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To Hou Heneka and Continuous Change

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Abstract: Beginning with Aristotle’s statement in Physics II.2 that motion must be continuous to be for the sake of an end, I argue that properly understood, continuity is actually a sufficient condition for the goal-directedness of any motion in Aristotle’s teleology. I establish this conclusion first for the simple motions discussed in Physics V–VI, and then for complex changes such as the generation and development of a living thing. In both steps of the argument, the notion of καθ’ αὐτό agency serves as a key link between continuity and goal-directedness. The understanding of Aristotle’s teleology that emerges from the consideration of continuity, finally, fits Aristotle’s discussion of that for the sake of which in Generation and Corruption II.9 and Physics II.8.

In Physics II.2, Aristotle introduces the cause for the sake of which—τὸ οὖν ἐνεκα—in terms of three criteria. Something is an end if (a) it is last (ἔσχατον)—that is, is an outcome of some motion; (b) the motion in question is continuous; and (c) the outcome is, as he puts it, the best:

For with respect to things of which—the motion being continuous—there is some end, this last is also that for the sake of which. For this reason also the poet was carried away absurdly in saying, “he has death (τελευτήν), the very thing for the sake of which he came to be.” For not everything that is last claims to be an end, but the best (Phys. II.2, 194a29–33).1

In short, the good outcome of a continuous motion is an end and that for the sake of which. Although each of the criteria involved in this description calls for an extended discussion, I shall focus here on condition (b): συνεχοὺς τῆς κινήσεως ὁμοίως.2 More specifically, I argue in the following pages that this simple condition is in fact, by itself, a sufficient condition for goal-directedness. Striking as it may seem, this conclusion emerges from a careful analysis of Aristotle’s concept of continuity, particularly continuity in motion. In the course of this analysis we shall see that for Aristotle, a change is continuous if and only if it has, as a whole, a καθ’ αὐτό agent cause. A καθ’ αὐτό agent is one that tends by its nature to produce an outcome of a particular sort; when it does so, therefore, this outcome is an end.

My argument proceeds in two stages. In the first, I establish the connection between continuity and goal-directedness in the case of motion in the strictest sense: that is, for simple changes in quantity, quality or place. In the second, I show how continuity

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1 Parallel texts are Phys. II.8, 199a8–9: “Further, in as many things as have some end, the first and the successive are done for the sake of this”; and PA I.1, 641b24–6: “We always say that this is for the sake of that, whenever there is clearly some end at which the motion concludes, should nothing stand in the way.” Similar statements can be found elsewhere (in Phys. II.3 and II.7, for example), but these three are the most complete.

2 For condition (a), see the discussion of Aristotle’s concept of limit (πέρας) in my forthcoming. On condition (c), see my also forthcoming.
and so also goal-directedness are found in complex changes such the coming to be of a
living thing.

With regard to the first point, I begin in section 1 by considering Aristotle’s
discussion of continuous motion in *Physics* V. By the end of this section we shall have an
initial argument that continuity is a sufficient condition for goal-directedness. In section 2, I develop this connection between goal-directedness and continuity by considering
Aristotle’s claim that motions are individuated in terms of continuity: that is, to be a
single motion is nothing other than to be continuous. In this section, also, the concept of καθ’ αὑτό agency emerges as the essential link between continuity and goal-directedness.

However, because Aristotle’s discussion of motion in *Physics* V–VI is concerned
only with simple motions, the scope of our conclusions in sections 1 and 2 will be
somewhat limited. In section 3, therefore, moving on to texts from *Generation and
Corruption* and *Parts of Animals*, I show how the notion of continuity can be extended to
include complex changes such as the coming to be of a living substance. In section 4, I go
on to examine the unity of these complex changes, and to show how this unity,
established by the presence of a καθ’ αὑτό agent cause, is the condition of their goal-
directedness.

The view of Aristotle’s teleology that emerges in the following discussion finds
additional support from many passages that I do not consider here. Two important texts
to which I do refer, however, are *Generation and Corruption* II.9 and *Physics* II.8. In the
former, Aristotle sets out to give an account of “how many and what are the principles of
all coming to be alike” (335a26–7). Without intending to give a detailed interpretation of
this account, I point out in section 2 the consonance between my conclusions in this paper
and Aristotle’s remarks in *Generation and Corruption* concerning form as end. With
regard to *Physics* II.8, I argue that on the interpretation of goal-directed motion
developed below, the first two arguments of this well-known chapter can be read in a
straightforward and highly plausible manner. Specifically, in sections 2 and 4 I consider
the argument based on the occurrence of natural phenomena “always or for the most
part,” and also in section 4 I discuss the analogy between nature and art.

I

To understand what Aristotle means by continuity in motion, we must return to
his claim that every change is defined by limits. More precisely, as he explains in *Physics*
V.1, the beginning and end of a given change may be opposed to each other either as
contradictories or as contraries (224b28–9). Thus coming to be and passing away are
defined by contradictories, whereas the limits of motion in the strict sense, in quality, in
size, or in place, are contraries (225b7–9). Often, of course, such limits are not absolute
contraries—the extremes in the genus to which they belong—but they are always at least
relative contraries, through their differing proximity to these extremes (224b30–35). For
example, not every change in color is from white to black or from black to white, but all
such changes exhibit a basic structure that appears most clearly in motions involving
these extremes.

Although Aristotle first mentions continuous motion in *Physics* III.1 (200b16–
18), whose topic is motion in the broad sense, his eventual discussion of continuity in V.3
depends on the distinction between change defined by contraries and that defined by contradictories. He first characterizes continuous motion as follows:

The last point (έσχατον) of the change is the contrary, and what the changing thing naturally arrives at, changing naturally and continuously, before it changes to what is last, is between. What is moved continuously (συνεχώς) is what leaves no gap (τό μηθεν ... διαλείπον), or the least possible, in the πρᾶγμα—not in time (for nothing prevents things leaving a gap, and straightaway after the lowest the highest being sounded) but in the πρᾶγμα in which it is moved (226b26–7, 23–5, 27–31).³

For a motion to be continuous, then, there must be intermediates states between its beginning and its end. It is both significant and perplexing for our purposes, as we shall see later, that for coming to be and passing away tertium datur.

Since every change has to do with opposites (ἐν τοῖς ἀντίκειμένοις), and the opposites are contraries and those by contradiction, and a contradiction has no middle, it is clear that what is between (τὸ μεταξὺ) is between contraries (ἐν τοῖς ἕναντιοις) (227a7–10).

