

Ethics in a Decaying Universe¹

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Abstract

All objects of the universe came into being in the time since the Big Bang. And all objects will decay after some time. The universe is not in a steady state, but evolves dynamically. So, why worry about conservation of Earth, which will not last forever? All life on it will decay eventually. What does “Reverence for Life” (Schweizer, 1943) mean in a system that can ultimately not be conserved? We need an ethics for sustainable development. However, science ultimately cannot define sustainability. I argue that ethics can only be based on non-rational perceptions of reality, such as empathy and hope. In addition to communicating objective results and likely predictions, scientists must develop their ‘gut feelings’ about their research and are responsible to voice them in public.

All has developed and all will decay

My decision to study astrophysics was motivated by personal interest, but also by ethics. I did not want the results of my research being misused for commercial or even military purposes. Some years into my PhD work at Cornell University I learnt however that my grant was paid by the US Navy who needed a sky map in the infrared. They were interested to detect enemy rockets by their infrared emission. The celestial infrared sources in the background, such as galaxies, star-forming regions, planets etc. caused confusion with approaching missiles. So the infrared sky had to be known accurately. And back were my ethical considerations. Is what I am doing good or bad? There is no escape from ethics. What we do excludes what we don’t do. Moreover, science has an additional ethical aspect since the results can never be extinguished once they are made, but their use in the future is open and unpredictable.

Let me start with the big picture. Stars get their energy from the fusion of hydrogen into helium. In the course of the stellar lifetime, the hydrogen in the interior gets exhausted, the burning zone moves outward, the star expands and its luminosity increases. In the late phase, a star swells so much that it swallows the inner planets. They evaporate all their atoms, including all those of all things on their surface. They intermingle with the atoms of the Sun. In a slightly later phase, the outer layers of the star, including formerly terrestrial atoms, are ejected as a planetary nebula into interstellar space. There is a star with the name 16 Cyg A in the constellation Cygnus at a

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distance of 70 light-years. It has the same mass as the Sun, but is four billion years older and 40% brighter (Güdel, 2003). Long before that stage, the Earth's atmosphere will get hot enough that more surface water will evaporate and drastically enhance the greenhouse effect. This in turn will drive evaporation even more. A run-away rise of the air temperature will extinguish all life on our planet. Present model calculations are not reliable enough to predict the remaining time very accurately. The typical time scale is a billion years. The human contribution to the greenhouse effect by enhancing the carbon dioxide abundance can only shorten this time.

Similarly, galaxies will decay, black holes will evaporate, and species living on Earth will become extinct. Given enough time, everything will eventually dissolve. What was born will perish. Decay is inevitable.

Is there any need for ethics and if yes, what kind of ethics in a developing universe where everything will vanish anyway? If the universe is perceived as a temporary gift (as interpreted in the Judeo-Christian tradition), how must we handle this gift?

The universe continues to develop

The development continues and the universe changes. Some ten new stars are forming in our galaxy per year. They are different from previous ones as they contain some of the remnants of the past. To decay does not mean that objects disappear into nothingness. The ashes of decayed stars are the stuff out of which planets and finally living beings form. The universe can only develop because material things are not eternal. More important, the future development is open and may include the formation of new objects that had never existed before. Unpredictable new directions of growth have emerged in the universe in the past: matter formed in the first microsecond, which later led to the formation of galaxies, which led to stars, planets, living beings, consciousness etc.

The important point is that the universe doesn't just change, but forms completely new entities. Such creativity also shows up in chemistry and biology, as well as in human society. In fact, it is the evolution of human societies that was the most prominent new development in the past ten thousand years. Human cultures are growing together, driven by the global technological civilization and its passion for progress. An interesting present-day development is the reaction to the threat of the environment: the major disturbances of our natural habitat have spawned a vigorous conservation movement – a remarkable worldwide development indeed.

A planet forms from existing substance but cannot be regarded as a straightforward derivation from the old. It contains old material, but is subject to a new order. There seems to be an inherent principle, the "Creative Principle," that continuously initiates new developments in the universe. Science approaches this principle on various levels and different fields. In the context of statistical mechanics for instance, it has been described by Prigogine (1980) as bringing "order out of chaos."

