simple.

Moreover, while driving a car from A to B is a teleological process, the crashing of the car (*qua* crashing) is bereft of any teleology. Thus, contrary to processes, events (*qua* events) are not immediately characterized by any teleology. An event just happens. The teleology only comes in if we consider the event as a part of an ongoing process. Thus, *processes are characterized by teleology, which events lack.*

Closely related to the previous point is that processes, such as driving a car from A to B, are characterized by a certain internal order or *coherence*. Events, however, being simple in themselves, lack this characteristic.

Thus, Peircean processes differ from Peircean events inasmuch as only the former are characterized by complexity, teleology, and coherence.

In view of the above given survey of Peirce's conception of causation and of the relationship between Peircean processes and Peircean events, I may now provide an anatomy of Peircean productive events. However, because this anatomy must be seen within the larger context of Peirce's categoreal scheme, I will start my exposition by giving a brief account of Peirce's categories.

III.3 THE ANATOMY OF PEIRCEAN PRODUCTIVE EVENTS

The basic idea behind Peirce's categoreal scheme is that all phenomena are infected by Firstness, Secondness, and Thirdness. Whatever it may be we are describing, be it theories, arguments, or events, there is always an element that does not refer to anything beyond itself (a First), an element that is related to this first element but not to anything else (a Second), and an element that relates or mediates between the first and the second element (a Third) (e.g. CP 8.328, 1904). In other words: Firstness is a monadic relation, Secondness a dyadic relation, and Thirdness a triadic relation.

According to Peirce, each event has an aspect of Firstness, Secondness, and Thirdness. The aspect of Firstness concerns the particular qualities - which as such are mere possibles - that are involved in the event. Secondness concerns the aspect of action *hic et nunc*, independently of any uniformity or law. Thirdness concerns the aspect of habit, or continuity of form; Thirdness "determines the suchness of that which may come into existence, when it does come into existence" (EP II: 269, 1903). Thus, each event owes its definiteness or *form* to Thirdness, which is of the nature of habit or final cause.

Though Firstness, Secondness, and Thirdness seem to reflect the traditional modal categories of, respectively, *possibility*, *actuality*, and *necessity*, the necessity of

Thirdness is not absolute, but it is *conditional necessity* of the form: *if A, there will be a tendency toward B* (e.g. EP II: 271, 1903).

Peirce held the view that modal distinctions correspond to temporal ones; thus *possibility, actuality, and conditional necessity* (or potentiality) are the modes of, respectively, present, past, and future (CP 5.459, 1905). Accordingly, it would appear that in each Peircean event three distinct temporal phases may be recognized: (1) reception of causal influence from the past, (2) (present) self-determining activity, and (3) influence upon subsequent events.

Thus, every *present event* is conditioned by the past while it conditions the future. Though the present event conforms to *the past*, it nevertheless contains an element of irreducible novelty, for causal conditioning always leaves a range of open possibilities, however small it may often be (e.g. in so-called mechanical processes). This insight, which Peirce shared, among others, with Henri Bergson (1859-1951) and A.N. Whitehead (1861-1947), was formulated by Whitehead in the following words: "An actual entity [that is, an event] is at once the product of the efficient past, and is also, in Spinoza's phrase, *causa sui*" (Whitehead [1929] 1978, p.150). Every present event is self-actualizing; it is an act of decision that selects and actualizes one possibility among various possibilities. Which of the causally possible events occurs is decided in the event itself, rather than beforehand.

Though future events are not necessitated in their full particularity, certain abstract, more or less *general*, features are determined in advance. Hence, given a certain event, it is necessary that a certain *kind* of event will occur, while it is not necessary that this rather than some other event will occur. For, *it belongs to the nature of an event, not only that it creates a new event (Secondness), but that it creates a new event of a certain type or natural class⁷(Thirdness)*. To what type a new event will belong, is determined by a (cluster of) previous event(s), and by the relevant law or final cause. For instance, an egg produced by a turtle will always be a turtle egg, partly because the event emerges from biological processes that occur in the mother turtle, and partly because of the 'law' of the development of a turtle egg.