The passage from non-being to being or from being to non-being is immediate; there are no intermediate states.

Let us examine this account of continuity more deeply, beginning with the observation that continuity in change, for Aristotle, depends on continuity in something he calls the πρᾶγμα of a change. The term πρᾶγμα is as flexible as our "thing," and is likewise often used to denote the reality corresponding to a word or phrase. In this case, however, it refers to the generic attribute—color, for example—with respect to which something changes. In the case of motions, the πρᾶγμα involves a continuum of possible attributes belonging to a common genus and bounded by a pair of contraries. Color, whose specific instances constitute a continuous spectrum limited by black and white, is one example. In the definition just quoted Aristotle uses pitch, which varies continuously between low and high. A third example, which turns out to be the most useful, is heat: In each case, however, continuity involves two things. First, the specific qualities between the extremes are arranged in succession (εφεξής) based on a progressively greater difference from one extreme, and similarity to the other. Second, any two successive parts of this range share a limit (Physics V.3, 227a6, 10–12).

A continuous motion, then, is one that leaves no gap (or the least possible) in the πρᾶγμα defined by the limits of that motion. As we have already observed, however, in the case of a change defined by contradictories there is no such πρᾶγμα. The two possible states are being and non-being; like an electric light with no dimmer switch, there is no intermediate between off and on. Continuity, therefore, as Aristotle defines it in Physics V.3, does not apply to coming to be and passing away. This conclusion presents an obvious problem for the description of goal-directed motion in Physics II.2. On the one hand, the most obvious and impressive case of change for the sake of an end is the coming to be of living things; on the other, such change, understood as coming to be, cannot be continuous in the strict sense. Later, we shall resolve this difficulty by finding

³ Lines 226b23-227a10 of this chapter retain Bekker’s numbering, but the passage was reconstructed by Ross for the OCT edition as follows: 226b23, 227a7-10, 226b26-7, 226b23-5, 226b27-35, 227a1-6, 227a10.
in other texts a broader sense of the term συνεχῆς. At the moment, however, the strict sense of continuity raises another interesting challenge: the claim, now seemingly implicit in *Physics* II.2, that even so basic a motion as becoming hot, provided that it take places continuously and that the outcome be good, is for the sake of that outcome.

To pursue this suggestion and its implications, we must first consider more carefully the relation between motions and their πράγματα. For as Aristotle’s point about low and high notes makes clear, the right sort of πράγμα is a necessary but insufficient condition of continuity in motion. Only if the successive stages of the motion correspond to those of the πράγμα—if, as Aristotle puts it, the subject passes from one contrary to the other without skipping anything in between—will the motion be continuous. Metaphysically, this means that for any two successive stages of the change, the είδος that defines the earlier defines the later as well, serving as both that to which and that from which. In an actually continuous motion, of course, such stages are only potentially distinct, and the είδος that defines them does not actually serve as a limit. An actual pause in time, as Aristotle later points out, would destroy the continuity even without any jump in the πράγμα (V.4, 228b3-7).

Moreover, although Aristotle chooses as his example an instance of change in which discontinuity is possible—think of the flautist who plays one note immediately after another—there are other motions in which discontinuity of this sort seems to be excluded. Motions of this sort are, as we shall see, by far the most interesting, and may well include all causally basic motions in Aristotle’s cosmos. To take an example, we may assume—in the absence of any evidence that Aristotle had a quantum theory of heat—that an Aristotelian body can become hot only by a continuous motion from its beginning relative coldness. As with any continuous motion, therefore, the heated body passes through infinitely many intermediate degrees of heat, each one of which is a potential endpoint. If the motion is necessarily continuous, then the attainment of every such potential limit is a prerequisite to the attainment of the actual endpoint. The motion is cumulative in such a way that each degree of heat is necessary for reaching the next.

There is a bit more to be said about continuity in *Physics* V, but we have enough already to consider its relevance to Aristotle’s teleology. As already observed, it follows from *Physics* II.2 and *Physics* V.3-4, taken together, that even the simplest continuous motion is for the sake of its outcome—provided, as II.2 adds, that this outcome be good. To press the importance of continuity even further, however, I want to consider before proceeding some evidence that the condition of goodness is—though perfectly correct on

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4 For example, Aristotle’s account of sound commits him to the claim that changes in pitch are causally dependent on changes in the mechanical means by which air is set in motion, such as the fingers of a flautist or the vocal chords of a singer (see DA II.8). Furthermore, Aristotle analyzes all changes of this latter sort in terms of heating, cooling, and locomotion. Finally, it is hard to read *Phys.* and *GC* without concluding that changes of these last three sorts are necessarily continuous. Thus, it turns out that a discontinuous change in pitch is causally dependent on continuous changes in temperature and in place. More generally, a careful reading of *GC* suggests, to me at least, that all bodily changes in Aristotle’s cosmos (where bodily changes are those not depending intrinsically on soul) should be analyzed in terms of locomotion, heating and cooling. This would mean that all causally basic changes are necessarily continuous. This conclusion would be a significant one for what follows, for if a motion only happens to be continuous, it is doubtful that its earlier stages are hypothetically necessary for what follows. This would, of course, weaken or even refute the claim that the earlier stages are for the sake of the later and of the outcome.
Aristotle's view—superfluous. In *Physics* II.2, Aristotle begins by claiming that every outcome of a continuous motion is an end. Only after reporting the poet's "absurd" mistake does he add that this outcome must be good. Now although we have not yet discussed the sense in which an animal's development counts as a continuous change, let us assume for the moment, quite reasonably, that its decline to death is not in any relevant sense continuous with its development to maturity. One follows the other, and that is all. This would mean, however, that the continuity condition already excludes the poet's mistake. This argument may not be enough to show that goodness is not a distinct necessary condition for goal-directedness. At the same time, to catch the poet out with the continuity condition alone would be suggestive—and would make continuity rather more important than it would otherwise be.\(^5\)

The claim I shall now try to defend, therefore, is a strong one: on Aristotle's account, continuity by itself ensures that a motion is for the sake of its outcome, and thus simultaneously ensures that the outcome is good. To begin motivating this claim, I want to consider as a possible counterexample the recently described process of heating. Surely, after all, we have no reason to think that the particular degree of heat at which this process ends is good for its subject. In fact, *Generation and Corruption* tells us that depending on the nature of the body and the degree of heat, the heated body may actually be destroyed. In this case, we would have a continuous change that results in the destruction of its subject, rather than its good. The heat that brings about such destruction is decidedly bad for the substance destroyed, and previous degrees of heat would thus seem to be neutral at best.

