ARISTOTLE'S TELEOLOGY AND UEXKÜLL'S THEORY OF LIVING NATURE

THE purpose of this paper is to draw attention to a similarity between an ancient and a modern theory of living nature. There is no need to present the Aristotelian doctrine in full detail. I must rather apologize for repeating much that is well known. My endeavour is to offer it for comparison, and, incidentally, to clear it from misrepresentation. Uexküll's theory, on the other hand, is little known, and what is given here is an insufficient outline of it. I do not maintain that either doctrine is *right*. I am fully aware that the problem of the essence of living nature by no means admits of an easy solution.[1] In offering for consideration the comparison contained in this paper I would go no farther than owning my belief that the two authors here discussed, both thinkers who combine an intensely philosophical outlook with a wide biological experience, are worth the attention not only of the historian of science and philosophy, but also of the student of philosophical biology.

One of the various meanings which φύσις bears for Aristotle is that of a *cause*. In the second book of his *Physics*, as is well known, he investigates the philosophical character of that cause. The result is what we are accustomed to call his *teleology*. He maintains that not only προαίρεσις but also φύσις is τῶν ἕνεκά του αἰτίων.[2]

This teaching has exercised a deep influence, especially throughout the Middle Ages. It has subsequently been discarded, especially since modern science established its mechanistic outlook on nature, which is strictly opposed to teleological explanations. Under its rule, a teleological interpretation of nature has been considered the arch-foe of scientific progress.

Aristotle clearly knows of two fields in which the τέλος is a causative force: Praxis and Nature. His doctrine that Praxis is teleological has not been challenged. That some end towards which man strives plays its part in the genesis of his actions and the events of human life at large does not seem an inadmissible assertion. The reason is that there exists, admittedly, νοῦς, which directs itself to the τέλος. But that in nature, which lacks νοῦς, the τέλος should have some part in causation, seems, to say the least, puzzling to the modern mind. It may have appeared so to the ancients as well. We gather from Aristotle's defence that among his own contemporaries the opponents of teleology based their disbelief on the fact that in nature, though a *something* is moving, we do not see it taking thought.[3] Aristotle admits the observation to be right but not the conclusion. He asserts that nevertheless the motions in nature are directed towards some τέλος.

Aristotle's teleology arose not only as an elaboration of Platonic thought[4] but also in explicit opposition to the atomistic theory, which made all physical processes—and it knew of no other than physical—occur ἐξ ἀνάγκης. We are accustomed to regard that theory as a first attempt at a mechanistic world explanation. It appears to be, in its foundations, an ingenious forerunner of modern physical science. Yet mechanism in its strict sense is not to be found in antiquity, as has been clearly

[1] The problem has been, and still is being, discussed by biologists and philosophers all over the world, and no agreement has been reached between those who defend and those who oppose *mechanism* in biology. J. S. Haldane's insistence that the *organism* is a *wholeness* of a living being, and *a system informed by an organic plan*, and that it *cannot be separated from its environment*, should be particularly mentioned in this connexion, though I must here refrain from further describing his views.

[2] *Phys. B* 8. 198^{b}10, and *passim*.

[3] Ib. 199^{b}26.

[4] Cf. *Phaedo* 97–8.

shown by Mr. Balme.[1] By mechanism, here, is meant the basic methodic idea of classical physics: that of an invariable cause-and-effect nexus. This idea implies, as an indispensable element, that the nexus will never break off. It continues for all future time. Now it is precisely in this that all ancient theory differs from that of the modern world. For an all-embracing nexus could not be and was not conceived of before the great astronomical and physical discoveries of the sixteenth and seventeenth centuries. Mr. Balme brings to light this distinction first by investigating the apparently mechanistic implications in Aristotle's system. Certain phenomena in biology are ascribed to 'hypothetical Ananke'. But the causal nexus due to this Ananke 'peters out'.[2] Ananke does not determine all successive stages. Therefore Aristotle could, as he clearly did, believe all sublunar processes to be by nature unpredictable, not only owing to the limits of the human intellect, but because they were in themselves indeterminate. Mr. Balme then shows the same to be true of the atomists. In spite of their general interpretation of change as due to Ananke they did not reach the modern conception of mechanism because they never conceived of Ananke as going on in its effects for all time. This vital feature of modern mechanism is absent in both ancient theories. Their Ananke was not conceived of as governing an endless sequence of effects. Hence it differed essentially from the modern world's idea of necessity. Thus far I feel myself to be in full agreement with the result of Mr. Balme's lucid investigation.

But I differ from him with regard to the conclusion which can be drawn from this concerning teleology. Mr. Balme suggests that it was Empedocles' and the atomists' failure to account for 'the orderliness of nature' which prompted Aristotle to offer his teleological theory.[3] This shortcoming, he thinks, has since been overcome, for

[1] D. M. Balme, 'Greek Science and Mechanism. I. Aristotle on Nature and Chance', *C.Q.* xxxiii, 1939, pp. 129–38; 'II. The Atomists', *C.Q.* xxxv, 1941, pp. 23–8. [2] *C.Q.* xxxiii. 138.

[3] Cf. *C.Q.* xxxiii. 129: 'The chief weapon which Aristotle finds to use against the *φυσικοί* is that natural physical interactions could not, unguided, produce the orderly world. Yet it is precisely the orderliness of nature which the modern mechanist invokes in his own defence.' Ib., p. 132: 'Lastly there is Aristotle's unceasing criticism of the *φυσικοί*. He attacks them with the very weapon with which they would now defend themselves: if everything is due to automatic interactions in nature, how is it that phenomena are so orderly?—The *φυσικοί* refer everything to Ananke: but this is manifestly untenable, for Ananke and chance could never produce an orderly world.' Ib., p. 137: 'he (*sc.* Aristotle) could not credit natural processes with orderly behaviour unless they were guided by a creative impulse towards ends. An orderly nexus of automatic causes and effects is not contemplated by him. The nexus which he contemplates in his attack on Empedocles is criticized as disorderly.' *C.Q.* xxxv. 23: 'The principle that a moving body must continue to move unless something stops it was not known to Aristotle. . . . This ignorance . . . compelled him to believe that nature could not be orderly unless guided by a purposive force. Therefore he attacked those scientists who had thought that the world could be explained in terms of the compulsions and interactions of natural stuffs—a principle which they vaguely called Necessity, Ananke. In attacking their doctrine Aristotle cannot have thought he was attacking the mechanistic determinism which modern critics have detected in their words: for he could not even conceive of such an idea.' Ib., p. 27: 'Epicurus saved the human mind from random behaviour, but he could not save his world from it. It seems likely that in the interval between him and Lucretius his opponents fastened upon that point, asking (with Aristotle) how atomism could account for the orderliness of nature (a question which has no cogency against Laplace).' Ib., p. 28: 'But he (*sc.* Lucretius) has not explained why nature should be so overwhelmingly regular in achieving *motus convenientes*, and why the abortive combinations are so conspicuously in the minority. On this point the Epicureans did not advance a step on Empedocles, and the answer which he had got from Aristotle was repeated to Epicurus by the Stoics.'

