Teleological Concept of Nature

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Abstract

Aristotle employed the teleological approach to explain the world. The adjective *teleological* is derived from the Greek word *telos* which means 'aim'. The teleological approach was used until the middle ages. It was largely abandoned in scientific discourse in favour of causal analysis.

However, as Immanuel Kant (1724 – 1804) argued in his *Critique of Pure Reason,* normal scientific discourse must be enhanced if one wishes to understand life, for living things cannot be explained purely mechanically but must be interpreted *teleologically*, i.e. one must ask, *what is it for?* In everyday life we ask, What is the nectar in apple blossoms for? The proximate answer is because the "nectar attracts bees which pollinate the flower. The nectar fulfils a certain purpose for the living thing. In this vein, we want to bring the question what is it for? back into scientific discourse: What is the purpose of nature? What is the purpose of life?" (Faber/Manstetten 2010: 85). Mainstream Economics views nature only as an environment that is used as a supplier of resources and a receiver of waste and pollution from economic activity, be it extraction, production or consumption.

In contrast, Ecological Economics has developed a teleological concept of nature which allows us to formulate a concept of nature so encompassing as to enable us to develop a conceptual basis for Ecological Economics.

This concept reintroduces the teleological approach to generate new perspectives and fruitful questions to help secure the foundation of natural life. Since this concept is purely theoretical one, it does not give a practical example.

Related concepts: BASICS OF LIFE; BASICS OF TIME; THERMODYNAMICS; EVOLUTION; INDIVIDUAL, COMMUNITY & ENTIRETY

1. History

Although the natural sciences are built upon nature, the term 'nature' does not appear in natural scientific terminology. Of course, certain concepts of what nature is implicitly underpin the procedures of natural sciences. Looking at the roots of the concepts of nature, we turn first to pre-modern cultures. In many of them 'it was normal to view nature as a whole, one whose forms and forces could be ascribed divine qualities. As just one example of such thinking, reference can be made to Plato; in his dialogue *Timaios* he presents the entire cosmos as a living creature, animated by the 'world soul', the most beautiful and highest form of life. One of the last philosophical-historic movements that breathed new life into the holistic concept was Romanticism which peaked in Germany between 1790 and 1810' (Faber/Manstetten 2010: 82; see also: 82-84 and Becker and Manstetten 2004). The Romantic "approach excludes the possibility of explaining nature solely within the categories of science" (Faber/Manstetten 2010: 83). [For English perspectives on humankind, nature and economy in the writings of Robert Malthus (1766 – 1834) and the romantic poet William Wordsworth (1770 – 1850), see the concept HISTORY OF THOUGHT and Becker et al. 2005].

"Thinking about nature and trying to understand nature as we experience it in our everyday life, it seems quite natural to ask the question 'What is it for?' in regard to life, animals and plants: Why does a blossom contain nectar? Why does a polar bear have such a thick fur coat?" (Faber/Manstetten 2010: 85).

"What is it for? is the key question of teleology, an approach that was founded by the Greek philosopher Aristotle (384 – 322 B.C.): "Aristotle and Aristotelian trends – in particular those of the Islamic philosophy of Ibn Sina (Avicenna, 980 – 1037) and Ibn Rushd (Averroes, 1126 – 1198), the Jewish philosophy of Moses ben Maimon (Maimonides, 1135 – 1204) and the Christian philosophy of Albertus Magnus (1200-1280), as well as that of Thomas of Aquinas (1225 – 1274) – have applied teleology in a theological and/or cosmological sense. As this type of teleology refers to religious beliefs and metaphysics, it has been a controversial concept in modern times. Modern natural sciences have rejected teleology entirely, in particular by classical physics (though not Newton) and evolutionary biology [EVOLUTION] since Charles Darwin (1809 – 1882) and Ernst Haekel (1884 – 1919) strive to stringently avoid teleological explanations. This means the question *'Wat is it for?'* in regard to non-human life is one that cannot be asked on the foundation of science as it is laid today.

However, our everyday experience, and the language with which we communicate it, continually compels us toward a teleological view of nature. Aristotle already commented

that phenomena like the nest building of a swallow, the web of a spider or the blossoms of plants can hardly be understood other than teleologically (Aristotle 1987: 91, Physics, book II, 8, 199 a 26 ff.) Furthermore, it almost imposes itself upon us to interpret the preservation and ever-increasing differentiation of life over several billion years teleologically. This is so, even though the process of life, including that of the living creature 'human' (the one which interprets this very process), may be viewed solely as the result of the blind chance of evolution since the Big Bang. This process seems, however, far more complex and intelligently thought-through than anything humankind in its purpose-orientated actions could come up with. If even simple things like automobiles, computers, spacecraft and power plants require a high level of purpose-aware intelligence in their producers, how much more purpose-orientated intelligence would be required on the part of the creating authority in order for humans – those creatures that invented and produced the above mentioned objects – to come into being? Above and beyond this, intelligence is manifested in the whole of nature: particularly impressive is the creative abundance of different forms of life on the one hand, and the inconceivably complex interactions of biological environments on the other. Here, the discoveries of modern biology can teach us wonderment" (Faber/Manstetten 2010: 86-87).

Another philosopher who developed different views of nature within his thoughts was Immanuel Kant (1720 – 1804). "Kant, contrary to almost all modern evolutionary biologists, assumes that teleological interpretations are unavoidable for the understanding of living things" (Faber/Manstetten 2010: 87). "With his Critique of Pure Reason Kant contributed to nature being generally viewed in the way it appears in modern natural science: as an aggregation of appearances that can be mechanically explained by means of regular interdependencies and laws. With such a view Kant is in accordance with the natural sciences of his time. In his later work, however, Critique of Judgement, Kant endeavors to demonstrate that such a concept of nature must be enhanced if one wishes to understand life, the act of living and living things. Living things, according to Kant, cannot be explained purely mechanically, but must be interpreted *teleologically*" (Faber/Manstetten 2010: 85).