There is, however, a problem with this counterexample as stated. The above account of destructive heating fails to note that on Aristotle's account of change, heating is the actuality not only of the body heated but also of the agent that heats it (*Phys.* III.3, 202a13–21). Moreover, although the immediate agent may simply be transmitting heat, such a process always involves a primary agent that is hot by nature. Such an agent may act indiscriminately, and so incidentally destroy what it heats, but the heat it confers is nevertheless the outcome of its natural activity, its ἔργον. For Aristotle, however, both actuality and that for the sake of which coincide with goodness, and so the identification of heat as the result of a substance's natural activity is enough to qualify it as good.\(^6\)

One is tempted to respond, of course, that compared with Aristotle's clearest examples of goodness in the natural world, namely, living things, calling heat good is at best rather trivial. This appearance of triviality is not damning, however, for it corresponds in Aristotle's metaphysics to a limitation in the sort of goodness something like heat can have. We have already seen that goodness, for Aristotle, is an aspect of actuality, and that actuality corresponds to form and to the activities that flow therefrom. Thus, to return for a moment to the hierarchy of form and function in *Meteorology* IV.12,

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\(^5\) We already know that Aristotle considers the good, by its very nature, an end. Although we have not yet mentioned spontaneity and chance, let me now introduce them by suggesting that if the good is by its nature an end, a good outcome can fail to be that for the sake of which only if it comes about κατὰ συμμεβεβακός.

\(^6\) For Aristotle's concept of goodness see my work elsewhere. It is worth noting here, however, that as soon as we think of the outcome of any change as an achievement of the agent rather than as a πάθος of the patient, there seems to be an intuitive sense in which we can characterize it as good.
it follows that both the degree of goodness associated with a given form, as well as the intuitive or non-intuitive character of attributing goodness to that form at all, will depend on its place in the hierarchy. In short, both the difficulty we may find in attributing goodness to heat, and the possibility of making this attribution plausible, are predicted by Aristotle’s account of goodness.

In addition to heat’s low place in the hierarchy of form, the heat in our example has another handicap from the evaluative point of view. Although such heat is the result of a natural capacity, and for this reason can be thought of as an achievement, this achievement is not directed so as to be “good for” anything. As Aristotle points out in *Metaphysics* Θ.2, capacities not accompanied by reason act necessarily on any receptive substance with which they come into contact. Thus, as we have seen, the heat that corresponds to an agent’s nature may be irrelevant to or even destructive of the patient. Only by chance—in the absence of some more comprehensive principle of order—might it turn out to be good. Perhaps for this reason, Aristotle recognizes a sense of δύναμις which he actually contrasts with nature: whereas nature (φύσις) is a substance’s capacity to act on itself, δύναμις is the capacity to act on another or on oneself as other (*Metaph. Θ.9*, 1049b5–10). The existence of natures thus constitutes the most basic way in which a substance’s capacity to act can be directed toward an effect that is good in a stronger sense: it is good for—in the sense of preserving or bringing to perfection—the agent itself.

In fact, however, despite these limitations, the heat in our example is not purely random. The capacity to heat is, by definition, for the sake of heating, and heating is for the sake of heat. If, therefore, an agent possesses the capacity to heat by nature, then heating fulfills an aspect of its nature. This heating is, in its own way, an ordered activity; it proceeds gradually toward a limit set by the capacities of the agent and the patient and by the immediacy of their contact. This minimal goal-directedness is not diminished by the fact that the activity is in other respects random and imperfect—less perfect even than the activity fire exhibits in feeding and sustaining itself on whatever lies at hand, and far less perfect than the unchanging, self-sufficient identity of thinker and thought which all goal-directed activity—especially activity aiming at self-preservation—tries to imitate.

II

In considering what is involved in one body’s heating another, we have developed a plausible argument to the effect that every continuous motion is for the sake of its outcome, an outcome that therefore has at least a minimal goodness. We have by no means exhausted, however, the various dimensions of the connection between continuity and goal-directedness. The next step in our investigation begins when we notice that in the chapter following his discussion of continuity in motion, Aristotle argues that to be continuous and to be numerically the same motion (to be unqualifiedly one) are equivalent. In doing so, he adds two requirements for strict continuity, over and above that of not skipping any portion of the πράγμα. The first is that the motion be specifically the same in all its parts—that is, it must involve only a single πράγμα, defined by a single pair of contraries. The second requirement is that the motion be accomplished without pause, in a single continuous time. Now although he relies on the intuitive plausibility of these criteria to justify their place in his account of motion, the thesis that every
continuous motion is for the sake of its outcome suggests that further reflection is in order. For if this thesis is correct, then we should expect each aspect of unqualified unity to be necessary in order to guarantee the teleological character of an apparently continuous motion.

In fact, a more detailed consideration of the various components of unity reveals a point-by-point correspondence between the components of unity and the various ways a motion might fail to be for the sake of its outcome. Consider, for example, a change whose analysis reveals two πράγματα, defined by two pairs of contraries. Such a change would actually consist of two successive or overlapping motions, which might only happen to occur together. In this case, even if the first change were to bring about the starting point for the second, it would do so incidentally, and not for the sake of the second and its outcome. Or, consider a change that involves a single pair of contraries but skips part of what lies between them. In such a change, likewise, the immediate outcome of the earlier stages may be related only incidentally to the later stages. Third, even without such a jump, a gap in time between the earlier and later stages may well indicate that the agent cause of the earlier stages was not aiming at the later stages when causing the earlier, but simply at the outcome of the earlier. A final case of discontinuity, which Aristotle does not mention in Physics V.4, would be an apparently continuous change that is in fact caused by two agents, one picking up at the exact moment when the other leaves off. Even without a gap in time, causal discontinuity of this sort means that the change need not be goal-directed as a whole. If, for example, the second agent carries the process farther than the first agent could have done, the first agent was obviously not acting for the sake of the outcome produced by the second. Once again, the motion as a whole would fail to be for the sake of its result.

In considering the relation between continuity and goal-directedness in motion, I have slipped in an aspect of motion that Aristotle does not mention in Physics V.3–4, but that is essential to his analysis as a whole. This is, of course, the fact that motion is the actuality of its agent cause as well as that of its subject. Although this added perspective has been necessary to uphold the thesis that every continuous motion is for the sake of its outcome, I think it can also justified independently of this thesis. First, if we return to Physics V.1 it is clear that the mover is an essential part of the analysis of any motion. Second, the definition of motion in Physics III.1–3 makes it clear that every motion, despite being a single reality existing in its subject, nevertheless pertains causally to both the agent and the patient. Therefore, we may safely assume that the individuation—and therefore the continuity—of motions must involve the agent as well as the patient.