To the present author it would seem that the Stoics, like Aristotle, were in the right with their criticism, and, what is more, that Aristotle's question does possess cogency even against Laplace. Mr. Balme thinks of mechanical order only, but the orderliness of nature which fascinates Aristotle is not explained by modern mechanism either, and defies all mechanistic explanation.

he sees its source in their failure to conceive of the causal nexus as going on for ever. According to Mr. Balme, Aristotle rightly felt the weakness, but, instead of improving their mechanism, replaced it by teleology. The implication is that with modern, i.e. perfect, mechanism at hand we need no teleology.

Mr. Balme's attitude to this question follows consistently from a belief in the physicist's method as the royal road in matters of causation, a belief shared by many. Teleology has been discarded. Physical mechanism is to satisfy the desire for a consistent explanation of the order in the world. Many scholars of Greek philosophy, following the lead of science, its logic, and its methods, take the same view.

But is there not an ambiguity in thus speaking of 'the orderliness of the world'? The physicist's world order is one thing, the 'orderliness' which the teleological theory envisages is another. All physical processes obey one and the same law, and form one interconnected system of change. They are directed by one and the same kind of cause, a moving cause, pushing, as it were, from behind, producing an *orderly* result, no doubt, i.e. acting with exactitude, effecting invariably the same result under the same conditions, yet pushing blindly, not minding what the result may be, or rather what it may mean. In this feature modern mechanism does not differ from ancient atomism, although it provides the basis for a more perfect order of nature than antiquity could conceive. It was certainly not this *order* which Aristotle had in mind. The eighth chapter in the second book of his *Physics*, where he expounds and defends teleology, shows that his eye was turned towards some other *orderliness*, or rather some *organization*, which he found in the world at large as well as in single parts of it. This awakened all his admiration and seemed to him to deserve all efforts in investigation. The phenomena which he is trying to account for are such as: the influence of the weather on the prospering of corn and fruit; the construction of a man's, or an animal's, teeth which are different from each other, each one well fitted for the special task it has to perform; the seemingly clever and well-organized behaviour of a spider, of ants and bees, of a swallow; the purposeful structure of a plant, where we find leaves protecting the fruit, and roots digging deep down into the ground for food. This, to his mind, is not the order established by the *pushing* cause. The evidence which he perceives in the individual living being as well as in the organization of groups of living beings or even in different parts of nature in their relation to each other, is of such a kind as to make him think of a plan, although, as he is anxious to state, we see nobody planning.[1] He gives expression to this phenomenon by stating that things tend towards the achievement of some τέλος. In later times the same evidence has given rise to the terms *organism* and *organization*. The startling and puzzling feature is that there is not so much a pushing from behind as a pulling from what is ahead, not a *vis a tergo* but a *vis a fronte*. This principle which seems to direct natural motions does not exist as a thing exists and cannot be perceived by the senses. It is unlike material and perceptible things. Aristotle calls it the τέλος. This appears to be non-spatial, and so, if I may venture the term, *spiritual*. The mechanist finds it hard even to detect it. Therefore, however important insight into the difference between ancient and modern mechanism may be, it cannot lead, on the ground that consistent mechanism solves the problems which nature presents, to the discarding of teleology. It must be maintained that the orderliness of nature which Aristotle had in view has not found and cannot find a satisfactory interpretation by means even of the most perfect mechanism. The reason why Plato and Aristotle

[1] Cf. above, p. 44 and ib., n. 3. In marked contrast to φύσις there is in τέχνη a planning agent, who is different from, and exists outside, the thing which undergoes the change. This agent is a human being, and he is led by νοῦς. τέχνη is one special kind of setting-into-motion within Praxis. Therefore, here as in all πρᾶξις, νοῦς, in the form of λόγος, is found to be playing its part: τέχνη is ἡ μετὰ λόγου ποιητικὴ ἕξις (*Eth. Nic. Z* 4. 1140^{a}4).

were so thoroughly opposed to all descriptions of natural motions and changes as due solely to Ananke was not the imperfection of the mechanical theories in question but something more fundamental: they were opposed to materialistic and mechanistic world explanation as such. It was against their deepest convictions that all events and all change in the world should be due to mechanical causes. The controversy between the two parties in antiquity is, to my mind, fundamentally the same as the nineteenth-century struggle between a materialistic science and its methods and logic on the one hand and an idealistic philosophy and view of the world on the other. There is no doubt this difference, that among the Greeks idealism prevailed, while mechanism, as Mr. Balme points out, did not appeal to the best minds and never to a great number.[1] In the modern world the position has become deeply changed. Yet even in the nineteenth century, at a period when mechanistic thought was at its height, there arose again in biology 'vitalistic' theories, and the need for finding a method proper to biology has been felt anew. Far though modern investigation of nature has gone beyond the primitive attempts made by the Greeks, yet, in questions of the philosophical outlook underlying scientific research, their discussions may not have become obsolete. Always aware of essential problems and less hampered than we are by vastness of knowledge and intricacy of detail, they have shown intensity as well as acuteness in tackling fundamental issues.

To maintain that some kind of *spiritual* interpretation of nature is a serious problem means departing from the physicist's basis. Perhaps, in fact, the biologist can be a safer guide than the physicist for an evaluation of Aristotle's views on nature. For Aristotle deals so predominantly in his numerous writings on nature with what we would call biological phenomena. They prevail over the purely physical, i.e. mechanical problems discussed by him. There is, of course, no clear demarcation line between the two, since physics as such had not yet been constituted. Observation of living beings guides his general conception of nature. He does not say how far in nature animateness reaches. All he clearly states is that *ψυχή*, as the principle of life, is at work not only in animals but also in plants. Beyond this he makes no clear statement on this point. The stone, it would seem, is not animate. Yet even that part of nature which is without *soul* seems to be included in his conception of nature as teleological. We miss a precise exposition of his idea of inanimate nature.[2] This field, in which modern science has made the greatest progress, seems to have obtained the least satisfactory interpretation from Aristotle. But we have his elaborate account of animals and their mode of being; and the philosophical idea of nature which he develops on this ground purports to cover the whole of sublunar nature. It is, then, primarily with biological phenomena in mind that an understanding of Aristotle's view of nature should be attempted. Now if these, as some modern thinkers believe, defy all consistently materialistic approach, then the problem of a non-mechanical method of interpretation cannot be regarded as obsolete.

