


Teleology



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Abstract:

In this article, Peirce's conception of teleology or final causation is discussed. According to Peirce, final causes are (a) general types that tend to realize themselves by determining processes of efficient causation. They are (b) not future events, but general (physical) possibilities. Given any process, the symptoms of final causation are that (i) the end state of the process can be reached in different ways, and that (ii) the process is irreversible.

Peirce holds the view that, instead of being two basically different types of causation, final and efficient causation are complementary inasmuch as there is in each act of causation an efficient and a final component. He therefore rejects the idea that mechanical and teleological processes are completely heterogeneous. *All* processes are teleological; mechanical processes are simply teleological processes with a low grade of finality.

Moreover, teleology involves objective chance, which is to say that there is an aspect of irreducible novelty at every stage of a process. And it involves novelty in the choice of the different routes that lead to a specified general end state, and in the possible evolution of the final causes themselves ('developmental teleology').

Keywords: Chance, Creativity, Efficient Causation, Final Causation, Mechanicism, Teleology

The objective of this article is to give a general account of Peirce's conception of teleology. The term 'teleology' derives from the Greek word *telos*, which means goal, task, completion, or perfection. Teleology may therefore be roughly described as the study of (the 'causal' roles of) end states, purposes, and goals. Thus, teleological explanations account for processes, events, facts or things in terms of their being directed at optimal or normal end states, or in terms of purposes or goals. Teleological explanation is usually contrasted with causal explanation: while teleological explanations (in the strong sense) are based on final causes, causal explanations only refer to previous efficient causes and some law governing the development of the causal process.

Typically, the defenders of teleology challenge the view that all natural processes can be adequately explained in terms of efficient causality. In contemporary philosophy and science there is a strong aversion to explanations by final causation; most approaches consider teleological processes as a special kind of mechanical processes, and try to reduce teleological explanations to explanations based solely on efficient causation.

Typical examples of such reductionist strategies are the system theoretical and cybernetic approaches. On the other hand, certain evolutionary biologists maintain that, though biology cannot do without teleological language, the explanations of biological processes cannot be based on anything but efficient causation.¹

Although it is currently held that there are no final causes in nature, the proponents of the reductionist strategy do not provide us with a clear theory of causality that shows how teleological processes can be explained by efficient causation alone. At the present moment, no adequate theory of teleological processes is available. However, the problem of teleology shows up time and again in all kinds of discussions; it is not only prominent in debates on biological evolution and biological behavior, but also in discussions about other areas of physical science, perhaps most prominently in physical cosmology.²

Not surprisingly, the problem of teleology has both an epistemological and an ontological aspect. The epistemological aspect concerns the question whether teleological explanations are valid scientific explanations. The ontological question concerns the reality of final causes as such, and thereby, among other things, the status of man in nature. For, if it is true that teleology is not part of the human condition, then - as some scientists wish to make us believe - human beings and other goal-directed organisms are merely complicated homing devices, such as thermostats and target seeking rockets.

The dismissal of teleology by most modern and contemporary philosophers is mostly based upon the rejection of three properties that are commonly thought to be involved in the concept of final causation. Final causation is usually believed to involve

1. a reference to individual, future events,
2. an influence of these individual, future events upon the present event
(backward causation),
3. a straightforward, completely determined course toward the end state of the process
(backward determinism) (Hulswit 1996; Hulswit and Sowa, forthcoming).

In this article, I will show that Peirce has made clear that none of these three properties belongs to the concept of final causation, and that the dismissal of final causation by most modern philosophers is therefore due to a fatal misunderstanding of the concept. Though Peirce's conception of final causation is particularly important both to the contemporary philosophical debate on teleology, and to the understanding of nearly all aspects of his own philosophy,³ in this article, I will restrict myself primarily to giving a

general exposition of Peirce's theory.

More concretely, I will successively discuss the following issues: (I) Peirce's anthropomorphic approach to final causation, (II.) the relationship between final causation and efficient causation, (III) the difference between mechanical and teleological processes, (IV) teleology and objective chance, and (V), the idea that teleology is creative. In the final section (VI), I will briefly discuss some outstanding questions. The issue of the relationship between final causation and natural classes will be dealt with in a separate entry of this Encyclopedia. [Natural Kinds and Causation]

I. Peirce's Anthropomorphic Approach

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Much of the aversion of contemporary philosophy of science regarding teleology is based on the erroneous view that teleological explanations imply final causes that are concrete future events. Such backward causation is rightly rejected because it is thought to be incompatible with the current views of efficient causation. Indeed, how could future events cause present events at all, if they do not yet exist? Thus, the idea of final causation as backward causation is preposterous. Peirce's critique of this erroneous view of teleology was in this respect in total agreement with Aristotle's view. Moreover, like Aristotle, Peirce endorsed the view that the conception of final causation is explicitly and intentionally anthropomorphic.⁵ While warning us not to identify final causes with *conscious* goals - "a purpose is merely that form of final cause which is most familiar to our experience" (CP 1.211; 1902) - Peirce used the model of goal-directed experience as point of departure of his analysis.