Thus, each event

1. is *causa sui*, that is, it involves a decision selecting one possibility among various possibilities,
2. is conditioned by a cluster of previous events, and by the relevant final cause,
3. conditions and limits the range of possibilities for subsequent events.

Though Peirce nowhere brought it to the fore, his view entails that the relevant final cause is the *perspective* by virtue of which the efficient cause and its effect are related. This claim needs some clarification. Consider the macro-event of twenty thousand people watching a live speech by the prime minister of some country on some controversial political subject. No doubt, the speech will yield twenty thousand different reactions, for each observer watches the speech event in the light of his own expectations, predispositions, feelings, etc. In other words, it is by virtue of the fact that each spectator observes the event from his own *perspective*, that the very same event yields such different reactions.

Such perspectives are basically habits, which help determine the future reactions of a person to specific events. For instance, if a person's perspective involves an abhorrence of discriminatory rhetoric, each utterance that smacks of discrimination may cause him to become angry. *Thus each perspective reflects a conditional necessity, which has the structure of a material implication.* The probable or potential reaction of some person called John to an event of the type X may therefore be described as follows: *If an event of the sort X occurs, then John will have a strong tendency to react in such and such a way (way Y).*

Schematically, the occurrence of John's fury may be represented as follows:



While A is John's perception of discriminatory talk, B is John's angry reaction, and C' is John's abhorrence of discrimination, A-B-C' is the one productive event of John's becoming angry. Thus, John's becoming angry is an act of causation in which John's perception of discriminatory talk is the efficient cause, and his (habitual) abhorrence of such talk is the final cause.

It would appear that, though he never worked it out in concrete detail, Peirce's view on causation entails that each present productive event assimilates the past event from a definite perspective. The past event is related to the present event as an efficient cause to its effect. This relationship is mediated by the final cause, which is the perspective.

Semioticians may recognize that there is a structural similarity between the *assimilation* of a past event by a present productive event, and the *representation* of a past object in a present sign. Indeed, it would appear that, from a semeiotic point of view, the perspective from which the previous event is assimilated is precisely the *interpretant*⁸. However, this complex issue of the relationship between Peirce's semeiotic and his theory of causation will not be discussed here; it is extensively discussed in (Hulswit & Sowa, 2001).

In the next section I will discuss some outstanding questions.

IV. Some Outstanding Questions

Peirce's theory of causality and causation is very valuable in many respects, and perhaps even revolutionary inasmuch as it is based upon one, and only one, coherent categorial system; contrary to the received view today (which is caught between a substance ontology and a fact ontology (see Hulswit & Sowa, 2001), Peirce's theory is based upon an event ontology in the strictest sense of the word.

However, there are several aspects of Peirce's theory that require further examination. First, the relationship between Peirce's categorial framework and his theory of causation needs further reflection. Though Hookway (1992) gives some valuable clues, the precise nature of this relationship must be worked out in greater detail.

Secondly, there is the intriguing metaphysical problem of the relationship between causation and time. According to Peirce, the most distinctive character of *time* consists in its asymmetry. While earlier members of an event-sequence may affect later members, the converse does not hold. Similarly, simultaneity is defined in terms of unaffectedibility: two events are contemporaneous if and only if "each is absolutely unaffected by the other" (EP I: 323, 1892). But since affectability is a causal concept, it would appear that Peirce held the view that time is derivative with respect to causation, which is to say that causation, rather than time, is ontologically primary. If this is correct, then Peircean events do not happen in time, but they are the condition of time, whatever time may be. However, the precise nature of Peirce's view of the relationship between causation and time needs further inquiry.