It may or may not be an error of Aristotle's that he applies his teleology to a wider field than that of biological phenomena. It is more evident that the modern world has gone astray in doing the reverse. Physical interpretation has overstepped

[1] *C.Q.* xxxv. 28.

[2] A. clearly holds that the various realms of nature, such as *ἄψυχα*, plants, animals, are not separated from each other by definite boundaries but show gradual transitions. He had observed in the sea living beings intermediate between plants and animals (*Hist. anim.* Θ 1) and seems to have thought that there exist similarly transitionary phenomena between *ἄψυχα* and living beings. He definitely states that *ἐκ τῶν ἀψύχων εἰς τὰ ζῷα μεταβαίνει κατὰ μικρὸν ἡ φύσις* (*Hist. anim.* Θ 1. 588^{b}4); similarly *ἡ γὰρ φύσις μεταβαίνει συνεχῶς κ.τ.λ.* (*De part. an.* Δ 5. 681^{a}12 ff.). In anticipation of the discussion below it may here be mentioned that Uexküll likewise inclines to believe in the unity of organic and inorganic nature.

its limits and attempted to rule over regions in which the existence of ψυχή[1] cannot be denied. By contrast Aristotle possessed a clear sense of the importance of applying the specific method of investigation appropriate to each field of *being*. Each region of ὄντα has its distinct ontological character, following from its specific ἀρχαί. In accordance with it the method of cognition in each field has to be shaped.[2]

In our times, the biologist J. von Uexküll has undertaken to outline a new theoretical biology.[3] His idea of nature and the spirit of his attempt at an adequate theory of nature appear to me to be akin to Aristotle's. I propose here briefly to outline some features of his biology in order to indicate the relation which I believe to exist between Aristotle's views and this modern conception.

Uexküll wishes to replace the *mechanistic* science of living nature by an interpretation and investigation based on the obvious though immaterial phenomenon of a *plan* (*Planmässigkeit, Plan*) in nature. He stamps *physiology*, i.e. the physical and chemical investigation of plants and animals, as purely *mechanistic* and therefore missing the basic character of a true *biology*, whose concepts and methods of investigation must be directed by a grasp of the central life-phenomenon, the *plan*. This insight has not only come to him by free observation of nature, but has been confirmed by experiment.

Uexküll, like other biologists before him and with him, has carried out experiments specially devised in such a way as to show by their outcome whether or not a plan is at work. The term *plan* does not imply any planning intelligence as the origin of the *Planmässigkeit* in nature. Uexküll appears to regard this problem as beyond the due limits of the biologist, for he has to restrict his statements to what he actually finds in nature. He does not find any planning agent but he does find the *plan*. The *plan* is immaterial, inaccessible to sense-perception, and yet a demonstrable phenomenon, found to underlie and to direct natural motion and change. This leads him to discard all *materialistic* explanations of life processes. On the other hand, Uexküll wishes biology to keep equally free from psychological interpretation. The animal itself is not the planning agent. To interpret animal behaviour by analogy with the actions of a human being is *unbiological*, because it fails to do justice to the subject-matter just as much as mechanical views. Biology is bound to recognize non-human organic nature as something *sui generis*. It lies, as it were, in between inorganic matter and man. It is the positive character of this intermediate phenomenon which Uexküll wants to express by the term *Planmässigkeit*.[4]

The biologist discovers in the embryo as well as in the developed animal sequences of impulses directed by rules. These rules (*Impulsregeln, Regeln der Impulsfolgen*) are observable. They can, with the help of well-devised experiments, be analysed in precise details. These rules represent the *plan*. Modern biological research has given

[1] I here take ψυχή in the Aristotelian sense as = principle of life, including the life of plants and animals.

[2] Here we have to remind ourselves of the distinction, so fundamental in Aristotle, between τὰ ἀεὶ ὄντα and τὰ ἐνδεχόμενα ἄλλως ἔχειν. Accordingly, the respective modes of cognition differ from each other. It is only concerning the invariable that strict knowledge is possible. The ἐνδεχόμενα admit of δόξα only, i.e. of a not firmly established way of thinking about them, since they themselves are not firmly established but variable. Plato likewise had held the view that the ontological character of what is being cognized determines the mode of cognition. We may compare his discussion of ἐπιστήμη and δόξα towards the end of *Republic E* (477 ff.). With regard to nature, accordingly, Aristotle endeavours to show in *Physics B* 2 how the method of discussion must follow from the subject. See below, p. 51.

[3] J. von Uexküll, *Theoretische Biologie*, 2nd edition, Berlin, 1928. Cf. also Baron Uexküll and G. Kriszat, *Streifzüge durch die Umwelten von Tieren und Menschen*, Berlin, 1934.

[4] *Theor. Biol.*, p. 144: 'Higher rules are called plans, regardless of whether or not they rest on human intentions.'

new and rich insight into the differentiation of the working of these rules in one field especially, that of embryology. Driesch eliminated, in an animal embryo, some material which would normally have developed into some definite organ or limb. The result was that the embryo transformed some other material in such a way as to produce that organ or limb. Further, Driesch cut the eggs of sea-urchins into two halves. The result was not the development of two halved animals (as was to be expected on the basis of *mechanistic* science), but the halved germ grew into two complete sea-urchins, each half the size of the normal animal.[1] Even the scientist most doubtful of a plan, so Uexküll points out, would admit that the results of these experiments show the insufficiency of mechanical explanation.

