# Chapter 3

# PEIRCE ON FINAL CAUSATION

> ... the non-recognition of final causation ... has been and still is productive of more philosophical error and nonsense than any or every other source of error or nonsense. If there is any goddess of nonsense, this must be her haunt. (C.S. Peirce MS 478; 1903)

## 1. INTRODUCTION

The problem of teleology is the question whether 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.[1] Typical examples of such reductionist strategies are the system theoretical and cybernetic approaches.[2] Furthermore, there are the approaches of certain evolutionary biologists who maintain on the one hand that biology cannot do without teleological language, but on the other hand insist that the explanations of biological processes need to be based on nothing but efficient causation.[3]

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 clear theory of teleological processes is available.

However, the problem of teleology shows up time and again in all kind of discussions; it is not only prominent in debates on biological evolution and



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biological behavior, but also in discussions about other areas of physical science, perhaps most prominently in physical cosmology.[4]

The purpose of this chapter is twofold. The first objective is to give an outline of C.S. Peirce's view of final causation. The second objective is to use some of Peirce's insights in order to show that most contemporary debates on teleology are based on dubious presuppositions. More specifically, the second objective is to offer a Peircean critique of the theory of teleology held by Ernst Mayr, one of the most prominent contemporary philosophers of biology.[5]

My analysis will be confined to Mayr's view, as set forth in his famous 1974 article, "Teleological and Teleonomic, A New Analysis,"[6] for two reasons. First, it has had a tremendous influence on later discussions about final causation, even far beyond the scope of biological theory. Secondly, it contains a number of disputable presuppositions shared - and probably borrowed from Mayr - by most contemporary philosophers of biology and of science in general.

## 2. PEIRCE'S CONCEPTION OF FINAL CAUSATION

In this section the following themes concerning Peirce's theory of teleology will be discussed: (2.1) final causation, (2.2) the relationship between final causation and efficient causation, (2.3) the difference between mechanical and teleological processes, (2.4) teleology and objective chance, and lastly (2.5), the idea that teleology is creative.

### 2.1 The nature of final causation

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.[7] 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).[8]

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.[9] 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.[10] 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.[11]

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 which 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).[12]

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, which 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.*

## 2.2 Final causation and efficient causation

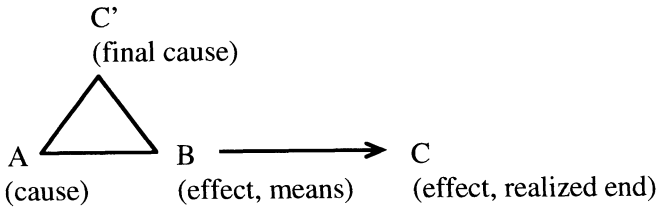
A thorough understanding of Peirce's conception of teleology requires a clear view of how he conceives the relationship between final and efficient causation. Peirce gives the following description of efficient causation:

> 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) relation[13] 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* (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:[14] "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.*

## 2.3 Teleological and mechanistic processes; Peirce's rejection of dualism

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. It will be seen 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, mechanical behavior is characterized by the following properties: (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 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."[15] 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[16]] phenomena are entirely 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)

Clearly, Peirce's synechism, which is a regulative principle of logic and of metaphysics,[17] 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."[18]

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 loose, 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.[19]

Though I 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.

## 2.4 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, I will first explore the meaning of 'objective chance,' and then the relationship between teleology and chance. In the next section, I will discuss the idea of developmental teleology.

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."[20] 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,[21] 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 as well as the possibility of there being different routes leading toward the same end state, 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.[22] 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.

## 2.5 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, 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, 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 I have considered already in the previous section; each event is creative to the extent that it contains an element of irreducible novelty. Here, I 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 be blocked, it may originate new lines of action.[23]

(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 efficient causation 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, 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; italics mine)

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 inductively 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, 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,[24] are selected by the more general final cause. This has far reaching consequences, as T.L. Short again 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, 406).

## 3. A PEIRCEAN CRITIQUE OF ERNST MAYR'S THEORY OF TELEOLOGY[25]

The problem of teleology is, no doubt, most prominent in philosophical discussions concerning biological evolution and biological behavior. The standard view nowadays is that, although teleological language may be indispensable to biology, the explanations of biological processes must be given in terms of efficient causation. Any reference to final causation is rejected. One of the major proponents of this view is Ernst Mayr. In this section I will use some of Peirce's insights to show that Mayr's rejection of final causation is based on a number of dubious presuppositions. Furthermore, I will use Peirce's theory of final causation to argue that Mayr's own solution to the problem of teleology is insufficient.