This, of course, raises the problem of anthropomorphism, that is, the problem of the justification of the ascription of human characteristics to non-human beings or things. Peirce, however, persisted that anthropomorphism is simply unavoidable. All our ideas in one way or another refer to our human experience (MS 293:1-2; 1906). The same holds for our theoretical concepts and scientific explanations: "every scientific explanation of a natural phenomenon is a hypothesis that there is something in nature to which the human reason is analogous; and that it really is so all the successes of science in its applications to human convenience are witnesses" (CP 1.316; 1903). Ideas of, say, causation, action, force, energy, motion, natural selection, etcetera are all anthropomorphic because they all find their origin in human experience. Consider the idea of causation: "The very conception of causality has its origin in our tendency to seek relations in nature analogous to intellectual relations" (MS 963; c.1893). Or

consider the idea of natural selection: it is only by analogy to human acts of selection that this idea makes any sense. Thus, all theoretical ideas in one way or another originate in and refer to human experience. If they did not, they would be meaningless: for, if they are to have any meaning at all, there must be *some* kind of relationship between them and our daily human experience. Consequently, far from being a problem, anthropomorphism is a sheer necessity.

The first thing we notice when considering our own goal-directed behavior is that, contrary to what is usually believed, our goals are neither things nor events. According to Peirce, goals are nothing but 'operative desires,' the objects of which are never concrete, but always general. Something desired is always something of a certain *kind*. We want a certain *kind* of apple pie, not one specific individual specimen (CP 1.341; c.1895). Of course, there are all kinds of levels of generality, and one goal may be more specific (less general) than the other: we may want an apple pie made of a special *kind* of apples and a special *kind* of dough. But even then, the object remains general. Accordingly, we can see that final causes are *general*, and not concrete.

If final causes are general, they cannot be events either, because events are always individual. Our wishing to eat an apple pie is an event that directs us toward some end. While the wish itself is an event, what it is we wish is of the nature of an idea, or a general type. Consequently, to regard final causes as concrete *events* is a category mistake (in the Peircean sense of the word).⁶

Furthermore, our conscious goals do not work from the future toward the present. One may have a purpose and only later be able to realize it, if at all, but that does not imply that there is an influence from the future on the present moment. At the present moment, the future is not there yet, nor can it influence anything. Thus, final causes cannot be *future* events; they are general types that may be realized in the future. These general types are no actual existences, but general (physical) possibilities for future realization.

These preliminary considerations may enable us to better understand Peirce's conception of final causation. Peirce gave the following description of final causation:

... we must understand by final causation that mode of bringing facts about according to which a general description of result is made to come about, quite irrespective of any compulsion for it to come about in this or that particular way; although the means may be adapted to the end. The general result may be brought about at one time in one way, and at another time in another way. Final causation does not determine in what particular way it is to be brought about, but only that

the result shall have a general character. (CP 1.211; 1902)

Elsewhere Peirce called a final cause "a tendency to produce some determinate kinds of effect" (MS 682:5-6; c.1895). About such tendencies Peirce made the following observation:

By a tendency to an end, I mean that a certain result will be brought about, or approached, and in such a way that if, within limits, its being brought about by one line of mechanical causation be prevented, it will be brought about, or approached, by an independent line of mechanical causation. (NEM IV: 66; 1902)

Thus, the final cause is not an existing thing at all. Indeed, it may be misleading to call it a 'cause,' for this term - at least in its regular modern sense - suggests that some concrete, existing thing, or event, or fact, has a determinate influence on another thing, or event, or fact. The final cause is not a concrete thing, but it is a type, a mere possibility; it is nothing but an *ideal* end state that a process tends toward.

Peirce called this tendency toward an end state a cause, because he attaches great value to the original meaning of concepts.⁷ According to its original, Aristotelian, meaning, a cause is some kind of condition without which a thing would not be what it is. Thus Peirce's notion of cause is much more general than the modern notion, which restricts the term to the Aristotelian efficient cause.⁸ According to Peirce, some reference to a final cause is required in any explanation of a teleological process, because the final cause is a determinant of it.