Embryological processes, however, are not the only field where a plan is found to be at work. The behaviour of a finished adult and all functioning of his life conform to a plan as well. To this problem of the animal's life in its world Uexküll has given special attention. His conception of a *world* needs some comment. He here knows himself indebted to one of the main conceptions of Kant's philosophy. In the *Critique of Pure Reason* man's world is interpreted in such a way as to correspond to, and even to be constituted by, the structure of man's understanding and cognitive powers. Uexküll wishes to extend this interpretation to all animal species. Each species has its specific structure, and correspondingly, its specific world. The animal's world is not identical with our world, nor is the world of one animal species the same as the world of another. The animal's world is constituted by what it perceives of its surroundings (*Merkwelt*) and by the extent to which it acts on its surroundings (*Wirkwelt*). By adding to the world of perception a world of action Uexküll has further extended Kant's thought. There is a perfect correspondence (*Einpassung*) between the animal's perceptive faculties and its *Merkwelt*, that is, those sensible characters within the world which alone are and need be accessible to it. There is, correspondingly, a perfect correspondence between its active faculties and its *Wirkwelt*. A primitive animal, e.g. a tick, perceives very few qualities and reacts with very few actions. Higher animals have richer and more complicated *worlds*, though this by no means makes their functioning any surer. Each animal's specific world (*Umwelt*) differs from what we call its surroundings, which are noticeable to man (*Umgebung*). It is perhaps the decisive and the most original feature of Uexküll's biology that its subject-matter is never the animal in isolation but the animal together with its specific world, whose *subject* (in a philosophical sense) the animal is.[2] An understanding of this phenomenon, the living being within its specific *world*, is related to the teleological outlook. The mechanist cannot catch sight of this *world*, he sees merely the animal's *surroundings*.

Thirdly, all processes of healing, or, more generally speaking, the ways in which a great part of the injury done to a living being's body is repaired by that body itself, bear witness to a *plan* in nature. In the field of this third phenomenon again, Driesch's experiments had given new insight and fresh impulses to biological research. We

[1] Op. cit., p. 148.

[2] We can compare, to a certain extent, Arist.'s ontology of the living being, as presented in *De anima*. For he also takes into account, while analysing the powers of ψυχή, the various ways in which an animal possesses a world and is equipped for it, by its two faculties of motion and perception. Plants grow into all directions of space, but they lack perception. Animals possess αἴσθησις. Colour, sound, smell, and taste are discussed as the ἀντικείμενα of the animal's senses, thus forming part of that phenomenon which is called a living being. Correspondingly, man's highest faculty, νοῦς, cannot be interpreted without an understanding of the νοητά. They do not exist in the animal's world, but they form part of the human world. Uexküll's analysis, naturally, is confined to the animal's world. Here, however, he goes far beyond Arist. by tracing out, with the help of experiments, exactly what the world of every one species is like, as distinct from the worlds of the other species.

may here follow his own account.[1] Driesch was able to show that where parts of a developing animal which are already in existence (and are no longer mere embryological material for certain parts to develop) are damaged or even cut away, the animal's body reacts, by some method or other, in such a way as to repair the damage. Driesch describes the methods used by nature for that purpose under two headings. In some cases the animal, part of which has been excised, will be found to complete its own body again. Starting from the cut surface the missing part of the body will sprout forth anew. This is, in Driesch's interpretation, a *genuine regulation*. The cut surface has produced, as he puts it, an *additional achievement* (*Mehrleistung*), i.e. there is a plus as compared to what would have been the same matter's normal achievement had no cut been made. In some cases the animal is found to respond by a second method. The histological nature of bodily parts already in existence can be found to change in response to the damage. It may even have to start this process of alteration by a retrogression, which, by introducing a more thorough shifting of the structure and of the functions of the various parts, achieves in the end the construction of a body which is again complete and fit. Driesch calls this way of making up for the damage a *metamorphosis* (*Umbildung*). It attains its end not by a mere *Mehrleistung* but by an *Andersleistung*: the achievement has been altogether altered. This is an even more admirable feat of nature than is *genuine regulation*. The two phenomena together show the animal's capacity for self-repair according to some *plan*.

On the basis of such experiments, and some additional observation and research initiated by himself, concerning the animal in its world, Uexküll recognizes three distinct *plans* in animal life which may now be summarized as follows:

1. There is a plan for building up the animal out of the fertilized germ. Embryological research shows that the animal itself, through various stages of increasing differentiation of cell-material which tend to develop a complete animal, constructs its own body, in accordance with rules at least as ingenious as those according to which a machine is built.
2. The animal directs by itself the management and working of this quasi-machine once it has been built up. This working is neither purely mechanical, i.e. altogether lacking direction with reference to its outcome, nor is it guided by an intelligence within the animal. It is rather a special phenomenon with distinct features of its own. Uexküll has investigated it under the leading idea that the animal and its *world* form one inseparable whole. Thus studying the animal in its *world* he has found ample evidence of *Planmässigkeit*.
3. The animal is capable of undertaking by itself repairs, if the *body-machine* which it has built and which it is using, suffers any damage. The rules (or *plan*) according to which the repair is carried through are naturally distinct from the *plans* both for building up the body and for using it.[2]

In all this, it will have been seen, the animal seems to show a certain similarity to a machine, for a machine or tool also is constructed according to one plan, functions during its use according to another plan, and can be repaired in accordance with a third plan. But the fact that it is the animal itself which directs construction,

[1] Cf. Driesch, *Der Vitalismus als Geschichte und als Lehre*, Leipzig, 1905, esp. pp. 193 ff. It should be noted that while Driesch's experiments are illuminating, his theory as a whole is misleading.

[2] Among the three *plans*, the *plan* for the functioning of adult life naturally has priority. Uexküll mentions that the *rule for functioning* dictates the *rule for genesis*. That the rule for *repair* is, in its turn, dictated by the rule for the finished animal's life functioning is self-evident. Hence also the animal–world relation is of comprehensive importance.

management, and repair shows the fundamental difference between a living being and any machine.[1]

In the case of the machine, the constructor, manager, and repairer are outside the thing, and is a distinct being applying his thought to the object, whereas the living being has somehow, as it were, its constructing, managing, and repairing *agent* within itself, although an *agent* without thought. The parallel to Aristotle's analysis is striking: the φύσει ὄν has the ἀρχὴ κινήσεως ἐν ἑαυτῷ, in sharp distinction from all τέχνῃ ὄντα.[2] It is this distinction with which Aristotle starts his analysis of nature in the second book of the *Physics*, and it being the central characteristic of living nature, he is careful not to lose sight of it. It is this phenomenon which makes him reject all mechanistic explanations and which, ultimately, leads him to interpret nature teleologically. For Uexküll likewise, this phenomenon, that the *agent*[3] of the various ways of planful acting has to be sought in the living being itself, serves as the central evidence, to which, again and again, he turns back, and which urges him to emphasize that, in even the minutest detail of biological description, mechanistic conceptions have to be avoided as misrepresenting nature and have to be replaced by such conceptions as will express the *plan* found within the living being or in nature at large.

Uexküll lays stress on the fact, not usually realized in biology, that the three *plans* (i.e. for genesis, for the functioning of adult life, and for repair) are distinct from each other. Each obeys its own purpose and, accordingly, has a law of its own. It has to be noticed, as a mark of this distinct character, that the working of one *plan* or the other sets in abruptly, not by any gradual transition. There is a sudden and distinctive change in all processes when a new *plan* begins to work.