The new cannot be predicted. It forms spontaneously and chaotically because the universe is not like a mechanical clockwork and does not evolve in a linear fashion. How should science foretell something that has never existed before? For this reason, the future development of the universe

remains open to a considerable degree. The “open” aspect does not only concern decay – which will occur eventually – but the formation of new structures from the old and the decaying. There is some element of surprise in this emergence of the new. It does not contradict the second law of thermodynamics, however. Entropy increases, but there is practically no limit of entropy in an expanding universe. Can we be certain that new things will form in the future?

No! There is a remarkable asymmetry between the decay of all things in the universe, a development that may in some cases be predicted accurately, and the formation of new things, which cannot be anticipated. We can only hope for the new. Of course this expectation may be an illusion, or a false hope that ignores the relevant facts. So how do we acquire the right hope? Hope is an emotion that results from various kinds of perceptions. It is not the result of scientific research.

Ethical implications

How should we live in a world that is changing? The status quo is no option. Concerning the changes on Earth, mankind has considerable influence on the direction where we are going. Thus we must assume ethical responsibility. The question is then how to assess a development. Which development is good and which is bad?

We need to reconcile our ethical outlook with the new world view of universal development. There must be a “Reverence for Development” in view of the cosmic developments that brought us here. It extends the well-known ethical maxim “Reference for Life” to the dynamics of evolution, including inanimate matter. However, we suspect that many current developments are not desirable. A necessary requirement for ethical behavior is that the development must be sustainable. This means that the development of Earth which has proceeded now for more than four billion years must not come to a halt. We cannot avoid taking part in the development, but our actions must not be guided by the short-term interests of the human species.

What does sustainability mean? The word “sustainable” has been used in the past in the sense of a closed system that must be conserved at any price. The universe is not a machine but a developing system. As long as the development is linear, it can be predicted. That will not go on forever. After a certain time – in statistical mechanics it is the Lyapunov time – the development will take an unpredictable direction. We are not moving in a train, but in an off-road vehicle capable of driving cross-country in several directions. But the journey could also end at some point. The development that produced such a magnificent plethora of life-forms may end in a barren desert where life comes to an untimely end. I must be aware of the developments, and as a single human being I must do my best to support the positive directions.

The Brundtland (1987) Commission of UNO defined sustainable developments as “developments that meet the needs of the present without compromising the ability of future generations to meet their own needs”. Here I would add that when in doubt the future needs to have priority.

New developments do not emerge inevitably. They require a certain complexity of the initial conditions. In popular terms, new structures do not result from a well-ordered (linear) system, but from chaos. Of course, chaos is not a sufficient condition, but rigidity is prohibitive. The best ordered system is a dead system where nothing changes. It is well predictable, but inert. Therefore, ethics in a decaying universe must aim at avoiding situations where no further development is possible.

This view is based on hope expecting a future development that matches the past. The past development from the beginning to the human race was extremely violent, but was experienced from time immemorial as in principle “very good” (Genesis 1, 31). In seemingly desperate situations, hope yields the strength to act ethically now. Hope is an “‘expectation’, [...] which sets about criticizing and transforming the present because it is open towards the universal future [...]” (Moltmann, 1993). Whatever the present evil, hope carries the presumption that everything will bear some positive meaning at the end.

Thus ethics in a decaying universe must include a vision in the form of hope for new developments born out of the old.

Responsibility of Scientists

It is the obvious responsibility of us scientists to warn about technological developments that lead to a dead end without future development. There are many issues. Some have been made public, but there are certainly many more developments that lead to disastrous and rapid changes that are not reversible for generations or never, and that reduce drastically the possibilities of future development.