In any case, it is clear enough that continuity from the patient’s point of view is not sufficient to guarantee goal-directedness. This point has already emerged, to some degree, from our discussion of heating as a goal-directed action. There I pointed out that in a cumulative change such as heating, the earlier stages are necessary for the later. Now if such a change is goal-directed, then this necessity turns out to be nothing other than Aristotle’s well-known hypothetical necessity. What first made the claim that heating is goal-directed plausible, however, was not simply its status as a cumulative change, but the fact that it is the actualization of a natural capacity of some agent. Moreover, it is now clear that being cumulative only guarantees one aspect of complete continuity: a cumulative change might include more than one πράγμα, and it might not take place in a
continuous time. Both of these possibilities, as we have seen, are significant because they reveal various ways, not all of them teleological, in which a given outcome can occur.

We will grasp more clearly the importance of the agent in goal-directed change if we reflect further on hypothetical necessity and the necessity involved in a cumulative change. For Aristotle, as the discussions to which I have already referred make clear (see Phys. II.9, PA II.1), hypothetical necessity is part of an important mode of explanation in natural science. Because each form can only exist in matter appropriate to it, the supposition (ύπόθεσις) that a given form is to be carries necessary consequences for the structure, materials, and coming to be of the matter whose form it is. In the simple case that we have been considering, a given degree of heat can be produced only in a body that has already been heated to nearly that degree. What makes this type of necessity explanatory, however, is not simply the dependence of form on matter, but the supposition that the form is to be. Without this supposition, as Aristotle frequently points out, nothing is explained. When a motion fails to be continuous (or unqualifiedly one) in one of the ways mentioned above, however, the merely incidental connection between the earlier and later stages of the motion makes the ultimate outcome irrelevant to explaining the first part of the motion. Any supposition of the end would be purely arbitrary, and so the hypothetical necessity fails to be explanatory.

In the last analysis, therefore, the continuity or unity of motion required if an action is to be for the sake of the end depends on the way in which the outcome of the motion, and therefore also its various stages, come about. More specifically, a motion will turn out to be continuous in the relevant sense if and only if (a) it is caused by an agent whose natural effect is the outcome of the whole motion, and (b) this agent in fact causes the various stages of the motion as stages in the production of this outcome. In the case of heating, the natural activity of the agent is to bring about the maximum heat that it can produce, and that the body on which it is acting can receive. Any intermediate degree of heat that such an agent produces is, as a matter of fact, produced on the way to this maximum, because no intermediate degree corresponds fully to the natural capacity of the agent relative to the patient. On the other hand, if the agent’s activity happens to be interrupted before it reaches its natural goal, then, in accord with Aristotle’s analysis of contraries, the degree of heat actually achieved will serve as a surrogate endpoint for the change. Despite having failed to reach its natural goal, the process of heating will still have been directed toward that goal.

Earlier, I stated that Aristotle’s notion of καθ’ αὐτό agent causality serves as a key link between continuity and goal-directedness. By considering continuity from the perspective of the agent, we can see how this is the case. Fully understood, the continuity condition ensures that a given change is directed by the source of that change, the agent, toward a predetermined outcome. In Aristotle’s terminology, this correlation between a change’s specific outcome and the specific active potentiality of its cause is a καθ’ αὐτό causal connection. As we have just seen, moreover, the existence of such a connection entails that the intervening change is for the sake of an end. If we add to this picture the account of spontaneity and change in Physics II.4–6, it follows conversely that absent any καθ’ αὐτό connection—that is, when an agent acts κατὰ συμβεβεκός—the outcome is not an end, but rather a result of spontaneity or chance.

The alternative between καθ’ αὐτό agency for the sake of an end, on the one hand, and κατὰ συμβεβεκός agency leading to a chance outcome, on the other, is one that
Aristotle himself proposes in his most important discussion of natural teleology, in *Physics* II.8. It serves as a premise in his first argument there that nature acts for an end, although the conditional form in which he states the premise has left it uncertain whether he actually accepts it. The continuity condition of *Physics* II.2, however, gives us an independent reason to take the alternative quite seriously: εἰ οὖν ἡ ἀπὸ συμπτώματος δοκεῖ ἡ ἐνεκά τοῦ εἴναι (“so if it seems to be either spontaneous or for the sake of something”: 199a3–4). Later, in section 4, I shall return to this argument and also briefly consider the analogy between art and nature that follows it in *Physics* II.8. It is already significant, however, that our discussion thus far supports a straightforward reading of Aristotle’s preferred argument that nature acts for an end.

Thus for the simple motions considered in *Physics* V–VI, Aristotle’s continuity condition and the accompanying requirement of καθ’ αὐτό agency guarantee goal-directedness. At the same time, simple motions like heating are far from Aristotle’s favorite cases of goal-directed change, namely, the coming to be of living substances. Moreover, because such complex changes involve really distinct stages, not to mention the coming to be of a new substance, they do not seem to fit the definition of continuity provided in *Physics* V. To understand Aristotle’s favorite example of goal-directedness, therefore, we need to see how he conceives of the unity and continuity of complex changes. However, before going on it may be helpful to review what we have accomplished already.

Drawing on the account of continuity in *Physics* V.3–4, I have argued that the continuity condition of *Physics* II.2 should be taken quite seriously—indeed, that continuity itself is a sufficient condition for goal-directedness in motion. To summarize the argument briefly, the outcome of every continuous motion is the actuality and defining limit of a natural capacity of the agent responsible for that motion, or at least an approximation of that limit. In such a motion, each successive stage is hypothetically necessary for, and is in fact brought about on the way to, the limit that defines the motion as a whole. In short, the continuity condition ensures that an outcome of change is actually playing, in the entire process that leads up to it, the causal role designated by the phrase τὸ οὖν ἐνεκά.

It is worth noting that in addition to explicating the continuity requirement, the account of τὸ οὖν ἐνεκά that I have just given corresponds perfectly to Aristotle’s account in *Generation and Corruption* II.9 of “how many and what are the principles of all coming to be alike” (335a26–7). According to this discussion, the principles in question are the form that comes to be, the matter in which it comes to be, and the agent that brings it to be. In this same chapter, moreover, criticizing the early naturalists’ over-reliance on the material cause, Aristotle observes that agent and form are correlative causal principles: agency, on his account, consists in transmitting to matter a form to which that matter is in potency, but which it cannot give itself (see also *Metaph.* Z.7–8).