This observation, to his mind, disproves the theory, once so influential in biology, that ontogenesis, i.e. the development of any individual animal, is an abbreviated repetition of phylogenesis, the assumed gradual development of its ancestors. There is no gradual passage from one species to another, and no gradual development of a species towards *perfection*. He states definitely that every species as such is *perfect* from the very beginning. To express the same thing in other terms: each *plan*, as far as it goes, is *perfect*. This idea of *perfection*, properly understood, forms an integral part of the conception of a *plan* in nature. The *plan* is, as it were, one all-round *whole*. (We may compare the concept of a *Ganzheit* and its role in modern German psychology.)[4] The whole is prior to its parts. The *plan* is something consummate in itself. In Uexküll's opinion, all evolutionary doctrines have to give way. The theory of evolution represents, to his mind, the specifically modern form of mechanistic interpretation of biological phenomena.

[1] The analogy of the three plans is applicable to the tool as well as to the machine. But when we come to the feature of self-motion in the animal, this is no longer comparable to a tool, yet the analogy to a machine still seems to hold true. The *machine-theory*, accordingly, has played a great rôle in biology. Uexküll, however, searching deeper, shows its inadequacy.

[2] *Phys. B* 1. 192^{b}13 ff.

[3] The word *agent*, of course, must be understood to be a mere metaphor, arising from the comparison with human craft. From a failure fully to realize this springs the misconception of some small *being* or *life-force* existing in the animal. Neither Uexküll nor Aristotle means anything of that sort. To them the cause that operates in the living being is not separable like an existing thing. It is of the very essence of nature, as distinct from craft, that there exists no agent, no *force*, but what is found is a peculiar mode of being. In other words, the living being as a whole has this specific mode of causation.

[4] The school of *Gestalt-Psychologen* thinks of *Gestalt* or *Ganzheit* as a primary phenomenon, not in organic life only. Uexküll considers *Gestalt* as an even more fruitful concept than *Ganzheit*. In agreement with Driesch he wishes to restrict the use of both concepts to organic nature. In inorganic nature we find merely sums but no wholes. In his view, it is the idea of *Planmässigkeit* that underlies both phenomena, *Gestalt* and *Ganzheit* (op. cit., p. 199). The Greeks, I think, who spoke of εἶδος, μορφή, and τέλος must have possessed this insight which modern science is reacquiring.

Uexküll's search, aiming at the *foundations* of biology, can be compared with Aristotle's notion of specific ἀρχαί underlying each region of being and constituting it, and his strict and methodic search for the τί ἐστι of every region. Thus *Physics B* is a search for the *what* or essence of nature. The result is that nature is found to be an αἰτία ἕνεκά τινος. And it is from this essence that the φυσικός has to take his directions as to how he must discuss nature.

Uexküll contests the view that after ages which produced animals of primitive structure there began gradually the formation of animals with a more and more complicated build. Darwinism had imagined this to have happened by the survival of the fittest, and Lamarckism explained it by assuming gradual adaptation. This trend of thought admitted of no *plan* in nature. Nature seemed to work blindly. For these biologists, although seeing in nature some fitting together, i.e. some apparently teleological evidence (e.g. animals well equipped with what they need in life), and setting out to explain this evidence, yet, by their thoroughly mechanistic interpretation, rather than explaining it explained it away. The attaining of a purpose—so the Darwinist argues—is not due to any striving towards it. It happens merely *by chance* that an end is attained. (This *owing to chance* means at the same time: by *purely mechanical reasons*, as opposed to any kind of *purpose*.) This idea repeats precisely the philosophical position of the Atomists as described by Aristotle.

Uexküll, on the contrary, maintains that nothing essential in living nature can be brought about by mechanical causes. All *fitting together* gives evidence of the underlying *plan*. He refuses to admit of *Anpassung* (adaptation) and suggests in its place, as a basic biological concept, that of *Einpassung* (fitting together, fitting into). This means that in each animal species we find a structure precisely fit for the special task of the animal. The animal's body, habits, and perceptions correspond exactly to the qualities of its *world*.

It is in keeping with Uexküll's basic idea of biology that he strongly emphasizes the epigenetic character of the embryological process. It had been supposed for some time that a differentiated and fully structured animal existed within the fertilized germ, so that all that was needed was that it should unfold and thus come to visibility, like a bud opening up and turning into a leaf or flower. The embryological research that followed, especially that undertaken by Driesch, finally disproved that idea. The primitive homogeneous cell produces, in successive stages, again and again, as it were, *new creations*. It creates ever new differentiations which lead to the existence of the organs. What exists in the later stage has not existed before. It is due not to mere unfolding but to some creative activity within the germ. There is, within this, a power of bringing into being a new multiplicity.[1] The growth proceeds towards increasing complexity. (Uexküll therefore suggests the term *Verfaltung* instead of *Entfaltung*, or *Verwicklung* instead of *Entwicklung*, because the germ undergoes a more and more complex folding. We may call it *involution* rather than *evolution*, or *envelopment* rather than *development*.) The view had been accepted, and the theory of epigenesis had replaced, in embryology, the theory of praeformation, long before Uexküll.

Similarly Uexküll emphasizes that the functioning of the life of any species is due to the underlying *plan* or organization, and therefore—to express the same belief by a different wording—he regards the genesis of a species as a *creative* process. He may seem extreme, and even reactionary, to modern biologists in his denial of a genesis of new species.[2] After the height of the evolutionary period,[3] so he points out, new

[1] *Theor. Biol.*, p. 195; ibid., p. 148.

[2] It will soon be found, however, that Uexküll does justice, after all, to what is considered as undeniable evidence in this matter, by his admission of a splitting into sub-species, so that it is merely on his *interpretation* of the evidence that he differs. See below.

