Ethics and Complexity:

Why standard ethical frameworks cannot cope with socio-technological change

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Abstract: Standard ethical frameworks struggle to deal with transhumanism, ecological issues and the rising technodiversity because they are focused on guiding and evaluating human behavior. Ethics needs its Copernican revolution to be able to deal with all moral agents, including not only humans, but also artificial intelligent agents, robots or organizations of all sizes. We argue that embracing the complexity worldview is the first step towards this revolution, and that standard ethical frameworks are still entrenched in the Newtonian worldview. We first spell out the foundational assumptions of the Newtonian worldview, where all change is reduced to material particles following predetermined trajectories governed by the laws of nature. However, modern physical theories such as relativity, quantum mechanics, chaos theory and thermodynamics have drawn a much more confusing and uncertain picture, and inspired indecisive, subjectivist, relativist, nihilist or postmodern worldviews. Based on cybernetics, systems theory and the new sciences of complexity, we introduce the complexity worldview that sees the world as interactions and their emergent organizations. We use this complexity worldview to show the limitations of standard ethical frameworks such as deontology, theology, consequentialism, virtue ethics, evolutionary ethics and pragmatism.

Keywords: Complexity, philosophy, ethics, cybernetics, transhumanism, universal ethics, systems ethics.

Introduction

In our accelerating society, everything is changing faster and faster, even change itself (e.g. Steffen et al. 2015; Russell 2017). Human nature is fundamentally affected by these changes. For example, biotechnologies are changing the functioning of our bodies, and by interfacing our bodies with technologies, we are challenging our very identity, giving rise to cybernetic organisms, or cyborgs that only existed in the realm of science fiction a few decades ago.

Cognitive technologies also affect human nature by extending the scope and power of the human mind, in much the same way as sensory and motor technologies extend the scope and power of the bodily perceptual abilities and movement (Dror and Harnad 2008, 3). Indeed, language, writing, printing, books and calculators already support our memory and thinking, and the amplification of our mental abilities only accelerates with the web, algorithms or artificial intelligent (AI) agents.

Obviously, any innovation can be used for positive or negative purposes. Therefore, we need an ethics to guide not just human behavior, but also the applications of technology and transhumanism. Nobody is able to stop technological progress, so it seems the best we can do is to carefully regulate these new developments. But according to which values, rules or criteria?

The challenge of ethics today is to find ways to understand, guide and steer the actions of a single global village of some 8 billion people and many billions of technological artifacts that we design, build, interact with, and increasingly depend upon.

Historically, ethical norms, rules and regulations appeared as sophisticated mechanisms to preserve human communities by inhibiting selfish behaviors. The evolutionary origins of morality show that even the most primitive bands of hunter-gatherers already have norms that suppress bullies, non-altruists and cheaters (e.g. Boehm 2012). Boehm further argues that the regulatory mechanisms of public opinion, conflict management and agreements on rules are present at all group sizes around the world: from foraging bands, to farming tribes, chiefdoms, kingdoms, early civilization and modern nations.

Evolutionarily, the formation of large groups of humans is very recent, so we arguably have little instinctive moral sense to deal with our globalized society. Indeed, we evolved to focus on social aspects such as unity, hierarchy, equality and proportionality within a small group (Rai and Fiske 2011). The values stemming from the evolutionary

roots of human morality are thus not sufficient to deal with the ethical challenges we are presently facing. Actually, each time the human group size increased significantly, new regulation and control mechanisms had to be designed. In our transforming and complexifying society, the relevant group becomes the entire planet. Therefore, we are facing the challenge of creating regulatory mechanisms at a planetary scale, hopefully toward a *global ethics*.

The issue is delicate because ethics is not just about humans anymore. The rise of AI, robots, and transhumanism leads to the emergence of new moral agents, such as augmented humans, cyborgs, AI-agents, robots, and different kinds of autonomous or semi-autonomous devices that are confronted with ethical decisions to make.