In the terms of the foregoing discussion, the form that comes to be is the defining limit of the agent’s capacity to bring it to be, and it is this that qualifies it as an end and that for the sake of which.
The question that we must now confront, however, is this: given that the generation and development of an animal or plant consists of many actually distinct stages, and involves the coming to be of a new substance, in what sense can be considered a continuous change? If the above discussion of simple motions is any guide, we are looking for a sense of continuity that that entails the unity of the process in question under the direction of a καθ' αὐτό agent. Moreover, despite its general silence on the subject of complex changes, Physics V.4 does suggest how we should think about this unity, pointing out a second sense in which we may call a motion one:

Further, we also call one a motion that is complete, whether in genus, whether in species, or whether in οὐσία, just as also in other things the complete and the whole pertain to what is one. But sometimes an incomplete motion may be called one, if only it be continuous (Phys. V.4, 228b11–15).

Aristotle’s reference to “the complete and the whole” in these lines is of obvious interest. Before discussing the unity of complex changes directly, however, let us prepare the ground by considering how he uses the term “continuous” to characterize changes that are not continuous motions in the strict sense of Physics V.3–4.

To set the context for our remarks on this topic, it will be helpful to consider briefly the curious ontological status of the process by which a natural substance comes to be. On the one hand, the generation and development of an animal is clearly not the sort of change Aristotle has in mind when he considers the properties of motion in Physics V–VI: it is not an incidental change in an independently existing substance. On the other hand, neither is it simply a case of coming to be in the sense of Physics V.1–3, for rather than an immediate passage from non-being to being, it is an extended process including both the coming to be and the development to maturity of a new substance. As Sarah Broadie has observed, however, coming to be in this sense does fit the broad definition of motion that Aristotle develops in Physics III.1–3.7 In formulating this definition he is concerned with processes of all sorts, from jumping to house-building (cf. III.1, 201a8–9). We have already considered the simple processes that fit his definition; our task now is to deal with those that are more complex.

Although complex κινήσεις do not have the sort of continuity or unity that Aristotle explicitly discusses in Physics V.3–4, I shall argue that the concept of continuity articulated in these chapters can nevertheless be extended to some of complex processes—and in particular, to the coming to be of living substances—in such a way that continuity remains a sufficient condition for the goal-directedness of any change. More specifically, building on Aristotle’s own use of the term συνεχής to describe complex processes, I show in the present section that such processes can verify the two conditions for continuity in general prescribed in Physics V.3, even if they do not meet the following chapter’s requirements for strict continuity in motion. In section 4, this broad notion of continuity will enable us to develop an the idea of a change that is not simply complex, but constructive. Despite its lack of simplicity, a constructive change

can nevertheless have a unity of completeness or wholeness, the sort mentioned in the lines from *Physics* V.4 quoted above. This unity, like that of simple motions, corresponds to the operation of a καθ’ αὐτό agent, and thus ensures that the constructive change is goal-directed.

A good starting point for extending the notion of continuous change is a passage in *Generation and Corruption* I.2 in which Aristotle contrasts coming to be and passing away with alteration:

There is unqualified coming to be and passing away ... whenever it changes from this to that as a whole.... For in the subject there is something as account (κατὰ τῶν λόγων) and something as matter (κατὰ τῆν ὕλην). Whenever, therefore, the change is in these, it will be coming to be or passing away; whenever in the affections and what is incidental (κατὰ συμβεβεκός), alteration (317a20–26).  

In the following chapter, Aristotle goes on to point out that “we do not say that what learns comes to be unqualifiedly, but that it comes to be knowing, whereas what grows comes to be” (319a9–11). Together, these two statements help us to formulate a succinct Aristotelian description of a living substance’s development: In the process of development, a living thing comes to possess in actuality attributes that are essential to the kind of thing it is (τῶ κατὰ τῶν λόγων), at the same time as its bodily structure (τῶ κατὰ τῆν ὕλην) develops to support these attributes.

On this account, development is not simply a series of secondary modifications a living substance, but a genuine case of coming to be. At the same time, as just mentioned with regard to *Physics* III.1–3, it strongly analogous to motion in the narrower sense. As in the case of heating, for example, in a living thing’s development a form comes to be in appropriate matter over a period of time, in such a way that the earlier stages of this process are hypothetically necessary for the later stages and for the final outcome. The difference in the case of unqualified coming to be is that the form acquired is not a secondary or incidental attribute of an already existing substance; it is, rather, the very οὐσία of the composite that it constitutes together with its subject. This is also, no doubt, why Aristotle insists in *Generation and Corruption* I.2 that in unqualified coming to be, the change is not only in the form but also in the matter, which especially in the case of living things comes to be as it is only for the sake of the form.

Not surprisingly, given Aristotle’s recurring cosmological concerns in *Generation and Corruption*, it is in same work that we find his most interesting uses of the term συνεχής and its cognates that depart from the strict sense of *Physics* V.3–4. Aristotle sets the context for this looser sense of continuity early in book I, when he concludes that coming to be is ceaseless (ἀπαυστον) because the passing away of one thing is always the coming to be of another (*GC* I.3, 318a24–6). Much later, toward the end of the work, this basic observation sets up an important conclusion regarding the cyclical transformation of the elements: “Hence motion in a straight line, imitating that in a circle, is also continuous (συνεχής)” (II.10, 337a8). Shortly after, he expands on the relevant notion of

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8 See also *GC* I.5: “In unqualified coming to be or passing away a thing does not remain (οὐχ ὑπομένει), whereas in alteration, increase and decrease the thing increased or altered remains the same, but in one the affection, in the other the size does not remain the same” (321a22–5).

9 See also *DA* II.1, 412b25-27, where Aristotle claims that in the case of living things the proximate matter neither precedes nor outlasts the existence of the composite.
continuity: "in things moved continuously—coming to be or altering or, in general, changing—we see a succession, and this coming to be after this so as not to leave a gap (ώστε μὴ διαλείπειν)" (II.11, 337a34–b2). The last phrase is generally translated into some such phrase as, "in such a way that there is no cessation." However, Aristotle is here analyzing the causal structure of continuous change, and he is quite clear that continuity in time is parasitic on continuity in the change itself (II.10, 337a23–6). The relevant point, therefore—as the rest of II.11 amply confirms—is not simply that no time elapses between one change and another, but that the each change is made possible by the one that precedes it: the changes are causally, and not merely temporally successive, in such a way that each follows immediately upon the last.