First, I will consider Mayr's rejection of a teleological interpretation of biological evolution, and show that it is based on at least three dubious presuppositions (see 3.1). Next, I will discuss two core ideas of Mayr's own solution: I will examine Mayr's dualism, that is, his distinction between seemingly and genuinely goal-directed processes, and show that it is based on an invalid argument (see 3.2). After that, I will examine Mayr's idea of a 'program as responsible for genuinely goal-directed processes,' and show that, contrary to Mayr's own opinion, it agrees perfectly well with the (Peircean) idea of final causation (see 3.3).

### 3.1 The goal of evolution

According to Peirce, biological evolution is a perfect example of a finious process because (a) there is a definite tendency toward a state of relative stability, (b) the general end state is independent of whatever the various lines of mechanical causation that lead to it may be, and (c) the process is irreversible. That the best-adapted species (or individuals)[26] will survive may easily be predicted, independently of what species are considered, and regardless of the specific mutations that may take place. Thus, explanations

of this tendency do not require any reference to specific, concrete efficient causes, but only to the *general* principle of "survival of the fittest," which functions as a principle of selection.[27]

More or less the same point is made by the contemporary evolutionary biologist Ayala: "... the overall process of evolution cannot be said to be teleological in the sense of being directed towards the production of specified DNA codes of information, i.e. organisms. But it is my contention that it can be said to be teleological in the sense of being directed towards the production of DNA codes of information which improve the reproductive fitness of a population in the environments were it lives" (Ayala 1970, 11).

Mayr considers Ayala's explanation to be a serious misinterpretation of the term 'teleological:'

> Natural selection is never goal oriented. It is misleading and quite inadmissible to designate such broadly generalized concepts as survival or reproductive success as definite and specified goals. (Mayr 1974, 96)

Mayr's rejection of a teleological interpretation of evolution is based on three dubious assumptions. First, as the quotation shows, Mayr has an unsound conception of 'goal'. As I have explained in the first part of this chapter, goals are always general. Though there may be a difference in the degree of generality - some goals are less general than others - there is always an element of generality involved. Survival and reproductive success are, of course, very general concepts, as Ayala boldly admits. Mayr charges that Ayala's referring to "completely generalized processes, rather than to specific goals" has ludicrous consequences. For instance, it would be "the goal of every evolutionary line to become extinct because this is what has happened to 99.9% of all evolutionary lines that have ever existed" (Mayr 1974, 97). Clearly, Mayr here fails to see that teleological explanations - as T.L. Short has made clear in his brilliant, Peirce-inspired essay, "Teleology in Nature"[28] - must *explain* a general tendency. The extinction of an evolutionary line does not, and cannot, as a final cause should, explain the process that generated that line. Consequently, such extinctions cannot possibly be final causes.

Secondly, Mayr identifies teleology with a completely determined, straightforward development toward a specific end, from which every form of creativity is expelled:

> Natural selection rewards past events, that is the production of successful recombination of genes, but it does not plan for the future. This is, precisely, what gives evolution by natural selection its flexibility. With the environment

> changing incessantly, natural selection - *in contradiction to orthogenesis* - never commits itself to a future goal. (Mayr 1974, 96; italics mine)

According to Mayr, natural selection cannot be teleological because it is highly flexible; contrary to orthogenesis (the theory according to which evolution is nothing but the completely determined development of what was present in the beginning), evolution is not teleological because it does not involve a straightforward progression to a completely predetermined end.

Mayr rightly stresses that evolution is a flexible process. There are, however, two problems with his explanation. First, it is not clear that the flexibility Mayr refers to, involves real creativity. Does *objective* chance play a crucial role in the process of evolution or is it a completely determined process? Only in the former case would biological evolution be unpredictable *in principle;* thus, even in the fictitious case that we would have knowledge of all the relevant causal circumstances, we would still not be able to predict which species will evolve. The process is not determined in advance. Mayr's insistence on "strictly causal and mechanistic" explanations, however, leads one to suspect that he rejects the idea of objective chance. The very concept of flexibility involves a commitment to a goal. For a strict determinist, the concept of flexibility has no meaning: que sera, sera. Thus, Mayr is faced with the following dilemma: if he acknowledges objective chance, he cannot insist on "strictly causal and mechanistic" explanations. But if he rejects objective chance, he cannot possibly claim that evolution is flexible.