This may be illustrated by the example of thermodynamic processes. These are teleological, because they tend toward an ultimate state of relative stability:

Those non-conservative actions which seem to violate the law of energy, and which physics explains away as due to chance action among trillions of molecules, are one and all marked by two characters. The first is that they act in one determinate direction and tend asymptotically toward bringing about an ultimate state of things. If teleological is too strong a word to apply to them, we might invent the word *finious*, to express their tendency toward a final state. The other character of non-conservative action is that they are *irreversible*. (CP 7.471; c.1898)

Finious processes are marked by two characters: (a) they tend asymptotically toward an end state, and (b) they are irreversible. Peirce hesitated to call thermodynamic processes teleological in a strict sense, because the end state is only approximated and never completely reached. Although they are teleological in a somewhat weak sense, they are nevertheless teleological, because the convergence cannot be explained by reference to the innumerable separate forces (efficient causes) alone; it can only be

explained by statistical laws. Consider for example the diffusion of gasses: whatever the initial state of the gas and the countless small forces the different molecules exert upon each other may be, these do not suffice to predict the end state of the gas. Such prediction requires knowledge of the relevant statistical laws, which are final causes in the Peircean sense (CP 6.24, 1898; NEM IV: 66, 1902).⁹

Thus, we may conclude that, according to Peirce, final causes are general types that control the efficient causation; they determine that the effects brought about by efficient causation are of a certain general character. The final cause determines what kind of means is suitable for reaching the general end. Moreover: final causes specify which efficient causes advance the realization of that final cause (CP 2.149; 1902). Whenever someone wants to realize an idea, this idea functions as a principle of selection in the choice of the appropriate means ('lines of mechanical causation') whereby the idea is to be realized. If one wants to build a house, he does not approach his objective by going for a swim, because swimming is not an appropriate means for building a house. The selection of the means may vary, as long as they are appropriate to the building of the house. A house brought about in a different way will no doubt be a (somewhat) different house, but it will still be a *house*. The fact that the means may be varied and yet may lead to a result of the same general type, can only be explained if we presume that the general type governs the whole process, and this general type is what is meant by 'final cause.'

We may now define final causes provisionally as follows: *final causes are general types that tend to realize themselves by determining processes of mechanical causation. Final causes are not future events, but general (physical) possibilities that may be realized in the future. The symptoms of final causation are (a) that the end state of a process may be reached in different ways, and (b) that the process is irreversible.*

II. Final Causation and Efficient Causation

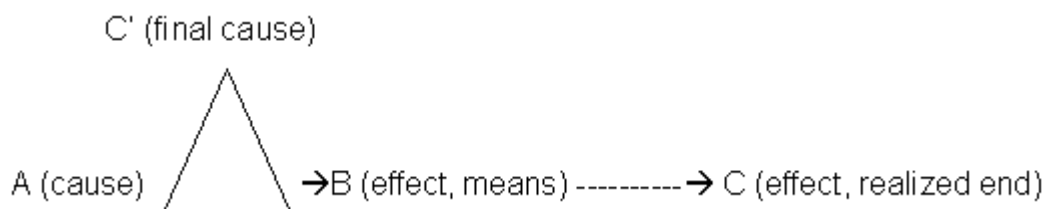
A thorough understanding of Peirce's conception of teleology requires a clear view of how he conceives the relationship between final and efficient causation. Peirce gives the following description of efficient causation:

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. (CP 1.212; 1902)

Thus, efficient causation, as opposed to final causation, is not directed toward an end in any way; it is blind compulsion.

To clarify the relationship between final and efficient causation, Peirce gives the example of someone who has the intention to shoot a bird. To hit the bird, he does not shoot directly at it, but a little ahead of it, taking into account the distance that the bird will fly before the bullet reaches it. This activity is end-directed, and thus belongs to final causation. But as soon as the bullet has left the rifle, there is only the stupid, blind efficient causation which in no way is concerned about the results of its activity; the bullet will not follow the bird swooping in another direction. Efficient causation has no regard whatever for results; it simply "obeys orders blindly" (CP 1.212; 1902).

While efficient causation, considered apart from its final causational component, is a dyadic (two-term) relation between two concrete individual events or facts, final causation is a triadic (three-term) relation¹⁰ 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 effect (B) functions as a *means* for the attainment of the *end* (C) (the motion of the bullet is the means for the shooting of the bird, which is the end). Schematically this may be represented as follows:



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

Most contemporary philosophers of science think that final causation and efficient causation preclude one another. The example of the shooting of the bird, however, illustrates that final causation and efficient causation are complementary. First, there plainly is no final causation without efficient causation. To shoot a bird it does not suffice to direct one's gun; one also needs the motion of a bullet that blindly obeys the action of the trigger. Conversely, there is no efficient causation without final causation.