It seems straightforward to develop a scientific program for sustainable development. The Brundtland Commission made a beginning. However, scientific predictions are always controversial since all theories are falsifiable and some may turn out to need replacement. This fact is sometimes taken as an excuse. However, some of today’s controversies seem to be just disagreements about details. In practice scientists often agree (except of course for people with conflicting interests). Take for instance the climate of planet Venus. Its atmosphere of mostly carbon dioxide produces a greenhouse effect that increases the temperature to its present value of 730 K. Solar irradiation without greenhouse effect would yield a temperature of only 230 K. In view of the 500 degree (900 F) enhancement in the atmosphere of Venus, no serious scientist can deny the danger of enhancing the carbon dioxide concentration in the Earth’s atmosphere, which has increased by 40% since the beginning of industrialization. On the other hand, new developments like a boosted growth of plants or algae may absorb the greenhouse gas. There is no question that the change in the composition of the Earth’s atmosphere is a dangerous development. But there is uncertainty and maybe there is hope. What should scientists do?

Here comes the problem. Ethical postulates cannot be derived directly from the framework of science. Nature is a dog-eat-dog world, in which the brutal necessity to eat or to be eaten seems to prevail. It cannot be the paradigm for human behavior. The survival of mankind is certainly of supreme value, but we cannot infer from the Is to the Ought without being trapping into the

naturalistic fallacy, in which only some positive aspects are selected to define ‘good’. The property of ‘good’ cannot be drawn from natural facts. Philosophically, the distinction between good and bad is ineffable (Moore, 1903). Ethics can only grow from a consideration of all perceptions of reality. Thus ethics requires more than science: It requires an empathic attitude thus emotion. Ethics does not flourish in a materialistic worldview where only “chance and necessity” (Monod, 1971) play a role.

This may explain why many of my colleagues including myself concentrate on their work and have little to say about ethics. They dislike the political controversies and sometimes hysteria of ethical and moral issues. We are experts in science, not in politics. Why wasting our time on issues where other people may be more effective? This is a legitimate argument, but we have to consider here also our own conflict of interests: It is so much more comfortable in the ivory tower than in the public world.

This is where participating perceptions come in. Scientific observations comprise only a fraction of reality. Science is defined here as quantitative studies of the material universe. It begins with selecting phenomena that are objective. This means that every observer using the same method measures the same properties of a phenomenon. Ethics is a philosophical endeavor to assess human actions. It cannot be measured objectively. The methodology of science thus excludes ethics from the very start. Originating from outside science, however, ethics can be and must be a necessary partner of the objective scientific process. How is this possible?