It is interesting to note that the philosopher Robert Spaemann and the natural scientist Reinhard Loew brought the teleological viewpoint back into scientific discourse in their groundbreaking monography *Die Frage Wozu? Geschichte und Wiederentdeckung des teleologischen Denkens* (*The Question 'for what Purpose?' History and Rediscovery of Teleological Thinking*) (1991). We shall make use of this unknown line of reasoning in scientific discourse and show its fruitfulness in the next chapter.

2. Theory

In conversation and debate, one encounters perspectives that represent very different views of nature (see Faber/Manstetten 2010: 80). We have chosen to present three perspectives on nature and we want to start with the question: What does nature mean in biology? (Section 2.1) Then we turn to the question of what nature means in ecology (Section 2.2). Then, we examine the relationship between nature and teleology (Section 2.3). Having introduced teleology, we ask how it can be applied to ecological economic purposes. This will enable us to describe a teleological concept of nature (Section 2.4). We then turn to the tree tele more closely (Sections 2.5 to 2.7) Having explained the three *tele* separately, we turn to their interrelationships (Section 2.8). We relate the three tele with the notion of phenotype and genotype introduced in [EVOLUTION] (Section 2.9). In other concepts we have dealt with thermodynamics, self-organisation, evolution, stocks, stores and funds as well as with individual, community and entirety. [THERMODYNAMICS; IRREVERSIBILITY; EVOLUTION; BASICS OF LIFE; INDIVIDUAL, COMMUNITY & ENTIRETY]. We relate these concepts to our teleological concept of nature (Section 2.10).

2.1 What is nature for biology?

As mentioned above, the term "*nature* does not appear in natural scientific terminology. Nonetheless the procedures of natural sciences express certain (not always properly thought through) concepts of what nature is. Take biology, for example. Nature, in the sense biology uses the term, encompasses everything that can be represented in biological terminology. If we view certain complex molecules, proteins or cells as the (so to speak) elementary building blocks of the biological scientific structure, then biology understands 'nature' as everything that contains building blocks of this kind. Thus, biology moves from such building blocks to the investigation of the entire organism and on to species, genus and their development. Finally, it also deals with the interaction of organisms and species [EVOLUTION; BASICS OF LIFE].

The building blocks are not necessarily put into the context of larger units. Nature as a self-organised 'unity' [IRREVERSIBILITY, Section 2.5] does not exist in biology. Nature as a whole can hardly exist in such a science as anything other than the additive sum of all its parts. The same holds for individual entireties in nature: organisms and their design. The integral form of organisms, such as a tree, is more than the sum of their parts. Seen through the lens of experience, as opposed to scientific knowledge [IGNORANCE] the form can appear

in biology to be a complex structure of 'cell clusters'. Thus it is conceivable that the field of genetics could approach nature as a box of building blocks, and those building blocks could be combined to construct new life forms – that is to say, differently structured cell clusters [EVOLUTION]" (Faber/Manstetten 2010: 81).

2.2 What is nature for ecology?

Ecology has been "developed as a subdivision of biology (Haeckel 1866:286) and today is still generally classified as a part of this science. Ecology and biology are indeed never in actual contradiction, but they do differ in their approach to their objects. Biology obtains its objects as the elementary building blocks of life through selection and preparation and analyses them in the laboratory outside of their natural contexts. Ecology, however, (without rejecting or neglecting the discoveries of biology) explores the interaction of organisms as they are, without interferences, within the framework of their natural surroundings. Its interest is the interplay of organisms and populations in a living, autonomously existing entirety, in a natural biocoenosis – i.e. a biotic community, e.g. a forest, a marshland, a lake and its surroundings, a coastal strip or a mountain valley etc. Therefore, it does not regard, as biology often does, an individual organism as an aggregation of elements, but as a part of a greater context with this question in mind: What does it contribute to the interplay of all organisms or species in a biocoenosis? [EVOLUTION]" (Faber/Manstetten 2010: 81).

Ecology includes experience in addition to scientific knowledge

Our everyday knowledge is grounded above all in experience and routine. We will call this kind of knowledge 'experience knowledge' (for details see Faber/Manstetten 2010: Chapter 6). "Ecology, despite its scientific biological background, includes an approach rooted in experience knowledge. Ecologists, insofar as they work in situ, observe and experience entireties existing in our world of life, whereas biologists mostly examine a world of which they can know nothing outside of their theories, models and laboratories. The cell level – on which biology first and foremost examines nature – is inaccessible to us for the simple reason that apparatuses (e.g. a microscope) are required to even observe them. Ecologists are, in a manner of speaking, in the midst of the object of their research, whereas biologists have their object before them (after the process of selection and preparation).

Nature consists of biocoenoses

For ecologists, nature consists of *biocoenoses* (of entireties) which combine to form one comprehensive entirety: life on Earth. Therefore, the life of individual organisms cannot be understood solely from the aspect of their genetic composition and environmental selection but must also be considered from the viewpoint of their role within such entireties [BASICS OF LIFE]. What this entails can be demonstrated by an example: The hand is a part of the whole human. If only the isolated movements of the hand are observed, certain physical statements about individual moments of the hand movement (changes in position and velocity) can be made. These can only be understood as part of a hand movement when viewed from the standpoint of the whole (the human being making the movement) and brought into the context of certain purposes. Likewise, it could be said that the development of an organism or a certain species can be observed in specific moments in isolation, but these can only properly be understood when regarded as part of the evolution of the biocoenosis [EVOLUTION] to which they belong. The evolution of humanity also plays a role in such structures.

The metaphor of the hand cannot simply be transposed to nature

The metaphor of the hand as part of the human being cannot, however, be so simply transposed to nature. When contemplating the movements of the hand, one necessarily puts it in the context of the entirety of the 'human being' (it is extremely difficult not to). Such a context is not absolutely necessary to explain the development of an individual species. This can be seen in the success of the Neo-Darwinist theory of evolution [EVOLUTION] which does without the assumption of such entireties and has a great reputation with ecologists.