The other point is, that there are three reasons why Mayr's identification of teleology with orthogenesis is mistaken: first, teleology does not imply orthogenesis at all, because one of its main characteristics is that it presupposes chance. Next, in teleological processes, the end state can be reached in various ways. Even if one does not agree with this Peircean criterion (but can one imagine other, better criteria?), he has to admit at least that there are processes in which the end state can be reached in different ways. This, however, is exactly what is precluded by orthogenesis.[29] Finally, teleology does not presuppose a completely fixed and determinate final end state. As Peirce has argued forcefully (see 2.4), final causes, while being realized, may become modified and developed. Teleology is basically developmental. Hence, contrary to orthogenesis, teleology is creative (in more than one way).

Thirdly, Mayr associates final causation with backward causation. In the quotation above, Mayr speaks of 'future goals,' and elsewhere in his article he writes: "The assumption that future goals were the cause of current events seemed in complete conflict with any concept of causality" (Mayr 1974, 93).

Mayr is certainly right in rejecting the idea that future events could have an influence on present events. But he is mistaken in that he concludes that this entails that there cannot be any final causation. He too mistakenly considers final causes as belonging to the same genus as efficient causes. In the first part of this chapter I have used one of Peirce's insights to show that this is a category mistake: final causes do not belong to the category of concrete events, but to the category of general possibilities. Accordingly, final causation has nothing whatever in common with backward causation.

## 3.2 Mayr's dualism

According to Mayr, nature is split up into two realms of "an entirely different nature:" the realm of genuinely goal-directed processes and the realm of seemingly goal-directed processes. But even the genuinely goal-directed processes can entirely be explained by efficient causation. Two questions are relevant here: (1) is it true that nature is split up into these two realms?, and (2) can all seemingly and all genuinely goal-directed processes be explained by efficient causation alone? In this section, the first question is explored; the second question is addressed partly in the present section, and partly in the next.

According to Mayr, the seemingly goal-directed processes which he calls teleomatic processes occur only in inanimate nature. They

> ... are 'end-directed' only in a passive, automatic way, regulated by external forces or conditions. Since the end state of such inanimate objects is automatically achieved, such changes might be designated as *teleomatic*. All teleomatic processes come to an end when the potential is used up (as in the cooling of a heated piece of iron) or when the process is stopped by encountering an external impediment (as a falling stone hitting the ground). Teleomatic processes simply follow natural laws, i.e. lead to a result consequential to concomitant physical forces, and the reaching of their end state is not controlled by a built-in program. The law of gravity and the second law of thermodynamics are among the natural laws which most frequently govern teleomatic processes. (Mayr 1974, 98)

Genuinely end-directed or teleonomic processes differ in (at least) three respects from seemingly end-directed or teleomatic processes. Teleonomic processes are marked by the following properties:

(1) The end state is not reached automatically, and
(2) A built-in program controls the process toward the end state,
(3) The end state is not determined by (a) external impediments or (b) by the condition that some potential is used up.

Furthermore, teleonomic processes occur only in living nature.

Mayr's so called fundamental distinction between teleonomic and teleomatic processes is based on four concepts: (1) automatism, (2) program, (3a) external impediments, and (3b) potential exhaustion. I will consider these one by one.

(1) The end state of teleomatic processes is reached automatically, that is to say, it is the straightforward effect of natural laws; in contrast, the end state of teleonomic processes is completely determined by a built-in program (e.g. DNA, acquired habits, computer programs[30]). But obviously, program-directed behavior is just as automatic as 'law-of-nature-directed' processes: "*Teleonomic processes are strictly causal and mechanistic*" (Mayr 1974, 112; italics mine). Consequently, teleonomic processes are just as mechanical as teleomatic processes.