For, even after the bullet has left the rifle, it conforms to a general law, the causality of which is of the order of final causality:¹¹ "Thus, the relation of a law, as a cause, to the action of force, as its effect, is final causation, not efficient causation" (CP 1.212; 1902). The bullet conforms, among other things, to the law of gravity, which "might without falsity be conceived as a final cause, since it certainly destines things ultimately to approach the center of the earth" (MS 682:7; 1913).

Peirce wrapped up this insight regarding the basic complementarity of efficient and final causation in the form of his famous analogy of the court and the sheriff:

The court cannot be imagined without a sheriff. Final causality cannot be imagined without efficient causality; but no whit the less on that account are their modes of action polar contraries. The sheriff would still have his fist, even if there were no court; but an efficient cause, detached from a final cause in the form of a law, would not even possess efficiency" (CP 1.213). [...] Final causation without efficient causation is helpless [...]. Efficient causation without final causation, however, is worse than helpless, by far; it is mere chaos; and chaos is not even so much as chaos, without final causation it is blank nothing. (CP 1.220; 1902)

Hence, final causation and efficient causation are not two different types of causation, each of which would act in different situations. In each act of causation, there is an efficient and a final component. While being caused by previous events, each event is part of a process, which is governed by a final cause. This entails that causal explanations are not more valid than teleological explanations; they just serve a different aim. Whereas causal explanations explain individual events on the basis of previous events and laws, teleological explanations tell us what general principle determines the tendency of a process.

To summarize: according to Peirce, *every teleological process implies a triadic relationship between an individual efficient cause, a general final cause, and an individual effect. Final causation and efficient causation are complementary inasmuch as each act of causation involves both an efficient component and a final component.*

III. Teleological and Mechanistic Processes

If final causation and efficient causation are complementary, a closer examination of their relationship cannot be avoided. This will be done by focusing upon processes. In this section I will explain the difference between teleological and mechanical processes. We will see that the problem regarding the relationship between the mechanical and the teleological aspects of natural processes involves the concepts of continuity and chance.

In Peirce's view, the following properties characterize mechanical behavior: (1) the end state depends completely upon the situation at the beginning; (2) there is only one way in which the end state can be reached; (3) mechanical behavior is completely reversible in the sense that knowledge of the end state and the relevant laws of nature make it possible to retrodict the initial state (MS 1343:26-7; 1902).

But, paradoxically, and contrary to what is sometimes suggested, 'pure' mechanical behavior does not exist in Peirce's universe. For example, in an otherwise excellent article about Peirce's conception of final causation, T.L. Short speaks of "completely mechanical" processes, and of entities that "may operate mechanically or by efficient causation [...] [while] others may operate by final causation" (Short 1981, p.374, see also Short, 1983, p.317). Expressions such as these are misleading. Peirce rejected the view that there are two kinds of fundamentally different processes for the same reason that he rejected every sort of dualism. The core of his argument is related to his synechism, which is "that tendency of philosophical thought which insists upon the idea of continuity as of prime importance in philosophy and, in particular, upon the necessity of hypotheses involving true continuity" (CP 6.169; 1902). Peirce tells us how synechism involves the rejection of dualism:

... dualism in its broadest legitimate meaning as the philosophy which performs its analyses with an axe, leaving as the ultimate elements, unrelated chunks of being, this is most hostile to synechism. In particular, the synechist will not admit that physical and psychical [read: mechanical and teleological phenomena are entirelyly distinct - whether as belonging to different categories of substance, or as entirely separate sides of one shield - but will insist that all *phenomena are of one character*, though some are more mental and spontaneous, others more material and regular. Still, all alike present that mixture of freedom and constraint, which allows them to be, nay, makes them to be teleological, or purposive. (CP 7.570; 1892; italics mine)

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Clearly, Peirce's synechism, which is a regulative principle of logic and of metaphysics (See for example: CP 6.173, 1902; 1.487, 1896; 1.624-25, 1898), rejects dualistic philosophies because they are all based on inexplicable ultimates. Synechism amounts to the principle that "whatever is supposed to be ultimate is supposed to be inexplicable," and that "inexplicabilities are not to be considered as possible explanations" (CP 6.173; 1902). Thus, synechism is committed to the idea that "*all phenomena are of one character*."