[3] 'Variation [*scil.* of species] is, according to

researches had led many biologists to restrict and carefully qualify their statements about the gradual development towards new and higher species. He himself is fully convinced that every species is *perfect* from the start. There is no gradual accretion in *perfection*. It may be noted that Aristotle, similarly, held that species are fixed. The coming into being of new species is admitted by Uexküll in a very limited sense only, and he stresses the fact that it represents one of those problems in biology about which we still know exceedingly little. But of one thing he feels sure: that this coming into being is of a character quite different from embryological genesis. In contradistinction to it, he is inclined to call this an *evolution*, taking this term in its precise sense.[1] When a new species arises, absolutely no new creation of a further multiplicity occurs. Since every existing species is complete from the start, all that can occur is that it may split into several varieties, called races. The more numerous are the different genotypes within a species, the more easily such splitting may occur. Such races which have been gained by splitting can then form new species. 'That is all we can say of the genesis of new species. This we can say with great probability.'[2] A new species is characterized by what Uexküll calls a new *sphere of functioning* (*Funktionskreis*). The whole structure is altered and is centred in a new way. This cannot happen gradually but must proceed in jerks. 'We do not know yet when, in what way, and by what cause new spheres of functioning arise. But it is better not to know than to cherish a false knowledge.'[3]

The view, stressed by Uexküll, that the processes set in not gradually but in jerks, holds true of both types of processes, the origin of a species (which must mean, at the same time, the beginning of an animal's life functioning) as well as the genesis of an organism from a fertilized germ, the latter being the one about which biology possesses a far richer knowledge. It is self-evident that repairing processes, which suddenly set in when an injury has occurred, show the same character. This phenomenon of jerks in all kinds of processes (corresponding to the three kinds of *plans* summarized above on p. 50) is an indication of what Uexküll calls the *Planmässigkeit* in nature. The processes start by jerks, because in all of them we are confronted with epigenesis, not with evolution.[4]

Uexküll's decisions, then, on various topics (the development of a fertilized germ as non-mechanical, the functioning of the animal's life as *well planned*, the processes of repair as likewise *planful*, these three *plans* as distinct from each other, the abrupt beginning of their working, their immediate perfection in contrast to a gradual achievement of greater perfection) are closely interconnected. They all follow from the one basis, which for Uexküll is more than a mere working hypothesis, rather a *ὑπόθεσις* in the Greek sense that, as an observer of nature, he finds it everywhere in existence, underlying all processes: namely, the *ὑπόθεσις* of a *plan* in nature.

It is from this basis that we have to understand his statements about perfection, which otherwise may seem absurd. They all represent the counterposition to any mechanistic theory, by aiming at showing the *plan* as the primary phenomenon in living nature. If a plan, and this implies some whole, precedes and guides the parts, this means that something complete directs the single data. It is, we may infer, this completion which Uexküll calls a *perfection*. The completion must be perfect, other-

the Darwinists, a chemical process, which produces living beings completely *planlos*. Among them the struggle for life eliminates, in a mechanical way, those which are unsuited, i.e. which are not fit for life, thus attaining a selection of the fittest' (op. cit., p. 195).

[1] Uexküll wishes to apply the term *evolution* only to a mere *unfolding* (in accordance with the root-meaning of the word), i.e. to an evolving of what has already existed. He insists that the word is incorrectly used with regard to processes that tend towards increasing perfection, or make something new arise.

[2] Op. cit., p. 196.

[3] Op. cit., p. 198.

[4] Loc. cit., pp. 98–9: 'In allen Fällen wird etwas Neues geleistet . . ., nirgends Evolution, immer Epigenese.'

wise the *plan* would not be really completed, and the system could not function. All single data and events are well fitted into each other. If there were any gap in this fitting, the working could not take place. Each animal species thus represents a system of its own, different from any other, but of such a kind that within this system every detail springs from the *perfect plan*. That is why Uexküll can state that all *plans* of nature are *perfect*. His idea of *perfection* is inherent in, and inseparable from, his idea of a *plan* in nature. For this reason also he states that every species is *perfect*, or, what is equivalent: 'Ein jedes Lebewesen ist prinzipiell absolut vollkommen'.[1] The phrase *die Vollkommenheit der Natur* really means *die Planmässigkeit der Natur*, so that Uexküll's sentence 'Die Planmässigkeit der Natur ist vollkommen' can be called a tautology. For he says: 'If the *Planmässigkeit* of nature could be proved to be imperfect, then the *Planmässigkeit* of nature would be no more than a mere illusion, and what we have admired as *Planmässigkeit* might turn out to be a play of Chance, as the Darwinists in fact assume.'

I cannot help thinking that this modern biological conception of a *plan* and of *perfection* is focused on very nearly the same thing which Aristotle had in mind when speaking of a τέλος. The Greek term as well implies the idea of some *Ganzheit*, and hence of some *perfection*, as is confirmed by Aristotle's use of the kindred words τελείωσις and τέλειον.

Aristotle emphasizes that τέλειον is derived from τέλος, meaning that which possesses the τέλος (e.g. in *Met. Δ*, chap. 16. 1021^b24–5, and chap. 24. 1023^a34). He further defines the τέλειον as that of which no part is missing (ib. *Δ* 16. 1021^b12 f., and *passim*). This means that it is there as a complete or whole thing. The τέλειον, then, is that which possesses wholeness, or perfection. It is consummate.

That τέλος means indeed to Aristotle something like wholeness, perfection, consummateness, or fulfilment, emerges with special clarity from *Met. Θ* 6. 1048^b18–36, a short paragraph of outstanding significance. We find there a distinction drawn between two kinds of *movements* (including human activities): (1) A κίνησις can be, and usually is, ἀτελής, i.e. fails to be in possession of the τέλος. Of such character are all the usual endeavours to attain some aim. While they are taking place, the state after which they are striving has not yet come into existence. They have, by their very nature, some part of themselves *outside themselves*. (2) There exist a few extraordinary activities whose τέλος is present within them, or rather, in each movement of this kind the τέλος is identical with the movement itself. Such κίνησις, therefore, is τελεία, and Aristotle prefers to call it ἐνέργεια rather than simply κίνησις, since it is fully active, completely present, with nothing missing, with no potentiality left unrealized. This type of activity, which possesses highest dignity, as is shown also in the tenth book of the *Nic. Eth.*, is represented by ὁρᾶν, φρονεῖν, νοεῖν, εὖ ζῆν, εὐδαιμονεῖν. In these activities the *past* is a *present perfect*, identical with the *present*; there is, in other words, no succession; they exhibit complete presence or existence in every stage. In no phase is there anything lacking. There is perfect fulfilment. We understand why Aristotle can call such an activity ἐντελέχεια as well as ἐνέργεια.

A similar meaning of τέλος occurs in *De caelo A* 9, where Aristotle speaks of the αἰών as τὸ τέλος τὸ περιέχον τὸν τῆς ἑκάστου ζωῆς χρόνον, οὗ μηδὲν ἔξω κατὰ φύσιν (279^a23), and as τὸ τοῦ οὐρανοῦ τέλος καὶ τὸ τὸν πάντα χρόνον καὶ τὴν ἀπειρίαν περιέχον τέλος (ib. 26). This τέλος, again, is an *entirety*.