Ethics is essentially about evaluating to what extent behavior is considered good or bad, whether it is by focusing on the rules by which one operates (deontic ethics) or the consequences of one's actions (consequentialist ethics). However, there are intrinsic limits to these approaches, especially as they implicitly assume that the rules are absolute, or the consequences perfectly clear and predictable in a deterministic fashion. Such assumptions make sense in a *Newtonian worldview*, where all change is reduced to material particles following predetermined trajectories governed by the laws of nature. Associated with this is an ontology of *being*, of static objects, with permanent identities, whose only activity is to change their position within an absolute space and time.

This is to be contrasted with an ontology of *becoming*, where identities emerge, change and eventually disappear. This means that the distinctions and categories we use to understand our situation are not fixed, but fluid. This is indeed how we experience our day-to-day, ever more changeful reality. The Newtonian worldview thus lacks the flexibility for dealing with our complex world. Unfortunately, even though the postmodern worldview emphasizes fluid identities, unpredictability and uncertainty, in practice it offers merely a second-order critique of the limitations of classical reason rather than substantive ethical guidance.

Additionally, traditional ethical frameworks remain anthropocentric and therefore cannot deal with transhumanism, ecological issues and the rising technodiversity. Ethics needs its Copernican revolution to be able to deal with all moral agents, not only humans. A few authors have explored a more "universal ethics" based on evolution and development (Vidal 2014, chap. 10), thermodynamics

(Ostwald 1912; Hammond 2005; Korbitz 2010; Vidal 2014), theoretical computer science (Bennett 2014; Delahaye and Vidal 2019), or by thinking about extraterrestrial ethics (see e.g. Vakoch 2014).

We wish to situate this chapter within this "universal ethics" effort, but will here focus on the need to go beyond the Newtonian worldview by criticizing traditional ethical frameworks based on it. Our goal in future works is to use universal *principles of cybernetics and systems theory* to propose strategies for a systems ethics that is adapted to our volatile, uncertain, complex and ambiguous world.

In Section 1 we trace the roots of western thought in ethics as stemming from a Newtonian, mechanistic worldview in which fixed, clear rules can be used to reach unambiguous, fixed goals in a deterministic and predictable way. We then argue that such a Newtonian worldview is now largely outdated, being insufficient both scientifically and as a model for ethics. We put forth the fundamentals of the complexity worldview, where there are no absolute rules, no absolute categories, and only limited predictability.

In Section 2 we criticize from this complexity worldview perspective standard ethical frameworks: deontology, theology, consequentialism, virtue ethics, evolutionary ethics and pragmatism.

From a Newtonian to a Complexity worldview

Newtonian science as an ideal for ethics

Philosophy has often envied the rigorous method, clarity, dependability, usefulness and progress of mathematics and science (see e.g. Adler 1993). Spinoza's *Ethics* famously uses the axiomatic method of Euclid and applies it to philosophy. However, a great addition to the formal axiomatic method appeared with Newton's publication of the *Principia Mathematica.* The universal law of gravitation he put forth is a landmark in the birth of modern science, where one single clear and concise law allows predicting the motion of both terrestrial and celestial bodies.

Newtonian science is thus expressed in terms of *laws* that are absolute and timeless, and that govern the behavior of all things. The predicted trajectories of objects are certain, objective, time-independent, time-reversible and context-independent. These are desirable features for scientific theories because they allow prediction and control. A theory that works uncertainly, or only at a particular time and place and for a particular subject is not useful compared to a

theory that is certain, and works always and everywhere (Heylighen, Cilliers, and Gershenson 2007).

If we would extrapolate the laws of motion to the behavior of all things, then Newtonian mechanics implies the philosophical doctrine of *determinism*, where all notions of uncertainty, freedom, surprise, novelty, emergence, creativity and evolution have become empty.

In this extreme form, ethics becomes pointless because everything is determined in advance from initial conditions and universal laws. Looking towards the past, it means that nobody can be held responsible for his or her past actions, because the game was already set. Looking towards the future, there is no point in choosing the best course of actions because everything is already determined, and the only attitude we can hold is fatalism.

This incompatibility has disturbed generations of philosophers who were trying to reconcile the free will we experience as human beings with the determinism of nature implied by the Newtonian worldview.