Interestingly, synechism also involves an element of chance. Chance is related to the fact that the laws of mechanics never agree completely with the course of events. What

we are inclined to call mechanical processes are processes that approach the laws of mechanics to a high degree, without ever doing so perfectly. Thus, the laws of mechanics are primarily formal laws, and as such they are independent of the matter in which they work. The laws of mechanics are laws that are the same in all possible worlds. As such, they lack an inherent drive toward self-realization. And thus, they fail to represent what is distinctive of real, material laws: "a real and living action in nature" (See RLT, 218-20, 1898, W1: 422, 1866).

But, wherever there is "a real and living action in nature," there is also objective chance. Though objective chance involves novelty, which is not reducible to any law, the *action* of chance does not yield randomness, for its effects are always subject to certain statistical laws. According to Peirce, this "mixture of freedom and constraint" has "inevitable teleological results" (EP I: 236; 1885). For instance in gambling, the overall end state of a series of games can be predicted on the basis of particular statistical laws, and knowledge of the boundary conditions (the number of players and the amount of money they deposit) and the pertinent statistical laws (which are determined by the rules of the game) enables one to predict the percentage of players who will win a certain amount of the money, the percentage that inevitably will lose, etcetera (EP I: 270-1; c.1887).

Granted, in "mechanical processes" the degree of deviation from the deterministic laws is minimal, and thus the degree of finality is very low. But even so, the fact remains that in some way, *all* processes are teleological, even though there is a difference in the *degree* of finality. Mechanical processes are teleological processes with a negligible degree of finality. Final causation in mechanical processes may be viewed as a degenerate kind of final causation (See MS 1343, 26-7, 1902; CP 6.322, c.1909).

Though we have not explained yet the precise meaning of 'objective chance,' it should be sufficiently clear that, in Peirce's view, a teleological process is not merely an *evolutio* in its original, Ciceronian sense, according to which evolution consists in the unrolling of a scroll. Instead of being a strictly deterministic process, teleology is decisively *creative*, albeit in a very specific sense which has yet to be examined.

IV. Teleology and Objective Chance

If we are to understand in what sense teleology is connected with creativity, it will be necessary to elucidate Peirce's concept of chance as well as his concept of developmental teleology. In this section, we will first explore the meaning of 'objective chance,' and then the relationship between teleology and chance. In the next section,

the idea of developmental teleology will be discussed.

Contrary to what is often thought, and contrary to what Peirce himself wrote in his earliest texts on chance, it would appear that 'objective chance' does not refer to a special kind of events that happen only every now and then. Hilary Putnam for example, in his recent introduction to Peirce's *Reasoning and the Logic of Things*, writes: "such indeterminism as Peirce postulated consists in the *very rare* occurrence of chance events" (RLT, 87, 1992; see also note 52, p. 278). This formulation smacks of a bifurcation of nature into a realm of chance events and a realm of completely mechanical events, which, as we have seen, Peirce categorically rejected. Putnam seems to view chance events as uncaused events, or in his own words, as "rare spontaneous events." But there is every reason to believe that this cannot possibly have been Peirce's view. Though there is some indication that Peirce believed that there are uncaused events,¹³ it may be argued that his position is far more subtle in that it affirms that *every* event is *partly* uncaused. This view is confirmed by Peirce's explanation of the variety and increasing complexity of the universe:

By thus admitting pure spontaneity or life as a character of the universe, *acting always and everywhere* though restrained within the narrow bounds by law, producing infinitesimal departures from law *continually*, and great ones with infinite infrequency, 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 accounted for. (EP I: 308; 1892; italics mine)

This text was taken from his "Doctrine of Necessity," in which he proposed "to examine the common belief that every single fact in the universe is precisely determined by law" (EP I: 298). Clearly, Peirce not only rejected the view that there are *some* facts or events that are not precisely determined by law; his position is far more radical: no event is ever completely determined by a law; an aspect of irreducible novelty characterizes each event.

Since each event involves an element of objective chance, and since the action of chance has "inevitable teleological results" (which are determined by certain statistical laws), each event has to be part of a causal chain that develops into a definite direction. Hence, objective chance must involve teleology.

But, conversely, there can be no teleology without chance. Without chance, all processes would be purely mechanical (deterministic). The variety in the world can, in Peirce's view, only be explained by chance. Besides, it is chance that accounts for the irreversibility of natural processes, without which there would not be any teleology.