Hence, we can proceed in two ways: The first way does not employ the concept of an entirety within its approach, while the second one uses a teleological approach which employs the concept of entirety. In the next section we shall outline an approach which conceives of nature as an entirety" (Faber/Manstetten 2010: 81f).

2.3 Describing nature teleologically

What is teleology?

The term teleology is foreign to almost all natural scientific analysis. "The Greek word *telos* means *purpose*, *goal*, *determination* or *end*. Teleology is the science of the order and relationship of purposes or determinations. Whoever interprets processes *teleologically,* asks the question: *What is it for?* This is the key question of teleology. The question *what is it for?* or *to what end?* within the sphere of life enquires after the purpose or goal of all life, as well as all its subdivisions in nature [BASICS OF LIFE].

Within the aegis of the experience knowledge (that means everyday knowledge) it seems quite natural to ask the question *What is it for?* in regard to life, animals and plants: What does a fruit blossom have nectar for? Why does a polar bear have such a thick fur coat? If a child were to ask such questions, we would probably reply: The fruit blossoms have nectar to attract bees and bumblebees so they can pollinate them. The polar bear has a thick, warm coat so it can survive in polarregions etc. Both the nectar in the fruit blossoms and the fur coat of the polar bear fulfil a certain purpose for the living thing in its specific environment" (Faber/Manstetten 2010: 85).

Questions of 'What is it for?'

"Such answers have been retired from the scientific view of modern biology. Or more precisely, such answers are not exactly inadmissible, but their biological formulation must make clear that phenomena in nature may not be reduced to inquiring *to what end?* Insofar as teleological answers infer that natural phenomena are based on a reasonable plan, one which would purposefully order the individual parts of a living thing in respect to its whole, then, from the biological point of view, such an inference is to be rejected. Under these circumstances, why would a teleological view of nature still make sense today?

A teleological view is generally to be found in regard to planned human actions that intimate the questions: What goal was set? What purpose or rationale was to be fulfilled? Such a view is based on the premise that the human being sees itself as a rationally thinking and acting creature that follows purposes in its actions, can offer an account for them, and can communicate those purposes and accounting with these others [HOMO OECONOMICUS & HOMO POLITICUS; IRREVERSIBILITY, Sections 2.6 and 2.7]. This occurs within the medium of speech. The terminology of purposes is characteristic for speech, for human actions cannot be translated into speech without speaking of purposes" (Faber/Manstetten 2010: 85f).

Describing nature teleologically

How can nature be described teleologically? "Describing nature teleologically, thus entails viewing it as if rational planning and reasonable actions were to occur within it, or even as if it were rationally planned as a whole. Such an interpretation, however, appears to be a solely external perspective on nature. Since non-human nature as a whole (or any a single part of it) cannot speak in our human way, or even manifest the capability of rational thought, nature cannot communicate any of its purposes. These can only be addressed externally.

And so, the question must be posed: Can one reasonably ascribe purposes to nature, even if it cannot communicate them itself and, as far as we know, is itself not aware of them? If one were to answer affirmatively, then the next question follows: Who or what are to be the goal-setting authorities of or in nature? Is nature itself to be understood as such an authority?" (Faber/Manstetten 2010: 86).

2.4 The triple teleology of living things: individuals, species and the entirety

Introduction

Having introduced teleology, we ask how it can be applied to ecological economic purposes. First, we explain the three tele before we turn to their interrelationships in the Sections 2.5 to 2.7. Then we go on to show how the triple teleology relates to two central concepts of evolution, phenotype and genotype [EVOLUTION] (section 2.8). This will allow us to relate several of our concepts and fields with each other; these are nature, thermodynamics [THERMODYNAMICS], self-organisation [IRREVERSIBILITY], triple teleology, the foundations life [BASICS OF LIFE] and evolution [EVOLUTION].

A comprehensive view: living things, species and biocoenosis in their reciprocal relationships to one another.

"In the following we assume that individual living things as well as species and entire natural biocoenoses can be viewed as self-organising units [IRREVERSIBILITY, Section 2.5]. A species is a group of living things that can reproduce with one another. A group of same-species living things which can reproduce amongst themselves is called 'a population' in biology. In the following when we speak of 'species' in the context of natural biocoenoses (see Section 2.2 above), we always mean the species within the particular biocoenosis

under consideration – the population. 'Species' and population are only the same thing when examining the biocoenosis of the entire Earth.

These three types of self-organising units (individual living things, species, the entire Earth) do not exist side by side – the larger encompasses the smaller. The living thing belongs to the species, and the species is included in the biocoenosis. Thus, living things, species and biocoenosis must also be considered in their reciprocal relationships to one another.

The starting point of such a comprehensive view can be the individual thing, the species or the biocoenosis. In the following we shall only consider the two extremes: the perspective of the individual living thing and that of the biocoenosis. We shall begin with the individual living thing.

Living things, relationships and the three tele

A living thing can be described in three respects:

1. In its individuality, i.e. its uniqueness as a living being.

2.In its relationship to its reproduction group, its species, and

2. In its place in the entirety of life – or in a large section of the entirety – a natural *biocoenosis,* for instance [EVOLUTION; BASICS OF LIFE].

The individual living thing must therefore be viewed within three relationships. From a teleological viewpoint, we can speak of three 'purposes' a living thing fulfils in its existence, independent of the question of whether an authority exists that might have given them such purposes. In order to differentiate from the usual use of the term 'purpose' in the following, we will refer to these purposes as '*tele'* (the plural of '*telos'*).

1. Self-preservation and self-development. This is the telos by which the living thing relates to itself and organises itself. By means of this telos, the living thing constitutes itself as an individual, self-enclosed organism.

2. Self-reproduction and self-renewal. This is the *telos* by which the living thing relates to its population or species and contributes to its own self-organisation [EVOLUTION and IRREVERSIBILITY, Section 2.5]. The species constitutes itself by means of this telos, under the conditions of the first.