Natural processes in the sublunar world, as distinct from ὁρᾶν, εὐδαιμονεῖν, etc., are successive. They are, in their varying stages, directed by a τέλος towards which they are striving. Ἄνθρωπος ἄνθρωπον γεννᾷ. An actually existing complete being is the cause of the genesis of a new being.

[1] *Theor. Biol.*, p. 138. Cf. this paper, p. 51.

Teleology does not so much mean the striving after some aim as it means the phenomenon that natural processes are directed from a whole (*Ganzheit*).

If we understand the τέλος primarily as the aim or the end in view, we are not faithful to the meaning it had for Aristotle. His assertion that processes in nature occur ἕνεκά τινος is the corollary of his conviction that τέλος is the leading cause in nature. It means ultimately that things happen for the sake of the τέλος, or, to express it more fully, directed by, and normally leading up to, the τέλος, in a succession of occurrences, each of which happens for the sake of the next, until completion or fulfilment is attained.

The meaning of the word τέλος is not identical with that of ἕνεκα. This seems to have been overlooked in the traditional understanding of teleology, where the *for the sake of* has acquired the central place, whereas for Aristotle τέλος is the main concept. His doctrine does not mean primarily that everything happens for the sake of something, let alone of an end in view, but first and foremost that some wholeness is playing the main part in causation. Yet for many centuries τέλος has been taken to be the end in view. This has led to much vicious thought in the history of biology and has contributed to discrediting Aristotle and all teleology.

Uexküll does not use the term *teleology*, just as he refuses to use the term *Zweck* with regard to nature. The reason is that *Zweck* and *Ziel*, like the English *aim, purpose, end in view*, mostly bear to the modern reader a meaning which makes them unsuited for the interpretation of nature as seen by Uexküll, a meaning too which τέλος did not bear to Aristotle. They suggest some consciousness, or, at least, some phenomenon of perception, or, to put it in Uexküll's biological terms, that there should be some *Merkzeichen* of the aim, that is, the animal should somehow perceive the *plan*. But consciousness is altogether excluded from animal life.[1] And the perception, or Uexküll's *Merken*, of which the animal is indeed capable, does not include the phenomenon in question. The animal perceives various data, but it does not perceive the *plan*. Besides, in the life, for example, of an embryo, where there definitely is a *plan*, there is as yet no perception at all. We should therefore not think of a *plan* as of a *purpose*.[2] Uexküll prefers to describe it as a rule for a series of impulses.

It is for this reason that Uexküll would restrict the term *aim* to human actions. That living being alone which is a thinking subject has aims, whereas nature has *plans*.[3] His cautious avoidance of terms like teleology and aim is only an expression of his conviction that the animal does not possess thought, and that, while possessing perceptive faculties, it does, nevertheless, in no way perceive the *plan*, though it moves according to that *plan*. Not only are the processes of animal life distinct from

[1] Just as in Aristotle. Nature lacks νοῦς. τέλος in nature, consequently, does not imply consciousness.

[2] The idea of some conscious planning, which almost inevitably creeps in when we speak of purpose, leads, with regard to nature, to two faulty views. (1) Either the animal itself is thought of as being conscious of the *purpose* even though only possessed of a vague consciousness (or *instinct*). Thus biology is falsely built up on the analogy of psychology. But the *plan* in nature is no psychological phenomenon. (2) Or, the planning intelligence is imagined to exist outside the animal. On this interpretation, the animal will be regarded as far too similar to inorganic matter on which an outside agent works. The agent, here, must be God. Thus we commit the two errors of making statements about something which lies beyond the biologist's experience, by bringing God as an agent into the analysis of nature, and, at the same time, of understating what our subject-matter, living nature, actually shows us; for the evidence shows that it is more than, and different from, lifeless matter. The basic phenomenon of living nature is a plan, inherent in the animal, but not known to it nor perceived by it.

[3] It is open to question whether in some higher animal species a certain aiming is to be found. Uexküll, in his *Theoretische Biologie*, does not seem to admit of the possibility, but in *Streifzüge durch die Umwelten*, etc., he says (p. 47): 'Vielleicht erweisen sich später gewisse Handlungen der höchsten Säugetiere als Zielhandlungen, die selbst wieder dem gesamten Naturplan eingeordnet sind.'

mechanical processes, but they must just as sharply be differentiated from human actions. The traditional dualism, then, must give way to a threefold division. There are not only two realms, matter and soul, distinct in their mode of being, but we find three ontologically distinct regions: matter with its mechanical laws, living nature moving according to *plans* of nature, human life possessed of thought.

Before further commenting on this triad I shall try to illustrate Uexküll's distinction between *Ziel* and *Plan*.

'On perception of sound in night-moths. It makes no difference whether the sound to which these animals react is produced by a bat or by rubbing a glass stopper. The effect is always the same. Upon one and the same high-pitched sound those species of night-moths which, owing to their bright colour, are easily visible, fly away, whereas those which possess a protective colouring settle down. Thus one and the same *Merkmal* has opposite effects. It is obvious that the two opposite actions are highly planful. There is no idea of the animals' making a distinction or pursuing an aim, as no butterfly has ever caught sight of its own colour. Our admiration for the *Planmässigkeit* that operates here is further increased when we find out that the night-moth's ingenious organ of hearing is constructed in such a way as to react only to the sound made by the bat. Except to this these butterflies are completely deaf.'[1]

If man, by his experiments, brings a disturbance into the normal functioning of nature (e.g., in the above example, by replacing the bat by a glass stopper), the result is a purposeless, even a nonsensical action. Also where man does not interfere, nature shows failures. They are to be explained in a similar way, that is, will be understood if we realize that the animal's actions and motions follow a *plan* but do not pursue an aim. They will, in case of a disturbance not provided for, continue to be performed in accordance with the *plan*, which, since the aim is not realized, cannot, by deliberation, be modified so as to suit the new situation which the disturbance has brought about.

Within definite limits, it is true, disturbances can be dealt with, namely where there exists in the animal a special *plan* fit to meet a new situation. So we have found that there is, in fact, a *plan* for repair in each animal, as well as in the embryo a plan for growing into a finished animal. But when the disturbance is one for which no *plan* had provided, the animal is helpless, whereas the mechanic would think out new devices to meet the new situation.