Hence, final causation and chance presuppose one another. And since the same holds for final causation and efficient causation, we may conclude that according to Peirce, every event (as part of a natural process) is characterized by an aspect of final causation, efficient causation and chance.¹⁴ If this is correct, it entails that all teleological processes are in some sense creative: they presuppose an aspect of irreducible novelty at every stage of the process. This is the reason why final causes cannot specify exact results. By rejecting strict determinism, according to which the definiteness of the world is given throughout all time, Peirce defended the fundamental creativity of the world: reality is always reality in the making.

V. Teleology as Creative; Developmental Teleology

Before examining what other forms of creativity may be involved in teleology, we must have a clear idea of what we mean by that term. In an article on cosmic creativity in Peirce, Carl Hausman defines 'creativity' as follows: "a creative act issues in an outcome that is new in kind, which was unpredictable, and which has a definite character that is neither reducible to the sum of its elements nor exhaustively traceable to its antecedents" (Hausman, 1974, p.14). The creativity of a process is seen as equivalent to the irreducibility of the outcome of a process to anything that preceded that outcome. Hartshorne, on the other hand, who was also influenced by Peirce, stresses the positive side of creativity: "it does not mean merely that what happens is *not* fully specified by the causal conditions and laws; it means that there is *more* definiteness in reality after a causal situation has produced its effect than before. This increase or *growth in richness of determinations* is not an absence of something, it is a positive presence" (Hartshorne, 1970, p.34). Both Hausman's and Hartshorne's approaches may be combined by defining creativity as follows: *a process is creative whenever it is incompletely determined by the causal conditions and laws (final causes), and is therefore unpredictable in minute detail. Each stage of the process involves "an addition to the definiteness of reality"* (Hartshorne's expression).

According to the Peircean interpretation, *creativity thus conceived, involves three elements: (1) the events involved within the process, (2) the process itself, and (3) the end state of the process*. The first aspect we have considered already in the previous section; each event is creative to the extent that it contains an element of irreducible novelty. Here, we will concentrate on the two other aspects of creativity.

(2) It has been explained already in considerable detail, that one of the main characteristics of final causation is that the end state of a process can be reached in

different ways. This entails that the ways toward the end state are not determined by the final cause. As appears from Peirce's definitions of final causation (as quoted in the first section), it is precisely this characteristic that distinguishes teleological from mechanical behavior. A limerick by Maurice Evan Hare (1886-?), which was written as a reaction to the idea of determinism, may serve as a funny illustration of this difference:

There once was a man who said, 'Damn!
 It is borne in upon me I am
 An Engine that moves
 In determinate grooves,
 I'm not even a bus but a tram.

The motion of the bus is teleologically constrained by its terminus, without its specific movements being determined by it. A tram, on the other hand, is bound to its tracks. According to determinism, that is to say, according to the view that rejects final causation, man behaves more like a tram than like a bus, because everything he does is completely determined by mechanical causes. Thus, a teleological process, in general, is creative to the extent that, whenever one way or line of mechanical causation is blocked, it may originate new lines of action.¹⁵

(3) So far, it has been assumed that the main purpose remains unchanged in the course of the process. But in fact, it frequently happens that the main purpose develops into another one. The idea of writing a paper on teleology in Peirce, for example, might change into the idea of writing about creativity instead. This would be an instance of what Peirce has called "developmental teleology." In Carl Hausman's words this is "the view that there are purposes that may evolve spontaneously" (Hausman, 1993, p.175).

Peirce uses the term "developmental teleology" only once, in his "The Law of Mind" (EP I: 312-33; 1892), which was intended chiefly to explain his synechism. The "law of mind" states, more or less, that all ideas tend to grow to a harmonious whole, and by doing so, lose intensity while gaining generality. Applying this idea to human personality, Peirce concludes that a "personality is some kind of coordination or connection of ideas." One of the most important constituents of a personality is its reference to future ends, which gradually come to be:

... this teleology is more than a mere purposive pursuit of a predetermined end; it is a *developmental teleology*. This is personal character. A general idea, living and conscious now, it is already determinative of acts in the future to an extent which it is not now conscious. This reference to the future is an essential element of personality. Were the ends of a person already explicit, there would be no room for development, for growth, for life; and consequently there would be no

personality. The mere carrying out of predetermined purposes is mechanical. (EP I: 331)