3. Service. This is the telos by which each living thing relates to living things of other species. By means of this telos, the living thing contributes to the development of other species and ultimately to the self-organisation of the natural biocoenosis to which it belongs [EVOLUTION; IRREVERSIBILITY, Section 3.5]. A biocoenosis is constituted by means of this

telos, under the conditions of the first two. We will now proceed to examine all three tele more closely" (Faber/Manstetten 2010: 88f).

2.5 The first telos – individual living things and self-development

The first telos concern individual living things. "In organising itself as a living organism, the individual living thing simultaneously separates itself from its environment and opens itself to it in a controlled way. The separation lends it individuality [INDIVIDUAL, COMMUNITY & ENTIRETY]; it begins at birth, lasts the entire lifetime, ending only in the moment of death with the decomposition of the body – the medium of its individuality. The outermost temporal limits for the separation of the living thing (namely birth and death) do not lie within the dominion of the living thing. Birth comes before all forms of active self-development and death ends them, usually against the efforts of the living thing.

Separation from the environment and a controlled opening to it make life possible in the first place. What is life? From the viewpoint of biology, the life of an organism requires certain genetic information. As a process of living, a realisation of this information, it is characterised by metabolic exchange with its environment and by reproduction, the transmission of genetic information to new organisms. Metabolic exchange is the most conspicuous way in which an organism interacts with its non-same-species environment. Reproduction is – in the case of sexual reproduction – the result of association between members of the same species of different sex. (A more detailed definition of the 'classic characteristic of life' can be found in Strasburger 1991: 2f.)

Within the process of metabolism, substances such as oxygen, water, carbon, minerals and energy are absorbed by living things [BASICS OF LIFE], and subsequent break-down products and entropy [THERMODYNAMICS; IRREVERSIBILITY] are emitted into the environment. For many living things, especially for animals, it is often necessary that other living things be absorbed in their metabolic exchange. This is true for both carnivores and herbivores. It can be observed in the entire animal world: Living things feed off and consume other living things. At the same time, an individual living thing will, if possible, flee from other living things if it fears being consumed. Living things also compete for limited resources such as food and habitat. These are the reasons why in the past biology interpreted the interactions of different living things as a 'struggle for life' in which only the 'fittest' survive (Haeckel 1866: 231f). In this, the scientific view of biology has struck upon something that is also of great phenomenological significance: Preserving its separation

from its environment, if necessary by fighting for it, is the most obvious goal of living things. Thus, one speaks of the survival instinct of all living things.

In the scientific view of biology, true self-preservation is not the preservation of the phenotype. Instead, self-preservation means that the consistency of the genetic information over time is, if possible, preserved in the generational chain: The life of the phenotype, its metabolism and its reproduction are only a means to the end of preserving this consistency [EVOLUTION] so that the phenotype can be viewed as nothing more than a 'survival machine'. What meets the eye, the development of the transitory form in its individual uniqueness, is of no significance for this biological view (see, in particular, Dawkins 1994). Thus, biology as biology is indifferent toward the fate the form encounters: From the point of view of metabolism and reproduction, there is no principle difference between the life of a hen in a laying battery and the life of its cousins in the wild.

This approach of biology is the reversal of our daily experience: In everyday experience the 'goal' of the mechanisms inside an organism is its visible and physical life as the organism experiences it. Whatever genetic structures exist within a living thing, or whatever vegetative, neuronal etc. processes take place, they appear as means to this end. For biology, on the other hand, the goal is the conservation and enhancement of genetic variability – the actual life of the individuals in question is merely a means to this end" (Faber/Manstetten 2010: 89f).

Self-preservation and self-development

"But how does life appear phenomenologically? [BASICS OF LIFE]. What we see, the phenomenon, is the living thing in its unique, isolated individual form. The living thing can, however, only manifest and preserve its individuality if it continually, though often all but imperceptibly, changes. In the course of this it develops its inherent possibilities, realising them step by step. Thus, self-preservation is only possible as long as it is simultaneously self-development: a process with structures that are inherent to the living thing itself.

The life of a butterfly, for instance, develops out of a fertilised egg cell and continues to develop into the forms of the caterpillar, the chrysalis, and finally the butterfly itself. Each of these three steps is self-development; nonetheless, it is only completed when all three steps have been accomplished. In this, the phenomenological, experience knowledge-based view of the living thing differs from the biological view: Phenomenologically, the development of the butterfly is not merely a means of its genes to preserve themselves, if possible, and to multiply by copying themselves, but an end in itself. The butterfly develops in order to be a butterfly, or as the Silesian poet and mystic Angelus Silesius (1624 – 1677) put it:

‘The rose is without why /

it blooms because it blooms /

it pays no attention to itself /

nor asks whether one sees it.’

(Angelus Silesius, 1985, Book 1, no. 289. Quoted according to Heidegger 1996: 41)

Although the developing self (like the rose) has no end other than itself, one can still describe its self-development as a form of ‘goal’. All the coordinated processes within the rose ‘have the goal’ of the rose becoming and remaining a rose – throughout its different stages of blossom and fruit-bearing. At the same time, the goal of the rose itself is its own existence – it can only exist as a rose by actively referring to its own existence and promoting it at every stage of life. Self-development, however, is a special goal. As a goal, it has the characteristic that it must have always been fulfilled, and yet it always remains something to strive for. Such striving does not occur consciously, of course, but seeking nourishment and (in the case of animal life forms) fleeing from enemies is still an expression of this. Thus, self-development is a goal that is achieved in each and every moment, but still includes aspects that have yet to be attained. In this sense, self-development embraces aspects of the present and aspects of openness or expectation in regard to the future [BASICS OF TIME].