In this chapter, the last of Generation and Corruption, Aristotle is concerned with the causal structure of the continuous change he finds in the cosmos; in particular, he wants to establish that continual coming to be is necessary. This means moving from the claim that each step in a continuous series of changes presupposes the previous, to the claim that the later step follows necessarily upon the earlier. Because an agent can always be impeded from acting, moreover, Aristotle does not think that the causal ability of the successive agents is sufficient to establish the necessity he wants (337b3-10; cf. Metaph. E.2-3). He therefore finds the grounds of necessity in the fact that the actually existing sequence of agents, both in the coming to be of the elements and in that of living things, follows a circular pattern. Starting with any point in the cycle, then, we can identify a goal-directed agency sufficient for supposing the recurrence—not with strict necessity, but at least ἐν το πολύ—of the same state at a later time. Given this supposition, in turn, everything in between must first come to be. Aristotle concludes that despite the lack of strict necessity from the point of view of agency, the causal structure of the continuous coming to be that we actually observe is sufficiently stable that the structure itself, unlike the individual events that constitute it, is necessary.

The causal structure in which Aristotle locates the necessity of eternal coming to be is, with one significant difference, the same structure that characterized as teleological the simple instance of heating that we considered above. The difference is, moreover, precisely the fact that heating, as we considered it above, does not involve the kind of reflexivity that according to Aristotle characterizes natural activity in the full sense, and that also, despite important differences, grounds the eternal necessity of coming to be in the sublunary sphere. Heating is a directed, constructive change from the agent’s point of view; but taken by itself, it falls far short of the ordered self-maintenance that characterizes the natural world as a whole. However, it is the similarities that now concern us. In discussing strictly continuous motion, we ended up identifying a basic causal structure that accounts for the teleological character of such motions. In the supposition of an end, grounded in the existence of a competent agent and itself grounding the necessity of what the end presupposes, we have now found the same causal

structure in continuous coming to be. This brings us an important step closer to specifying what it means for coming to be to be continuous.

Before raising this question directly, however, it is worth noting that there are several passages in which continuity of the kind we are now considering is explicitly linked with being for the sake of an end. They are parallels—in the same or slightly different terminology—of the text from *Physics* II.2, but unlike this text they emphasize the fact that an end may be reached through an ordered series of steps. Consider the following three:

Further, in as many things as have some end, the first and the successive are done (πρότερον καὶ τὸ ἑφεξῆς) for the sake of this (Phys. II.8, 199a8-9).

For by nature are whatever, being moved continuously (συνεχῶς) from some principle within themselves, arrive at some end: and from each not the same for all, nor just anything (οὐδὲ τὸ τυχόν), but it would always tend to the same, if nothing impeded” (Phys. II.8 199b16-7).¹¹

Matter of just such a sort must be present if a house or another such end is to be; and this first, then that, must come to be and be moved, and indeed in just this way, successively, up to (ἐφεξῆς μέχρι) the end and that for the sake of which each thing comes to be and is. So also in what come to be by nature (PA I.1, 639b26-640a1).

With these passages in mind, we can now ask what, in the context of coming to be, Aristotle means by the term συνεχῶς.

First, it is interesting to note that in the passage just quoted from *Parts of Animals* and in the first of those from *Physics* II.8, Aristotle uses the technically weaker term ἑφεξῆς just as he elsewhere uses συνεχῶς. As noted in section 1, for two things to be ἑφεξῆς, or successive, is the first of two conditions for continuity, the second being that they have a common limit. In the text from *Parts of Animals*, moreover, ἑφεξῆς occurs in a description reminiscent of the negative phrase μη διαλείπειν, which we saw applied to coming to be in *Generation and Corruption* II.11. In each text, the underlying cluster of concepts is the same: In describing a complex process, each step in which is hypothetically necessary for a given end, Aristotle uses terms such as μη διαλείπειν, ἑφεξῆς, and συνεχῶς to indicate the relation between any step and that which must take place immediately before it. Let us reflect briefly on these terms.

First, recall that in *Physics* V.3, the terms ἑφεξῆς and μη διαλείπειν express Aristotle’s requirement that a continuous change cover the entire πρᾶγμα defined by its limits. In considering this requirement, we discovered that for certain cumulative changes, at least, it is part of the stronger, causal continuity necessary for the goal-directedness of simple changes. What, then, do these terms express when it comes to the more complex changes that we are now considering? Beginning with ἑφεξῆς, suppose that for a given step B to occur presupposes the occurrence of step A. Now states A and B

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¹¹ This passage, although not obviously relevant from the text itself, has to do in context with the development of living things from their respective seeds.
will be successive, in the causal sense that Aristotle needs, if and only if no intervening step C is involved in B's following from A. In other words, A must be a sufficient, and not merely a necessary condition for B. If, conversely, A were not sufficient for B, then B could only follow from A by way of C, in which case A and B would not be successive. The phrase μη διαλείπειν expresses a closely related point. Literally, it excludes any gap in process, whether temporal or simply causal. For instance, suppose that although B follows immediately upon A in time, it is in fact caused not by A but by C, which is causally unrelated to A. In this case there is a causal gap in the temporally continuous process leading from A to B, and so we do not have a significant case of continuous motion. In the change as a whole, the stages up to and including A would be related only incidentally to the stages following A and thus to the end.

What, then, of συνεχώς? We are now in a position to say exactly to what extent Aristotle's account of continuity in motion applies to continuous coming to be; moreover, the answer turns out to be surprisingly straightforward. The two share exactly what is signified by the adjective "continuous" when taken by itself, apart from either substantive. Continuity in general, as Aristotle defines it in Physics V.3, is present when successive things of whatever sort—place, time, motion, and so forth—share a limit. Not only in simple motions, however, but in complex continuous changes as well, causally successive steps do in fact share a limit. To see this, let us return to our first example, in which step A in a complex process is a sufficient condition for B. This can only be the case if the possibility of B is immediately contained in the actuality of A, so that as soon as A occurs, B will follow. In fact, Aristotle explicitly discusses this sort of immediate possibility in Metaphysics Θ.5 and 7, one conclusion of which is that strictly speaking, we call something possible only when nothing further is necessary for it to come about, so that if nothing interferes it will, in fact, occur. In short, although it would be incorrect to say that the potentiality for step B is identical to the actuality of A, it is nevertheless contained within it, so that the limit-to-which of A's coming to be is the limit-from-which of B's coming to be. This is what it means to say that two steps in a complex change are continuous.