Thus, growth refers to a process in which the purposes as such may evolve. But, 'developmental teleology' is not restricted to human personality. It is applicable to the idea of teleology in general: learning from the developmental aspect of our own human purposes, we can abductively infer that all final causes in nature are, at least in principle, subject to evolution. Thus, in the process of being realized, the final causes themselves may change. Moreover, final causes differ in degree of generality, and the more general ones can, while being realized, generate less general, or subordinate final causes. In T.L. Short's words this means: "chance thus leads to new ends, but only when the new is a way of fulfilling a more general and already operative end" (Short, 1994, p.406). The newly developed subordinate final causes must fit within the overall scheme of the more general final cause. For instance, if the more general final cause is the idea of writing a paper on some aspect of Peirce's cosmology, then the change in idea from writing on Peirce's conception of efficient causation to the idea of writing on his concept of teleology fits within the overall scheme of the more general final cause. Moreover, the new subordinate purposes, which arise by chance,¹⁶ are selected by the more general final cause. This has far reaching consequences, as T.L. Short so well expresses: "Final causation thus results, not in the dead uniformity of a single plan, but in the unpredictable heterogeneity of enterprises, personalities, and species that fill our world ..." (Short 1994, p.406).

VI. Merits and Outstanding Questions

Before discussing the merits of Peirce's theory and some outstanding questions, I will first briefly recapitulate his theory.

Peirce argued that 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."

Thus, final causes are not future events, but general possibilities. The symptoms of final causation are that (i) the final state of a process can be reached in different ways, and (ii) that the process is irreversible.

Peirce rejected the idea that final causation and efficient causation are two different types of causation. Instead, they complement each other inasmuch as each act of causation has both an efficient and a teleological component. He also rejected the idea that there are two sorts of processes: respectively, purely mechanic and teleological processes. Instead, each and every process is more or less teleological. Moreover, an aspect of irreducible novelty, which coincides with objective chance, characterizes each act of causation.

Peirce's theory is very helpful in showing the blatant fallacies inherent to three of the most important premises of nearly all contemporary discussions regarding teleology. Final causes are often rejected because they are erroneously thought (i) to be individual events that (ii) retroactively influence the present (backward causation), and (iii) do so in a strictly determinate manner (backward determinism).

Peirce's conception of final causation is in total agreement with Aristotle's view inasmuch as both views are explicitly and intentionally anthropomorphic, and both reject the idea of backward causation. But, 'Peircean final causes,' though referring to the Aristotelian terminology, clearly differ in a radical way from 'Aristotelian final causes' inasmuch as they are not (directly) related to the structure of *substances*. Indeed, Peircean final causes are to be understood in terms of his own categorial framework. They reflect *conditional necessities, which have the structure of a material implication: if such and such conditions obtain (p), then there will be a tendency toward some specific end state (q)*. Thus, the structure of the final causes themselves is *relational*, rather than something embodied in a substance.

By thus rejecting each and every substance ontology and by endorsing an event ontology instead [see the entry "C.S. Peirce on Causality and Causation"], Peirce's conception of final causation fully accords with the modern scientific experience, which primarily concerns the laws of *interaction* rather than the structure of *things* in and by themselves. Moreover, as far as I know, Peirce's theory is the only theory available that explains how different efficient causes may lead to the same general end state.

There are some indications that Peirce's conception of final causation might be an important aid to the understanding of a number of important philosophical problems, such as the problems of mind (or more specific: mental causation), artificial intelligence, and self-organization. I will briefly address each of these problems.

Peirce's theory of final causation entails a (double aspect) theory of *mind*, according to which each natural event has both a mental and a physical aspect. The mental aspect is

the aspect of final causation, whereas the physical aspect is the aspect of efficient causation (CP 7.366; 1902). By thus considering mind and matter as two *aspects* of one and the same process, rather than as two different kinds of substances or processes, the contemporary discussion might free itself from the last vestiges of a belief in a 'ghost in a machine.' However, the precise nature of Peirce's view of mind and its relationship to the contemporary discussion needs further investigation.

The question whether we should attribute intelligence or mental capacities to some complicated machines is an important aspect of the problem of *Artificial Intelligence*. In Peirce's view, *intelligence* is characterized by the anticipation of a future state. Intelligent action involves the causation of one event as a *means* to some end state. Thus, an action is intelligent if it is teleological (CP 5.473; 1907). If this view is valid, the now so common fully deterministic models of artificial intelligence might yield to Peirce's conception of final causation and thereby foster the development of *indeterministic models* for artificial intelligence (Hulswit & Sowa, forthcoming).

From the 1960's on, the concept of *self-organization* has played an increasingly important role in the natural sciences, the social sciences and the humanities. 'Self-organization' may be roughly defined as the spontaneous emergence of globally coherent patterns out of local interactions between initially independent components, without central or external control. Examples range from magnetization, crystallization, the movements of flocks of birds, to the evolution of economies. However, the concept of self-organization is ambiguous inasmuch as there is no set of necessary and sufficient conditions by virtue of which self-organizing systems can be distinguished from other self-regulating systems.