(2) Mayr defines 'program' provisionally as: "*coded or prearranged information that controls a process (or behavior) leading it toward a given end*" (1974, 102). If I leave out "coded or prearranged information" - the meaning of which is not at all obvious - this conception of program agrees perfectly well with the general concept of a law of nature. For (according to the realistic interpretation), laws of nature induce things to behave in a definite way. I have considered already the law of gravity and the second law of thermodynamics; they are good examples of general principles that "control a process leading it toward a given end." Thus, nothing stands in my way of considering laws of nature also as built-in programs. Consequently, the validity of a real distinction between teleonomic and teleomatic processes on the basis that only the latter are directed by built-in programs, is debatable at best.

(3) Finally, according to Mayr, teleomatic processes, as opposed to teleonomic processes, come to an end (a) as the result of some external impediment (as a falling stone hitting the ground), or (b) because some potential is used up (as in the cooling of a piece of iron). But these criteria are both very vague. The first one is certainly ambiguous. For, what Mayr calls an external impediment might be called an internal impediment as well, depending on how the system is defined; and perhaps it even ought to be called an internal impediment. Thermodynamics usually studies isolated systems, and there are of course no isolated systems without boundary conditions. Thus, the boundary conditions are part of the system, and what Mayr calls external impediments may just as well be called internal impediments. The second criterion is, taken by itself, too wide: an athlete who runs a race as fast as he can uses up his potential. According to Mayr's terminology, this would be an example of a teleomatic process, while it is clearly teleonomic.

Hence, the three criteria used by Mayr fail to support the distinction he makes between teleonomic and teleomatic processes. But more importantly, as we have seen in the first part of this chapter, neither teleonomic nor teleomatic processes can be explained on the basis of mechanical causation alone; even our explanations of thermodynamic processes - according to Mayr a plain instance of teleomatics - need to refer to some general type which functions as a final cause. Therefore, there is no reason whatever to regard his distinction as *fundamental*.

## 3.3 Mayr's idea of a program as 'causally responsible' for teleological processes

The key word in Mayr's definition of 'teleonomic' is the word 'program.' The process tending to the end state is controlled by a built-in program, which "is *causally* responsible for the teleonomic nature of a goal-directed process" (1974, 99; italics mine). Apparently, there is no final causation involved in teleonomic processes.

Mayr gives two reasons why a program is responsible for teleonomic behavior, and without thereby involving final causation: "a program is [1] something material, and [2] it exists prior to the initiation of a teleonomic process. Hence, it is consistent with a causal explanation" (1974, 102). The argument involves three premises, all of which are dubious: (a) information (a program) is something material, (b) causes are always material, (c) causes always precede their effects.

What it means to say that a program is something material is by no means clear. The concept of matter is a philosophical concept with a long history; if one wishes to use it as a key concept, he is obliged to clarify its meaning. But, the concept of matter involves at least something spatio-temporal, i.e. something that can be indicated in space and time. One should know therefore in what sense a 'program' refers to something spatio-temporal.

Granted, the information of the program needs a substrate (a 'material' carrier), but this does not imply that it is identical with its substrate. Though the substrate can be indicated in space and time, information itself cannot, because it is *general* and not concrete. Indeed, the same information content may be inscribed in different 'material' substrates, and the same substrate may carry different information. In Aristotelian terms, one might say that the information refers to form, not to the matter. It is the *form* that matters, not the matter that (in) forms.

The two other presuppositions of Mayr were that (b) causes need to be material, and (c) that they always precede their effects. Are these true? The least one can say is that the debate is not closed; there may be mental causes as well as physical ones, and it would appear that many causes *are*

contemporaneous with their effects. Thus, these two presuppositions are by no means obvious.

But apart from these considerations, there are other difficulties with Mayr's concept of 'program.' He stipulates that:

> ... it is in the nature of a teleonomic program that it does not induce a simple unfolding of some completely preformed Gestalt, but that it always controls a more or less complex process which must allow for internal and external disturbances. (Mayr 1974, 99)

Mayr might be very surprised to discover that this description of the functioning of a program agrees perfectly well with Peirce's concept of final causation; the process toward the end state is not "completely preformed" but "flexible," and the end state itself is independent of the various different efficient causes. Final causes - so I have written in section 2 - "are general types that tend to realize themselves by determining processes of mechanical causation." If 'causally responsible' should be interpreted as 'due to final causation,' there would not be any problem. But obviously, this is not what Mayr means, for he holds that "teleonomic explanations are strictly causal and mechanistic" (Mayr 1974, 114).