Thirdly, given the major role of signs in our knowledge of causes (smoke, for example, is not only caused by fire, but it is also a sign of fire), and given the apparently intimate relationship between signs and causes in contemporary discussions, it may be helpful to approach the problem of causation from the point of view of an adequate theory of signs. A first attempt to elucidate the problem of causation from the perspective of Peirce's semeiotic is made in (Hulswit and Sowa, 2001). There it is suggested that Peirce's semeiotic explains the stubborn problem how *forms* be transmitted from causes unto their effects. However, though it seems clear that there is an intimate relationship between Peirce's semeiotic and his theory of causation, the precise nature of this relationship is as yet far from clear.⁹

Fourthly, there is the topic of mental causation - causation involving mental events as

causes or effects - which in contemporary philosophy is a hotly debated topic. Though Peirce has hardly written any explicit texts on mental causation, his semeiotic may involve a radically new perspective on the subject. This aspect of Peirce's thought deserves more attention than it has received until now.

Finally, there is the problem of Peirce's place in the history of philosophy in respect of causation. Roth (1985) explicitly discusses the question "Did Peirce answer Hume on Necessary Connection?," and Hookway (1992) provides some valuable insights into Peirce's relationship to Hume, Kant and Russell. Hulswit and Sowa (2001) situate Peirce's theory within the context of the historical evolution of the concept of cause from Aristotle to the present discussions. The topic needs far more research, though.¹⁰

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Endnotes

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1. Peirce thinks here of the interpretation of 'the law of the conservation of matter and energy,' according to which causation is transformation of energy and mass. This

- interpretation, which was rejected by Peirce, was formulated by Paul Carus (a critic of Peirce) as follows: "The law of the conservation of matter and energy rests upon the experience (corroborated by experiments) that causation is transformation. It states that the total amount of matter and the total amount of energy remain constant. There is no creation out of nothing and no conversion of something into nothing" (quoted in Peirce, CP 6.601, 1893). ←
2. "According to the dominant mechanical philosophy, nothing is real in the physical universe except particles of matter with their *masses*, their relative *positions* in space at different instants of *time*, and the immutable laws of the relations of those three elements of space, time, and matter. Accordingly, at any one *instant* all that is real is the masses and their positions, together with the laws of their motion. But according to Newton's second law of motion the positions of the masses at any one instant is not determined by their positions at any other single instant even with the aid of the laws. On the contrary, that which is determined is an acceleration [the effect is the acceleration]. Now an acceleration is the relation of the position at one instant *not* to the position at another instant, but to the positions at a second and a third instant" (RLT 199, 1898). For further explanation, see RLT 199-201 ←
 3. See Peirce's "The Ethics of Terminology" (EP II, item 19). ←
 4. According to Peirce, association is "a *habit* or *disposition* of mind in consequence of which an idea of one description is likely to bring into comparative vividness of consciousness an idea of another description" (RLT 232, 1898). ←
 5. The following section is borrowed for the greater part from my 1996 paper; for a detailed analysis, see Hulswit 1996, especially 182-198. See also Hulswit & Sowa 2001. ←
 6. Peircean processes are creative in a triple sense: (1) each event involved in the process contains an element of irreducible novelty; (2) the end state of a process can be reached in different ways; whenever one way or line of causation be blocked, it may originate new lines; and (3) the end state toward which a process tends, may evolve spontaneously (see Hulswit 1996, 195-98). ←
 7. For an extensive discussion of Peirce's theory of natural classes, and particularly its relationship to his concept of final causation, see Hulswit 1997. ←
 8. John's becoming angry is not only a sign of discriminatory talk (object), but it is also caused by some discriminatory utterances (efficient cause). John's abhorrence of discrimination is from the causal point of view the perspective or final cause, and from the semeiotic point of view the interpretant. ←
 9. There are in fact two problems regarding the relationship between Peirce's semeiotic and his theory of causation: (1) what is the role of semeiotic principles in causation (which is the

problem briefly discussed above), and (2) what is the role of efficient causation, final causation and chance in semeiotic. The latter problem is usually indicated as the problem of 'semeiotic causation.' Both problems will be discussed in the entry "Peirce on Semeiotic Causation." For an extensive discussion, see also Hulswit and Sowa (2001). ←

10. I thank Guy Debrock for a number of valuable suggestions, which have helped to improve my text. ←