Studying self-organization is equivalent to investigating the form and dynamics of the attractors of a system. The concept of 'attractor,' defined as a preferred position of the system such that the system evolves so as to yield that preferred position, may be seen as a teleological or quasi-teleological concept in the Peircean sense. Thus, Peirce's conception of final causation may shed a new light on the ambiguous concept of self-organization, which, according to many, challenges the standard mechanistic conceptual framework.¹⁷

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Endnotes

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1. An important representative of this view is the evolutionary biologist Ernst Mayr. For an extensive, Peircean critique of Mayr's views, see my Hulswit, 1996. ↵
 2. See for example the current discussion about the anthropic cosmological principle in Barrow and Tipler 1986. ↵

3. Peirce's conception of final causation is not only a basic tenet of his pragmatism, his process metaphysics, and his semeiotic; it is also a fundamental aspect of his theories of experience, meaning, belief and action, mind, self, scientific inquiry, and truth. See especially Smith 1978; also: Colapietro 1989; Hausman 1993; Hulswit 1997, 1998; Hulswit and Sowa (forthcoming); Rosenthal 1994. ←
4. The body of this article (sections I-V) is an excerpt of my 1996 publication. ←
5. Probably, the two major differences are that (a) Peirce's theory does not, as Aristotle's does, presuppose a substance ontology, and (b) contrary to Aristotle's conception, Peirce's conception presupposes chance. According to Aristotle, chance entails the absence of a final cause. ←
6. Considered from the perspective of Peirce's categoreal scheme, efficient causation belongs to the category of Secondness, and final causation to Thirdness. Thus, "it is nonsense and utter confusion to treat [final causes] as forces in the material sense" (CP 1.265, 1902). ←
7. For Peirce's "ethics of terminology," see EP II, chapter 19 (263-266). ←
8. There are some important differences between Aristotle's notion of efficient cause and the modern notion. Perhaps the most important one is that according to Aristotle, efficient causes are related to things, while according to the modern theory, they are either events or facts. ←
9. According to Short (1981, 372, 375), these statistical laws, and final causes in general, are nothing but tautologies. We think that Short makes a mistake here. Final causes are characterized by an inherent drive toward realization, which can never be said of tautologies. Short seems to consider the statistical laws as "purely mathematical." In a sense he is right: they are mathematical in form. But they always refer to distributions of *physical* phenomena. Mathematical laws are not in themselves final causes; they do not determine anything but mathematical entities. Final causes are *physical* possibilities, not just logical or mathematical possibilities. That Short does not refer to the tautological nature of statistical laws in his 1983 article may indicate that he abandoned this view. ←
10. Characteristic of a triadic relationship is that it cannot be resolved into (two) dyadic relationships. ←
11. In the next section I will explain that the final causation of mechanistic laws is a degenerate kind of final causation. ←
12. "The distinction between psychical and physical phenomena is the distinction between final and efficient causation" (CP 7.366; 1902). ←
13. Peirce holds the idea that 'objective chance' refers to 'absolutely uncaused events' from 1880 till at least 1884 (see MS 674 and "Design and Chance," EP I: 217; 1884). During this period, the discussion is not yet placed within the context of his categoreal scheme. It

would appear that - according to Peirce's later works - every event involves an aspect of Firstness, Secondness, and Thirdness. This entails that every event involves an element of objective chance, efficient causation, and final causation. ←

14. See note 13. ←
15. A good example that shows that in the choice of routes there is creativity involved is the idea to write a book on a certain theme. It is clear that the way the subject is handled forms a crucial part of the creative process. Different routes may lead to different books on the same subject. ←
16. During the realization of a final cause, there is always the confrontation with the material world. This is the ground for the evolution of new final causes. New ideas (purposes) do not happen just by chance, but only as a response to an actual problematic situation. We think it is precisely this that Peirce was referring to when he wrote: "The way in which mind [read: final causation] acts upon matter [read: chains of efficient causation] is by imposing upon it conformity to certain peculiar laws, called purposes; and the manner of the reaction is that the purposes themselves become modified and developed in being thus carried out (MS 478, 18, 1903)." Consequently, developmental teleology requires more than just chance; it presupposes an interrelated activity of chance, efficient causation, and final causation. This agrees with Rosenthal's conclusion that developmental teleology can only be understood in terms of all three of the Peircean categories (Rosenthal 1994, 125). ←
17. I thank Guy Debrock for several valuable suggestions. ←