Orientation toward the future

Let us begin with the latter. Structural aspects of life that are orientated toward the not-yet-attained require a certain disposition from every living thing. We call these aspects needs or urges. Both expressions refer to the fact that a living thing cannot find on a long-term basis complete satisfaction solely in the present but exists in some form of orientation. In this context the word *need* displays orientation in the sense that it accentuates a specific deficit together with the effort to remedy this deficit. Such orientation can also be addressed with the word *urge*. In contrast to the term *need*, *urge* emphasizes an inner disquiet leading to external movements and actions. A need is viewed as an urge when it becomes a cause for external movement.

It is, however, questionable whether living things actually ‘have’ needs and urges, for such ‘having’ would imply a certain distance to what is to be had. When a human being says ‘, I hunger’, the sensation and the human being ‘having’ it are two separate things. The human being is more than its state of being hungry, it has further needs and interests, and can consider whether or not to submit to them [INDIVIDUAL, COMMUNITY & ENTIRETY]. Does a hungry lion on the hunt ‘have’ the sensation of hunger in this sense? Is it not rather the

hunger that 'has' the lion? Would it not be even more correct to say that the hunting lion 'is' entirely hunger – that its whole existence while on the hunt is the lion's particular expression of hunger? In such cases, the path to the fulfilment of a need cannot be differentiated from the actual fulfilling. Both path and end are equally self-development.

Being open to the future includes two further aspects for many living things: the ever-present threat to its own safety – be that from members of other species or its own species – and the struggle to find food. Due to such aspects (as they reveal themselves by human beings in the phenomenon of anxiety), self-development can occur under increased concentration and intensity. Thus, wild pigs are considerably more intelligent than their close cousins domestic pigs under the conditions of intensive livestock farming.

On the notion 'the struggle for survival'

What biologists call *'the struggle for survival'* is part of being open to the future. Yet hardly any living thing develops its life principally through the struggle for survival. No less important is the pure present, the quiet 'being themselves' of animals and plants. In the case of some plants (trees, for instance), the aspect of 'resting within themselves' is phenomenologically predominant – despite the many silent movements within, despite the tenacious struggle of the roots beneath the ground to find hold and food, and despite the self-assertion of the trunk and branches in the face of a storm. In the case of many animals, the times of rest also far outweigh the time spent in search of food. Aspects of the pure present can also reveal themselves in forms of movement. The playing of a kitten with a ball, the romping of horses in a pasture, the song of the birds in a forest – all these things may be seen by biologists as part of a strategy for the preservation and improvement of fitness within the context of intra-species and inter-species competition, but viewed phenomenologically, they are a manifestation of a purpose-free joy of the living thing in being alive.

One special form of knowledge also belongs to this first *telos*. In their natural habitat, plants and animals 'know' what is beneficial for them and protect themselves as far as possible from what is not. Thus, animals consume food that is good for them and avoid what is unhealthy. Such knowledge is not complete, however – animals quickly lose their certainty when taken to areas significantly different from their natural habitats or when they find themselves confronted with foodstuffs not native to their natural surroundings" (Faber/Manstetten 2010: 90-92).

2.6 Second telos – the species and self-reproduction and self-renewal of the living thing.

The second telos concerns entire species [INDIVIDUAL, COMMUNITY & ENTIRETY]. "It differs from the first in that it does not exist within the life span of a single living thing, but within the span of the preservation and development of an entire species [EVOLUTION]. From the viewpoint of an individual living thing, this telos stands for the passing on of its life to one or more other living things. Thus, by fulfilling the second telos, a living thing realises (retrospectively, as it were) the fact that it itself was produced as an entirety. Its own birth lay not in its power, for its existence required its parents to fulfil the second telos. The realisation of the second telos is, however, the precondition for the birth of one or more offspring.

The productivity of nature probably manifests itself most clearly in the birth of an individual living thing. A new living thing is never a repetition of its parents, but a product in the sense of a unique existence. Reproduction is thus not only reproduction in the sense that the identity of a species is preserved; it is also a new production in the sense that a new existence emerges in which the entire species can slowly (in the case of mutation, erratically) change [IRREVERSIBILITY].

A species produces itself by means of the second telos , thus it is the second *telos* which forms the background of a species' evolution. Evolution not only means that a species reproduces itself and changes over long periods of time; the evolution of a species can also lead to new species emerging that did not previously exist [EVOLUTION; IGNORANCE].

Self-reproduction: partners and sexual community

Viewed from the perspective of the individual living thing, it would seem apposite to regard its reproduction-oriented activities as part of its self-development. The result is the preservation and renewal of the species, but its actual enterprise is, as it seems, the development of itself. Indeed, the first telos, preservation and development of the self, and the second telos, reproduction and renewal of the self in another self, are closely linked. In its blossoming, its pollination and the formation of fruit, the tree develops itself (first telos). This self-development is, however, also the foundation of the second telos, the passing on of life to a new generation. This linking of self-development and the passing on of life presents itself in a different way by animals which reproduce sexually. The impulse to unite with a partner of the opposite sex is, in certain moments, one of the strongest urges of a

living creature's self-development. So, the second telos, self-reproduction and self-renewal, seems derivable from certain aspects of the first telos.

The activities of a living thing that are of significance for the fulfilment of the second *telos* can, however, be clearly differentiated from other activities belonging to self-preservation and self-development. This is because, within the framework of the second *telos*, a living thing is obviously oriented in some way toward living things of the same species. On the most elemental level of life, this orientation can simply be disposition. Thus single-cell organisms have the capability to divide and thus produce a living thing of the same type, but this seems more like something that happens to them than an effort of their own. When a species of living things exists in the form of separate sexes, however, the disposition to produce offspring is joined by an effort oriented toward one or more other-sex living things of the same species. In the case of animals, and particularly higher animals, the different-sex partners must seek and find one another, and they occasionally perform certain rituals before they unite. In the second *telos*, two living creatures generally serve the desires of the other directly. Such service appears as a kind of side effect of natural urges. With some animals, however, there is also a direct orientation toward offspring, often more strongly in the female than the male. This begins with the female seeking a suitable place for its eggs (for example, in the case of ichneumon flies) and can in many cases culminate in the rearing of the young.