IV

It is now clear enough that natural coming to be is continuous in a straightforward sense. By contrast with continuous simple motions, however, it is not clear what kind of unity we can attribute to an instance of coming to be. Because the equivalence of continuity and unity played an important role in establishing the goal-directedness of continuous motion, an investigation of unity in coming to be seems in order. The need for such an account will be clearer, however, if we first point out what is not included in the kind of continuity I have just described. First, although it was drawn from Aristotle's discussions of natural coming to be, the above account of continuity in change does not guarantee that the sequence of changes so characterized is directed toward any particular outcome. In the case of simple motions, this difficulty is ruled out by the observation that a single continuous motion involves only one πράγμα. In the case of coming to be, however, even if every change in the sequence can be described separately as the καθ' αυτό effect of some agent, the sequence as a whole may still be a random concatenation. Moreover, the fact that such a sequence of changes may include instances of coming to
be and passing away removes even the continuity that would be present in a progressive series of motions undergone by a single subject. In short, what we have so far is only sufficient continuity to keep the world as a whole moving: there is no guarantee yet that some complex portions of it are going anywhere in particular.

To find this guarantee, however, we need only return to the basic structure of goal-directed change that emerged in sections 1–2. As in the case of continuous simple motions, what can ensure the continuity of a complex change as a single, goal-directed process is its relation to a single agent, aiming at a single outcome. This agent need not be the immediate cause of each stage in the process, but it must be responsible for the process as a whole. That this is frequently the case, however, Aristotle takes to be obvious from the simple fact that complex changes leading to familiar outcomes occur repeatedly, in the same or similar circumstances, throughout the world as we know it. As already observed, that which happens always or for the most part does not happen by spontaneity or chance, that is, κατὰ συμβεβεκός. Not to happen κατὰσυμβεβεκός, of course, is to have a καθ’ αὐτό agent cause, and the operation of such a cause provides grounds for supposing that the final outcome will take place. This means, finally, that the process is hypothetically necessary for, and takes place for the sake of, its outcome (see Physics II.8, 198b34-199a8). The continuity we are looking for, therefore, is that which characterizes a process of this sort.

We are now on familiar territory, and there is no need to explain in detail or to provide extensive references to the various arguments by which Aristotle establishes the teleological structure of the complex but ordered changes that characterize his cosmos. Most or all of these arguments are found in Physics II.8; most or all are found elsewhere as well, especially in Parts of Animals I.1 and I.5. Moreover, the first argument from Physics II.8 is the argument we have just mentioned concerning what takes place always or for the most part. A brief discussion of the second, however, the well-known analogy between nature and art, will help us develop the concepts of continuity and unity in change that we need to complete our commentary on Physics II.2. It will also help make clear what sort of agent we need if a complex change is to have a καθ’ αὐτό cause.

In the art analogy (199a8-32), Aristotle points out that many of the changes we observe in nature have the characteristic structure of things done for the sake of an end—a structure that we have already discerned by observing and experiencing human activity. When we set out to make something, for example, the various steps in which we engage are cumulative, and cumulative in just such a way that they result in this particular end. Their cumulative character is analogous to that of a unified simple motion, although more complex changes—we might call them “constructive” rather than “cumulative”—typically involve multiple steps that differ from each other in kind. Aristotle’s point in the art analogy is that if we know what to look for, we find in nature instances of constructive change as diverse as ants working cooperatively to store food for the winter, and plants growing to maturity and producing fruit. To make the analogy as forceful as possible, he comments that if a house came to be by nature rather than by art, it would nevertheless have to be constructed in more or less the same way as it is now. Taking the art analogy together with the cumulative character of goal-directed simple motions, we can now identify the cumulative or constructive nature of goal-directed change as one of its general features.
However, the analogy between nature and art is not meant to stand alone as an argument that natural processes are goal-directed, nor can it do so. In principle, a constructive change of the sort Aristotle has in mind might take place spontaneously, in which case it would not take place for the sake of an end. Nevertheless, the analogy serves to focus our attention on the fact that constructive change is typical of, though it does not necessarily imply, goal directed action. Such change, moreover, is the norm rather than the exception in nature. Thus the central premise in Aristotle’s first argument, the dichotomy between goal-directed change and spontaneity or chance, also provides the context within which the art analogy gains its force.

Aside from the art analogy and its place in Aristotle’s arguments, the notion of a constructive change and its difference from a merely cumulative change such as heating is worth dwelling on. We have already seen the grounds of this difference in the fact that a motion like heating has a stable substrate, constituted by material and formal principles that remain the same throughout. The change is cumulative in that each degree of heat attained disposes the subject to receive a greater degree of heat. As long as the change remains a motion, the basic existence of the substance involved is not affected. Coming to be, as we have seen, is quite different. Here the change involves the matter and the form themselves, so that a new substance comes to be. If we consider the hierarchy of matter and form by which Aristotle accounts for various sorts of substances, moreover, we can easily see why the notion of constructive change seems so appropriate for coming to be. Coming to be always involves producing in appropriate matter a higher, and therefore a more determinate, and so in turn a more clearly discernible form. In this way, each level of actuality builds upon the previous.

The notion of construction turns out to be even more appropriate if we consider that in Aristotle’s cosmos, the actuality or form of every natural substance is something complex. Even the simplest bodily substances, the elements, have two defining qualities each. In the homogeneous bodies composed of these elements, we find a much greater variety of active and passive bodily qualities. These in turn make possible a wide array of heterogeneous bodies, which display an even greater complexity insofar as they can be formed from more than one homogeneous body and are characterized not only by their directly perceptible qualities, but by their shape and by the relations of their parts to one another. All this, finally, makes possible the complex forms of living things, a complexity which Aristotle takes points out at some length in Parts of Animals I.2–4 when he argues that living substances cannot be defined by dichotomy.

Although the point cannot be discussed thoroughly here, Aristotle also makes it clear in De anima and especially in Generation of Animals that within the complex form of a living thing, some capacities are for the sake of others. The best example of this is that the perceptual faculty depends for its existence on the nutritive faculty, and the nutritive faculty in a given animal must therefore be of the right sort to support its perceptual life. Moreover, any serious study of living things reveals an enormous complexity of similar relations, a complexity barely hinted at in De anima but investigated at great length in the biological works. The production of a living form in matter, therefore, is necessarily a complex process in which the most essential aspects of the nutritive faculty come to be first, in the parts that serve as their matter. These are followed by other parts and other faculties, and so on until the animal reaches maturity.