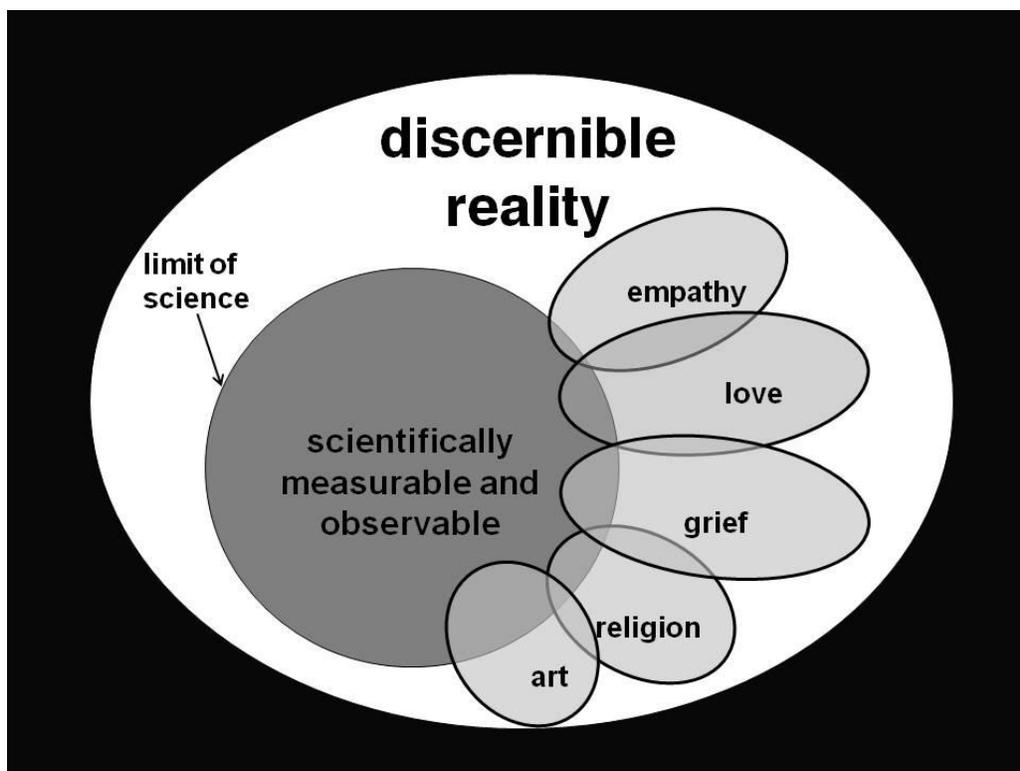


Figure 1: Schematic representation of perceptions. *White*: discernible reality; *dark gray*: perceptions selected by natural sciences; *light gray*: some parts of perceptions accessible only by participation (from Benz, 2016).

I start from the observation that some of the most important aspects of human life are perceived in non-scientific ways. Yet they are real. There is more than physics. There are other perceptions than those that qualify for the scientific selection (Figure 1). These other perceptions are not supernatural. They differ from scientific observations by their subjective character. Empathy is at the basis of every ethics. Empathy is a relation that a person has to another person or situation afflicted by hardship. Thus there is an objective situation, which is perceptible to everybody. The empathic person participates mentally in the hardship by compassion, and each individual does it differently. It is a subjective emotion that is not compulsory. If uncritical, the emotion can become subjectivistic or an ideology. Even keeping a critical distance, the perception of the situation is not objective, but more than just subjective. The empathic person participates in the perception. Participatory perceptions are not limited to an individual. The objective part of the situation and critical reasoning make the perception intelligible and comprehensible to many, although the basis is empathy, a subjective emotion.

There is no question that an emotion as empathy includes activities of the brain that can be observed objectively. Thus the oval of “empathy” in Figure 1 overlaps partially with the realm of scientific objectivity. As the basic perception is subjective, however, a complete explanation by objective science is not imaginable. The “more than physics” is no ontological statement, but epistemological. The actual perception is experienced as a reality and can be approached only partially by indirect objective means.

As indicated in Figure 1, there are other participating perceptions, such as love and grief. They cannot be assessed fully by objective measurements similar to empathy. Art and religion are also based on participatory perceptions. I take them seriously, but not uncritically. Only other perceptions can suggest whether they are real or illusions. Real is what has a lasting effect on a person. As the perceptions are not objective, certainty cannot be gained.

Such perceptions are an issue in modern investigations in the context of “embodied cognition science” It is the way already primitive animals learn about their environment as described by Thomas (2018) in another paper in this collection. Embodied cognition is not an objective perception, but is the result of interplay between sensory stimuli of the body and emotions of an individual. Not only the brain is active, but also nerves in other places, which form a network including for instance the solar plexus. As feelings are the result also of the personal past life and his or her awareness of the environment, the cognition includes the whole situation of the individual. It is an integral perception and cannot be reduced to the scientific observations. Embodied cognitions eventually become more processed primary emotions and finally sophisticated feelings and values, such as ethics. Empathy is the result of perception mostly outside of science, or as de Saint-Exupéry (1943) put it: “It is only with the heart that one can see rightly; what is essential is invisible to the eye.” The heart stands here for the whole person who must participate for such perception. We may paraphrase ethics as a result of the interaction of the heart with the brain.

Scientists must leave their safety zone of rationality, which pretends to protect them from error. This zone is intrinsically distanced, materialistic and limited. Scientists should raise their voice even if the forecast is not certain. Of course, we have to declare our opinion not as scientific evidence, but as our best estimate or 'gut feeling'. Scientists must take seriously their participating perceptions and embodied cognitions. Of course they must be critical about subjective views which may be prejudiced or ideological. Feelings may be inappropriate or naive. Therefore, they must cultivate their sensors for empathy, love, grief, spirituality etc. Scientists must develop their non-scientific opinions about their research and develop their guts. Most of all, they have to have the courage to stand up. Why should the subjective opinions of the people that are knowledgeable about the rational side of reality not be considered? Scientists are responsible not only for the correctness of their results, but are responsible to voice their ethical feelings about them publically.

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