Understanding the life of many living things

The result for our understanding of the life of many living things, particularly higher developed animals, is this: Under the aspect of the first telos, the life of a living thing appears solely in its relationship to itself; under the aspect of the second telos, this life must be regarded in context with at least one partner (the sexual partner), and often in context with the offspring. An asymmetry can exist in this between the male and female, however. The offspring of birds and mammals already consume resources within the body of the mother [BASICS OF LIFE], whereas the father is generally not involved. The mother serves more directly and to a greater degree than does the father.

If the offspring are independent living creatures, they are often taken care of by the parents, or at least one parent (generally the mother), and thus make use of the energies of the parents. In some cases, the offspring are protected from enemies, even if the parents must lay down their own lives. In this case serving involves the commitment of one's own life.

In these cases, the second telos encompasses the community in its most elementary form, namely the sexual community [INDIVIDUAL, COMMUNITY & ENTIRETY]. In many cases it also involves an expanded form of community, namely the family. Occasionally we observe

larger communities of animals: packs, herds, swarms and insect colonies. In general, one can say: the behavioural patterns of most animals, seen from their own viewpoint, are, within the framework of the second *telos*, oriented toward at least one other creature, often more. These other creatures, the sexual partners or offspring, are generally treated differently than those creatures that are consumed within the first telos.

Second telos: self-development and service

In the second telos, self-development is thus joined by an aspect of service. If, from the viewpoint of the first telos, one can regard the second telos as an especially intensive form of self-development, from the perspective of the species it becomes clear that the living thing not only exists for itself, it also exists for others [INDIVIDUAL, COMMUNITY & ENTIRETY]. Existing for others within the framework of the second telos encompasses at the very least sexual union, but often also includes the offspring. The living thing often devotes a not insignificant part of its time and resources toward existing for others. In this regard the second telos demonstrates that life can also be service.

We consider the development of living things in their diversity and multiplicity within the second telos. If this process of development is examined over long periods of time, one recognises evolution as a creative process, the inventiveness of which seems all but infinite [EVOLUTION; IGNORANCE]. Consequently, the second telos deals not only with self-reproduction, but also with self-renewal. This process has something almost playful about it as one cannot ex ante ascribe any specific direction to it; thus, it displays analogies to the development of art, which is equally ex ante unpredictable: It would hardly be conceivable to predict the works of artists like Da Vinci, Shakespeare or Mozart without actually producing them oneself" (Faber/Manstetten 2010: 92-94).

2.7 Third telos – the service of living things: service

While the first and second tele are well known in biology, the third telos will be unfamiliar to readers since we have introduced it in order to deal with the relationships between different species in an entire bioceonosis [INDIVIDUAL, COMMUNITY & ENTIRETY]. "Observing the development of an individual living thing or species together with the development of the environment (which of course contains a multitude of other species), reveals a third telos of living things. Every living thing 'serves' with its life, and usually with its death, the development of other species in its habitat, and thus the development of the entire biocoenosis [BASICS OF LIFE]. Such service we call ´self-denial', It is only under this aspect

that a truly ecological view becomes possible. Here, a truly holistic viewpoint emerges for the first time [INDIVIDUAL, COMMUNITY & ENTIRETY], whereas previously particular viewpoints were predominant. Both perspectives of the first two goals, those of the individual and the species, are particular, as is the definition of environment as long as it is only related to the fulfilment of the first and second goals. Environment is only truly *environment* if it is an environment for something or someone. If our desire is to consider the environment as a whole, it is no longer environment. Consequently, we require another expression for it such as *habitat*, *biotope*, *biocoenosis* or *ecosystem* (*geocoenosis*).

From the perspective of the third telos, the habitat of a species will no longer be viewed as the environment of the species. Instead, the species and the organisms belonging to it are viewed as an essential part of the development of the habitat. From this viewpoint it could be said that the third telos of every living thing is to 'serve' the development of its habitat. At the same time, it also serves the other species that live within the habitat.

The third *telos* is about all the services living things provide for other living things [BASICS OF LIFE]. These services must generally be viewed differently than those provided within the framework of the second telos: In the second telos, the living thing serves voluntarily (in a manner of speaking). That is to say, its urges, its impulses, its instincts or its genetic structure, or whatever one wishes to call that which regulates its behaviour, motivates it to serve its same-species cousins. In regard to services for living things belonging to different species, this seems to be only one of several possibilities, and it is only the case when such services are 'recompensed'. Thus, certain plants provide nectar for insects which 'recompense' this service by transporting pollen and enable the realisation of the second *telos* for the plants. When service between organisms belonging to separate species implies vital mutual dependency, biology speaks of symbiosis [EVOLUTION]. Clover accommodates in its roots so-called rhizobia bacteria which, in turn, provide the plant with carbohydrates (sugar) and nitrogen in the necessary form. In the case of symbiosis, the first and third telos of the living things involved are closely linked. In a similar manner we also find inter-species interrelationships in commensalisms. In this, services are provided for living things belonging to another species whereby the recipient profits, but the provider does not. The latter does not, however, suffer loss in the relationship. Thus, jackals and vultures profit from the remains of lions' prey that the lions no longer make use of.

The third telos as a determination

In many cases, however, the services living things provide for other living things entail some form of harm or injury for the provider. When plants serve as food for herbivores, their integrity is violated. Some plants defend themselves against such injury. For example,

thistles, roses and blackberries grow thorns, and stinging nettles produce toxins. By such harm or damage one can assume that the fulfilment of the third telos by those that serve occurs reluctantly. Such reluctance toward service for other species manifests itself particularly in animals that can become prey for other animals: The mouse attempts to flee the cat; the hedgehog curls up as a signal to its enemies not to attempt to prey upon it; the snail withdraws into its shell; bees threaten with their sting. These forms of behaviour express something that was also peripherally evident within the framework of the first two *tele*: Living things often serve involuntarily – in other words, (driven by their instincts, their genetic structure etc.) all their efforts are directed against such service. This is most particularly the case when they serve the self-preservation or self-development of other living things with their own lives. The flight or defence-mechanisms of living things force us to conclude that they experience service within the framework of the third telos, insofar as it harms or destroys their lives, as suffering. Here we understand suffering as a state a living thing strives to avoid at all costs.