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12 This point is particularly clear in Aristotle’s remarkable discussion of matter and form in Mete. IV.12.
and is capable of producing another like itself. Here, obviously, the notion of a constructive process is fully exemplified.

Before returning to the question of unity in complex processes of coming to be, there is a final point to be made about the constructive character of such processes. When we considered simple motions like heating, I pointed out that such motions, though teleological at a basic level, are relatively weak examples of goal-directed activity. This was mainly because of the disconnect that can exist in such cases between the actuality or good appropriate to the agent cause of the motion and that appropriate to its subject. In the worst case, the agent’s self-fulfillment can result in the patient’s destruction. Obviously, however, this cannot be the case in coming to be. Here, whether the agency is internal or external, the agent of coming to be necessarily—by definition, in fact—expresses its nature constructively. This colloquial use of the English “constructive” brings out the fact that the outcome of coming to be is, necessarily, the actuality and the good both of the agent and of that upon which it acts.

Earlier, in order to pursue the notion of continuity in coming to be, I postponed discussion of a text from *Physics* V.4 according to which a motion can be one in virtue of being complete. It is now time to see how continuity and the notion of a constructive change can help us approach the notion of completeness, and thus arrive at the unity of coming to be. Let us first review the text:

Further, we also call one a motion that is complete, whether in genus, whether in species, or whether in ὀσία, just as also in other things the complete and the whole pertain to what is one. But sometimes an incomplete motion may be called one, if only it be continuous (*Phys.* V.4, 228b11–15).

In writing these lines, Aristotle may or may not have been thinking particularly of motion in the strict sense. In any case, the point clearly applies to coming to be as well. A change is complete, on Aristotle’s account of completeness, when it reaches the limit to which it is directed (cf. *Metaph.* Δ.16, 1021b24–5). In the case of coming to be, this is obviously the form of the resulting composite, and what takes place between the starting point of the complex change and this final limit is obviously a single process of coming to be. As we have already observed, moreover, and will consider further in just a moment, these two limits are the boundaries of a constructive process governed by a single agent. The steps that fall between the limits are therefore continuous with each other in a way in which they are not continuous with any changes that fall outside them. Thus for coming to be as well as for motion, unity and continuity is this final sense coincide. This sense of continuity is, finally, the sense in which continuity guarantees that a process of change, whether or not it is a continuous motion in the first sense of *Physics* V.3-4, takes place for the sake of its outcome.

As in the case of simple motions, therefore, the key step in establishing that an instance of coming to be is continuous is to show that such coming to be is brought about by an agent whose activity is aimed at producing the mature form. Of course, this is not always be the case: the subterranean production of various homogeneous bodies is, no doubt, largely a matter of chance. Aristotle’s favorite case of natural coming to be, however, is the reproduction of living things, and this can easily be distinguished from random or partly random processes by applying the criteria developed in Aristotle’s

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13 There are actually two agents, but the goal of the first is to produce the active power of the second; see below.
discussion of chance (Phys. II.4–6). Several times in the course of this discussion, Aristotle writes that chance events are those that, although they might have come about for the sake of an end, in fact have only a accidental cause. Such events unfold, perhaps, just as they would by nature or art, but there is no καθ’ αὑτό cause of this development. As with the continuous and pseudo-continuous motions discussed in section 2, it is the presence or absence of a καθ’ αὑτό agent that determines whether coming to be takes place for an end.

Aristotle holds that apart from the few cases of spontaneous generation, the coming to be of living things is always the result of a καθ’ αὑτό cause—or rather of two such causes, the role of the first being to produce the second. To summarize the account found in Generation of Animals II.1–4, the agent cause of an animal’s coming to be as a distinct substance is the male parent. This parent, either through its own activity directly or through the motions it imparts to an instrument, the semen, produces from the material supplied by the female a conceptus (κύημα). This conceptus is a relatively undifferentiated mass separated by a membrane from the more fluid parts of the καταμήνια and thus structurally distinct from the mother. As soon as it exists, the active role of the male in the reproductive process is complete: the conceptus already has a primitive nutritive soul, and if it receives adequate nutrition can develop to maturity by its own agency.

Once the conceptus has come to be, the first internal organ to develop is, Aristotle argues, that which is to direct the rest of the process. In sanguineous animals, this is the heart, which from the first moment of its existence is the source from which both nutriment and the heat required to concoct it come to the various parts of the developing animal. He is clear that the temporal priority of the heart in coming to be must be understood teleologically: for the process of reproduction to succeed, the parts and faculties most essential to the offspring’s existence and development must come to be as quickly as possible. The male parent, therefore, produces a distinct substance which has a primitive structural integrity through its surrounding membrane, and within which the master organ, the source of nutrition and later of perception, is on the point of coming to be.

We must, therefore, distinguish two stages in the coming to be of a living thing. In the first, the parent or parents produce a new substance distinct from themselves. The immediate result of their action is the instantaneous, unqualified coming to be of the offspring, its passage from non-being to being. However, this coming to be is incomplete in that the form at which it aims has not yet been achieved. The complete process of coming to be continues under internal direction by the nutritive faculty, which exists primarily in the heart or in an analogous organ. Despite this division into two stages, however, coming to be is a single, continuous, and complete process because the first of the two agents involved has as its καθ’ αὑτό effect the nutritive soul, i.e., the faculty by which the coming to be is completed.

I have argued that Aristotle considers continuity a sufficient condition of goal-directedness for any sort of change. The robust sort of continuity that can play this role, however, is that of a single process, directed by a καθ’ αὑτό agent toward an end
determined by the agent’s nature. The matter in which this end is produced is hypothetically necessary for the end, as is each of the stages or steps by which the agent brings about the end. In teleological terms, the agent acts for the sake of the form it brings about, and the matter in which it produces this form is also—within the causal context determined by the agent—hypothetically necessary for the sake of this form.

I shall not attempt here to reflect at any length on the consequences of these conclusions for our understanding of Aristotle’s natural philosophy. Rather, I shall simply highlight one consequence that, if not entirely original, is certainly worth further reflection. If the foregoing interpretation of goal-directed change is correct, then Aristotle’s teleology is inseparable from his analysis of change and agency. In the study of nature as he understands it, therefore, to reject the causal role of ends is in fact to negate all causality, and so to posit an utterly random and wholly unintelligible world.