Mayr fails to explain what he means by 'causal.' I can only interpret him as follows: a program is an efficient cause, which in combination with other efficient causes (the internal and external disturbances) completely determines the end state of a process or behavior. If so, then Mayr owes us an explanation of how, under different circumstances, and thus, given different sets of efficient causes, the same program may lead processes to the same general end state.

More importantly: how can programs be considered as efficient causes at all? Or put more concisely: is there a theory of efficient causation that meets with the idea of a program? That seems unlikely, for efficient causes are *singular events or facts,* while programs are not. Programs, however, are, as Peirce would say, of the nature of a habit.[31] And habits are always *general*, and this in a double sense: (a) contrary to concrete efficient causes, habits not only induce one or more lines of mechanical causation at one singular moment, but they start new lines whenever possible. Besides, (b) a habit never completely determines *all* characters of the end state toward which it leads; for example, the habit of smoking does not (completely) determine how and how often one smokes. Accordingly, I may safely conclude that Mayr's conception of teleonomics is, to borrow his own expression (which he uses to refute teleology), "in complete conflict with any concept of causality" (Mayr 1974, 93).

Mayr's critique of teleology is partly based on the mistaken assumption that the conception of (efficient) causality is unproblematic. But this

assumption is a myth, which is, unfortunately, widespread among philosophers and scientists alike. An adequate account of the problem of teleology requires a thorough analysis of the concept of efficient causation. Nothing is gained by unmasking the supposed myth of teleology by banking on yet another myth.

## 4. CONCLUSION

In the first part of this chapter an outline was given of Peirce's theory of final causation. In the second part, some of Peirce's insights were used to show that Ernst Mayr's theory of teleology is flawed. I chose to discuss Mayr's view, partly because he has had an enormous influence on contemporary discussions, and partly because it illustrates a number of dubious presuppositions that are to be found in most of the current discussions.

*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. The symptoms of final causation are: (I) the end state of a process can be reached in different ways, and (ii) the process is irreversible.*

Peirce rejected the idea of a bifurcation of nature into two kinds of fundamentally different substances or processes. Hence, he rejects the view that final and efficient causation are two basically different types of causation. On the contrary, they are complementary inasmuch as there is in each act of causation an efficient and a final component. He also rejects the idea that there exists a class of mechanical processes next to teleological processes. *All* processes are teleological; mechanical processes are simply teleological processes with a low grade of finality.

Moreover, teleology presupposes objective chance, and thus, there is an aspect of irreducible novelty at every stage of a process. But teleology also 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").

It was shown that Mayr's dismissal of a teleological interpretation of biological evolution is based on the rejection of three properties that he mistakenly attributes to the concept of final causation. Mayr imagines final causes to involve:

(a) Individual events,
(b) An influence of the future upon the present (backward causation),
(c) A straightforward, completely determined course toward the end state (which entails the absence of any form of novelty).

If this analysis is correct, Mayr's rejection of final causation is based on a fatal misunderstanding of the nature of teleological processes. Moreover, it was shown that Mayr's distinction between genuinely end-directed or teleonomic processes and seemingly end-directed or teleomatic processes is essentially without foundation. Furthermore, it was shown that, contrary to Mayr's opinion, both teleonomic and teleomatic processes require an explanation by final causation. Finally, I have examined the key concept in Mayr's idea of teleonomics, which is the idea of a program. I have shown that, contrary to Mayr's opinion, programs are good examples of final causes.

Mayr's mistakes are largely due to two false premises that are characteristic of nearly all contemporary debates on teleology. The first of these is that he regards final causes as belonging to the same genus as efficient causes. A hundred years ago, Peirce has shown that this is a category mistake: contrary to efficient causes, final causes are not individual events or facts, but general principles.

The second false premise is the assumption that we have a clear concept of efficient causation. Harmful though both premises may be, the second of these is by far the most ferocious. The failure to see that causation is a philosophical *problem* instead of a clear-cut, self-evident idea proves to be fatal to Mayr's analysis.

In the next chapter, I will pursue my inquiry into the nature of causation by studying Peirce's conception of natural class. Indeed, Peirce's theory of causation requires an explanation of his conception of natural class, for Peirce held that the condition for causes and effects to be mediated by final causes is that they belong to a natural class.