From the viewpoint of the individual and even the species, one cannot define the service of the third *telos* as an inner orientation in the same manner as the first two tele. The third telos cannot therefore be called a goal, but it can be called a determination, one to which the life of living things is subject. Here it must be noted that a species of an individual can only develop or reproduce within the development of the biocoenosis to which it belongs. In this regard, serving the development of the entire habitat is not something external or unnatural to the individual, for it indirectly serves its own preservation and that of its own species. The preservation and development of the whole is simultaneously the development of the space in which each individual can develop in its own way. If the species were capable of stopping their service toward the whole and toward other species, they would vanish along with their habitat. This, of course, does not mean to imply that the rabbit eaten by the fox voluntarily serves the fox or the preservation of their mutual habitat. Equally, one need not imply that the fox eats the rabbit in order to maintain the balance between the species. It suffices that the rabbit and the fox actually perform these services. Thus, one need not ask who wishes to provide such services, but only whom they actually serve: For the third telos, the natural biocoenosis is the 'self' whose development requires these services" (Faber/Manstetten 2010: 94-96).

2.8 Relationships between the three *tele*

In the concept EVOLUTION we have explained and discussed at length the biological concepts phenotype and genotype. Here we want to examine the relationship between these two concepts and the three tele.

"The three tele refer to the individual organism, the species, and the ecological entirety, respectively. Obviously, organisms are elements of species, species are elements of an ecological whole; i.e. these three concepts are nested.

We now wish to indicate the ways in which the three tele are related to each other. For example, the concept of self-preservation, which we used to characterize living beings in the first telos, can also be applied for the second and third tele, using differing points of view.

We note that there is a parallel between the elements and the second tele. In the first telos, we have the element of self-preservation which allows the individual some continuity over time. In the second telos, we have the element of self-reproduction which allows the species continuity over time.

In the first telos, we also have the element self-development (i.e. ontogeny), and in the second *telos* there is the notion of self-renewal of the species (i.e. phylogeny). Both ontogeny and phylogeny are examples of development of the form of a corresponding element, organism or species, although ontogeny is predetermined (i.e. it is a phenotypic evolution [EVOLUTION] while phylogeny is not predetermined, but involves the emergence of novelty (i.e. it is genotypic evolution) [EVOLUTION; IGNORANCE].

We also see that the first telos is a necessary condition for the operation of the second telos, and the first and second tele are necessary for the operation of the third telos. This is the case because without the first telos there would be no continuity of organisms, so the concept of the species would be meaningless. Similarly, without the second telos there would be no continuity of species, so the concept of the ecological entirety would not apply.

We might therefore be tempted to see the first telos as the most basic, followed by the second telos, with the third telos as the highest of the three, 'resting' on the first two. However, the third telos is a fundamental requirement for ecosystems to exist, so it, in turn, is a 'foundation' for 1 and 2. In other words, we have a recursive rather than a hierarchical relationship between the tele. Each is necessary for the others.

This circularity of our three tele reminds one of the circularity within Hegel's philosophy of rights (1821) where he derives the concept of the state from the individual but then points out that the individual can develop only in a supporting State" (Faber et al 2002: 176-177).

2.9 The three tele, phenotype and genotype

"Above we have mentioned the relationship between our teleological concept of nature and our concept of evolution several times [EVOLUTION]. Here we will turn to the question as to what relationship exists between the three tele, genotype and phenotype. "The three tele defined above derive from our attempt to formulate the minimal set of principals concerning organisms which give outcomes consonant with the phenomena we observe in nature. That is, our three tele are phenomenologically based.

We believe that, in principle, the whole range of possible organisms of species' interrelationships and transformations, and those of the ecological entirety and activities, can be derived, at least in outline, from these three tele. We might even say that the three tele summarize the potentialities of organic activity and thus of life at the three levels of the individual, species and ecological whole [INDIVIDUAL, COMMUNITY & ENTIRETY]. We could therefore speak of the three tele as constituting the genotype of the organic world.' (Faber et al 2002: 177) We remind the reader that in the concept EVOLUTION we defined the phenotype and the genotype of an organism in the following way: 'An organism has a certain appearance, capabilities, characteristics, etc. the appearance that it presents to the world is known as its phenotype. The phenotype displayed by an organism results from the interplay of two factors. The first factor is the potential inherited from its parents, i.e. its genetic make-up, or genotype. The second factor is the environment; for example, organisms that are otherwise identical (e.g. identical twins) will grow up to different sizes and exhibit differing capabilities if they are subject to widely differing nutritional regimes" (Faber et al. 2002: 142).

The three *tele* as constituting the genotype of the organic world

The corresponding phenotype of the three tele as constituting the genotype of the organic world, mentioned above, is the entire phenotype panoply (i.e. "a group or collection that is impressive because it is so big or because it includes so many different kinds of people or things"; source: Merriam-Webster's Learner's Dictionary) of organic behavior, development, reproduction, interaction and evolution. Unlike the normal relationship between genotype and phenotype, as for an organism, the genotype corresponding to the three tele determines the phenotype only in broad principles, rather than in fine details. [EVOLUTION]" (Faber et al. 2002: 177). Hence our concept of triple teleology is consistent with our conceptual approach to our view of evolution.

2.10 Nature, thermodynamics, self-organisation, the foundations life, evolution, and triple teleology

In other concepts we have dealt with thermodynamics, two arrows of time, self-organisation, stocks, stores and funds as well as phenotype and genotype, individual, community and entirety [THERMODYNAMICS; JOINT PRODUCTION; IRREVERSIBILITY; EVOLUTION; BASICS OF LIFE; INDIVIDUAL, COMMUNITY & ENTIRETY]. In the following we relate these concepts to our teleological concept of nature. We believe the following sequence of statements to be the essence of biological evolution [EVOLUTION].