Like Aristotle, Uexküll emphasizes the far-reaching similarity between a planning human workman and his work on the one hand and the *plan* of nature on the other. In both regions there is causation of the kind *for the sake of something*, to put it in Aristotle's words, or, to put it in Uexküll's, there is in both a *plan* at work. Yet, so both authors feel, there is one distinguishing feature. Uexküll expresses it by speaking of *Zielhandlung*, or *zweckmässige Handlung* on the part of human planning, while speaking of nothing else than a *plan* in the case of nature. Aristotle expresses the same difference by stressing that nature lacks *νοῦς*, while asserting that the structure *for the sake of something* as such does not depend on the existence of *νοῦς*.[2] He therefore can, for illustration's sake, make the assumption that the wood might contain its *agent*, the shipbuilding power, within itself, thus equalling nature,[3] or that a house might grow up by nature,[4] and also, on the other hand, that natural beings might owe their genesis to craft. Now it is on this point that the modern biologist has attained more far-reaching insight. Uexküll likewise raises the question: 'What qualities would be found in a simple article of everyday use, for instance in a chair, if, instead of a foreign and passive *Bauplan*, which makes the chair depend completely on the carpenter, it possessed a *Bauplan* of its own, an active one, in other words, if it were not a

[1] *Streifzüge durch die Umwelten*, etc., p. 49.
[2] *Phys. B* 8. 199^{b}26–8.
[3] Ib. 28–30.
[4] Ib. 199^{a}12.

heteronomous but an autonomous thing?'[1] In answering this problem he is driven to postulating all that similarity between nature and craft on which Aristotle had already insisted. Nevertheless, in the end, he comes to grasp the point of difference, discernible more clearly to modern biological research. The illustration runs thus.

If you cut away one leg from the chair, the carpenter will easily replace it. If the chair were a self-moving natural object ['wenn er einen eigenen aktiven Bauplan besässe'], the result would be the same. Nature itself, or the active plan, would replace the missing leg. If you cut the whole chair lengthwise into two halves, again the result will be the same, whether nature or the carpenter repairs the damage: each of the two halves will be supplemented so as to grow into a whole chair. A very special illustration is needed to show the difference between nature and craft. You only split the seat of the chair. What will happen? The carpenter will join the two halves of the seat by planks to contrive a useful seat. The active plan in nature, however, brings about a very different result. Each half of the seat will regenerate in accordance with the plan. The result will be a monstrous chair, with one back, two seats, and eight legs. The cause of this difference is easy to see. The carpenter sees the whole of the situation, whereas the active *Bauplan* is blind.

An experiment of this kind had in fact been made on the *Plattwurm* or planaria. As long as the experimenter divided it, in whatever way and direction, complete regeneration took place. This seemed to prove *nature's wise guidance.* But when an animal of the same kind was split only up to the middle, it grew into a monster with two heads and one tail. Vulpian, towards the middle of the nineteenth century, inferred from this that there exists no such thing as nature's wise guidance, that the *Lebenskraft,* in which people believed to find the wise architect, was, on the contrary, acting most foolishly. He therefore rejected all vitalistic theories. For Uexküll, however, this experiment, properly interpreted, shows the specific structure of nature with its definite *plans.* Nature is unmechanical, yet, in a way, blind, but with a blindness different from that of mechanical causation. In nature there are *plans* but no aiming. There is no conscious insight into the whole of the situation. Vulpian had not yet been able to grasp the depth of this problem. 'Für ihn gab es entweder einen weisen Tischler oder den physikalischen Zufall.'[2]

This last sentence exposes the old belief in the duality of the world as spiritual and material. For the *wise carpenter* represents a teleological, or rather psychological, interpretation of the phenomenon in question, whereas *physical Chance* here stands for the mechanical explanation according to the law of matter. Mechanical laws, as it were, do not mind what they bring about: they leave the result to Chance. While the favourable results of the first experiments seemed to prove nature to work teleologically (and this appeared at that time to imply an aiming), the last experiment with its unfavourable result made Vulpian believe that nature worked mechanically and blindly after all, following the *vis a tergo,* leaving the result to Chance. Uexküll thinks he is solving the problem by acknowledging a third and intermediary ontological region. The causation found in nature is *sui generis.* A *plan* is at work, as Uexküll puts it, or, in Aristotle's words, a causing for the sake of the τέλος, but without νοῦς. The understanding of this third region causes difficulties to the modern mind. Most interpreters hold that *teleology* implies a conscious agent. From a theological standpoint, therefore, it will often be readily accepted as a demonstration of the wise divine guidance. On the other hand, the strict biologist, who rightly feels that he

[1] *Theor. Biol.,* p. 214. *Aktiver Bauplan* is a term meant to characterize nature. Machines depend on a foreign and passive plan, whereas animals possess a plan of their own, and one that is active. A chair, e.g., possesses a foreign and passive plan which makes the chair entirely depend on the carpenter. The chair, therefore, is a *Heteronom,* whereas the living being is an *Autonom.* The difference is explained, *Theor. Biol.,* p. 200, and *passim.*

[2] Ib., p. 215.

ought not to go beyond the phenomena, shrinks from teleology for the same reason for which the religious mind feels attracted to it. The cautious historian of philosophy, however, has to admit that Aristotle, while expounding the *for the sake of the* τέλος, does not—or hardly ever does—speak of God as the agent of planning. Sir David Ross is doubtless right in stating that Aristotle neither means that nature itself is conscious, nor does he, with any definiteness, make God the conscious planner of the teleological structure of the world. But when Sir David says that for this very reason the doctrine of teleology is unsatisfactory, since a purpose or end without one who has it in view is an absurd concept,[1] we cannot share in this criticism. Would not Aristotle admonish us to save the phenomena? Can we declare a concept as absurd, while something in reality corresponds to it? The fact that the conception of a plan without a noticeable planner has hitherto been given no place in our thought can hardly be proof that it is valueless. In the realm of being, if not yet in the realm of thought, the phenomenon of a plan without an observable planner does appear to exist. Should we not, then, have to produce a concept which faithfully represents this reality? I venture to think that Aristotle would uphold this position just as strongly as Uexküll does, and that in *Phys. B* as well as, again and again, in his other works,[2] he in fact expresses this conviction.

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[1] W. D. Ross, *Aristotle*, p. 186: 'The notion of unconscious teleology is, it is true, unsatisfactory. If we are to view action not merely as producing a result but as being aimed at producing it, we must view the agent either as imagining the result and aiming at reaching it, or as the tool of some other intelligence which through it is realizing its conscious purposes. Unconscious teleology implies a purpose which is not the purpose of any mind, and hence not a purpose at all. But Aristotle's language suggests that he (like many modern thinkers) did not feel this difficulty, and that, for the most part, he was content to work with the notion of an unconscious purpose in nature itself.'

[2] With special emphasis in *De Partibus Animalium, A.* 1.