1. The two laws of thermodynamics and the corresponding two Arrows of Time [THERMODYNAMICS; IRREVERSIBILITY] are fundamental for all movements, exchange, transformations and self-organisation in nature because for all these occurrences energy is necessary.

2. The interaction with matter and (low entropy) energy yields non-living self-organised structures [IRREVERSIBILITY], e.g. a rain cloud which is generated by the interaction of dissipating heat and atmospheric water power.

3. These self-organised structures "are available as constituent elements of higher order self-organising systems. The emergences of higher level structures generate further heterogeneity and reflect the emergence of further novelty [IGNORANCE].

4. The emergence of these self-organising structures and their cooperation in higher order self-organising structures implies that the evolution of self-organising structures tends to an increase in the interconnectedness of relationships between them over time (cf. Allen and Starr 1982, Ullanowicz 1992).

5. The outward appearance of a self-organising structure we term its *phenotype*, while the factors which cause this appearance we term the *genotype* [EVOLUTION and Faber/Proops 1998: 170-171]. Once self-organising structures become sufficiently complex, they may maintain their structural stability over time by incorporating their genotypes within their phenotype. Any self-organising structure with this incorporated genotype, and the ability to replicate itself, we call an organism; we note that this is a definition of life. An organism is unlike, say, a cloud, where the genotype is the parameters of the air and underlying earth's surface. We note that the distinction between a self-organising structure with a genotype external to its phenotype (e.g. a cloud) and one with an internal genotype (i.e. an organism) corresponds to the distinction between the complex but non-living and the living. We remind the reader that the genotype corresponds to the potentiality of a self-organising

structure, as the phenotype corresponds to the realisation of this potentiality [EVOLUTION]" (Faber et al. 2002: 170-171).

6. The material foundations of life are stocks and stores. The evolutionary process yields organisms, species and what we have called funds [BASICS OF LIFE]. The triple teleology provides a framework for all these phenomena. As we stated in the previous Section 2.9: The three *tele* summarise the potentialities of organic activity and thus of life at the three levels of individual, species and ecological whole [INDIVIDUAL, COMMUNITY & ENTIRETY]. We could therefore speak of the three *tele* as constituting the genotype of the organic world.

3. Sustainability and the Triple Teleology

The theoretical teleological framework will enable us to come to the conclusion of this concept, namely to sketch how the concept of sustainability [SUSTAINABILITY & JUSTICE] can be formulated in a novel and enlightening way, which allows a more encompassing view.

Sustainability

"The question of sustainability is usually only asked regarding one species (or fund), namely humans (Norgaard and Howarth 1991). The continued existence of other species (funds) is seen as a sustainability issue only in so far as it influences the welfare of humankind (cf. the literature on the optimal extinction of species, e.g. Clark 1976). From our approach we may derive a more encompassing view on sustainability. We noted above that our three *tele* are recursive within an ecological whole. As long as this recursion is maintained, the integrity of the ecological whole remains, and we may term the system 'sustainable' in a broad sense. As a consequence, sustainability means that a certain balance or harmony (Faber/Manstetten 2010: 120-121) is maintained between the three tele for each species within the ecological entirety. If any of these tele becomes too important, for any species, then sustainability is threatened.

For example, if the first tele (self-preservation) of a species is allowed to grow out of proportion, that species will come to overuse the services of other species, risking their, and eventually, its own continuation. If the second telos (self-reproduction) becomes dominant, then over-population of that species becomes a threat to the ecological whole. Finally, if the third telos (services) becomes disproportionate, the rendering of too great a service to other species will threaten the continuation of that species, and the integrity of the ecological entirety.

This broad concept of sustainability, using the recursive nature of our three tele, we have applied to the history of economic development, from the pastoral/agricultural phase through modern industrialisation. There we shall offered examples of how the three tele lose balance and harmony in our discussion of economic development" (Faber et al. 2002: 182).

What does a teleological concept of nature offer which Mainstream Economics does not?

How does Mainstream Economics consider nature? To answer this question, it is useful to note what the economist Bertram Schefold recently had to say on this subject: "As the editor of a series of a hundred classics in Economics, whose end is foreseeable, I do not edit any book in which reference to nature takes center stage. Nevertheless I endeavor to compile a canon which contains the most important works in the history of our science" (Schefold 2001: 7; our translation). This shows how little Mainstream Economics is concerned about nature in its history of over the last 250 years. Thus, Mainstream Economics views nature only as an environment which is solely used as a supplier of resources and a receiver of the waste and pollutants from economic activity, be it extraction, production or consumption.

In contrast, Ecological Economics has developed a teleological concept of nature which is comprehensive in several respects. Some of them include (for details see the journal Ecological Economics):

1. The focus encompasses the entirety of all living organisms and all natural materials.

2. A biological and ecological perspective is developed by differentiating between individuals, communities of species and different entireties, such as the globe and even the cosmos.

3. The interactions between all organisms, including human beings, are explicitly recognized since our approach allows us to deal with humans and other living organisms at the same level of abstraction.

4. Temporal development is explicitly recognized and thus taken into account. Temporal relations are developed in the concepts THERMODYNAMICS, IRREVERSIBILITY, BASICS OF LIFE and BASICS OF TIME. In particular, the triple teleology is foundational for SUSTAINABILITY & JUSTICE.

Finally, we note that the triple teleology is a decisive element for the endeavor of Ecological Economics to construct a language and a set of concepts to analyse economic environmental interactions (see e.g. Georgescu-Roegen 1971; Costanza 1991; Faber et

al. 2002) and to develop adequate tools for environmental policy (see e.g. Baumgärtner et al. 2006) which Mainstream Economics does not supply.

4. Literature

The content of MINE originates from scientific work published in books and peer-reviewed journals. Quotes are indicated by a special typographic style.

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The main sources of this concept are the following publications:

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