Complexity science as an ideal for ethics

In our globalized society, the economic, social, technological and ecological systems that we are part of become ever more interdependent. This means that changes in one component can affect any others, often in an unpredictable way, leading to undesirable systemic effects, such as cascading failures (see e.g. Helbing 2013). These complex, uncertain and unpredictable dynamics create stress for individuals and their organizations, in part because their traditional methodologies based of reductionistic Newtonian thinking simply do not apply, as they try to isolate phenomena instead of examining their relationships.

The Newtonian worldview has been undermined by five major scientific breakthroughs.

First, the discovery of indecidability in formal systems in logic and mathematics (Gödel 1931) shows that *absolute certainty* in terms of being able to prove the truth of falsity of any proposition does not exist in most formal axiomatic systems. Since physics and most other sciences use mathematics as a language, these fundamental limitations contaminate the whole scientific edifice.

Second, Einstein's discovery of relativity theory has shown that the absolute space-time of Newtonian physics does not hold and that one can only *compare* relative positions, velocities or generally

measurements (see Nottale 2019 for a history of relativity theories). One core lesson of relativity theory is that we always need to take into account the observer making the measurements.

Third, the development of quantum mechanics has shown that Newtonian mechanics fails when it is applied to atoms and elementary particles. Two fundamental conclusions are the *intrinsic limit on predictability* implied by the Heisenberg uncertainty principle, and that the act of observing particles influences the results of experiments, undermining the scientific ideal of independent observation and objectivity.

Fourth, chaos theory has shown that many systems behave non-linearly, meaning that there is no proportionality between cause and effect. For example, microscopic fluctuations in initial conditions may be greatly amplified, a phenomenon known as the "butterfly effect", because it implies that the fluttering of a butterfly can produce a hurricane. The lesson here is also *unpredictability*, although a practical one, because chaos is expressed in terms of deterministic steps, yet the non-linearity can step-by-step transform unobservably small fluctuations in huge macroscopic effects.

Fifth, thermodynamics challenges Newtonian science by requiring a *statistical* description of the world, which makes predictability less absolute. Moreover, the second law of thermodynamics shows that disorder can only increase or stay the same in a closed system, but never decrease. This implies a fundamental *irreversibility*, which defines an *arrow of time* that is absent in classical and relativistic mechanics.

Relativity, quantum mechanics, chaos theory and thermodynamics define contemporary physics. However, they are each counterintuitive theories that are difficult to reconcile and integrate in an elegant, coherent picture such as the Newtonian worldview. Rather, it is tempting to lapse into an indecisive, subjectivist, relativist or nihilist worldview if one focuses on all the limitations that these theories have put to the fore.

However, these modern physical theories still have fundamental limitations in that they do not deal with goal-directed agents, which are of central importance for ethics. As such, physics will always remain an insufficient source of inspiration for ethics. One has to go beyond purely physical theories to find relevant scientific concepts and models to understand purposeful systems such as animals, humans, organizations, societies, or our ever more autonomous technological artefacts.

We will now argue that evolution, cybernetics, systems theory and complexity sciences provide a promising integrative scientific framework to replace the Newtonian worldview.

In classical physics, there is fundamentally nothing new that can emerge, no creativity. This is because the basic structure of classical causality *conserves distinctions* (Heylighen 1989): equal causes have equal effects, and distinct causes have distinct effects. By contrast, the evolutionary process is essentially creative and as such *creates distinctions*: the same initial form can give rise to an ever-larger diversity of variations. Evolution is what produces goal-directed organisms, and its study is thus fundamental to descriptive ethics, and to a certain extent, to prescriptive ethics too.

The overall effect of the myriad interactions, mutations, recombinations, non-linear dynamics, etc., even if each could be formalized as an explicit rule, would not be predictable. It would seem extremely hard if not impossible to predict the present bio- and techno- diversity starting from the first lifeforms that appeared 4 billion years ago. This is why scientists today make use of computer simulations to run and re-run models step by step and try to find general patterns (in biology, see e.g. Bedau 2009; in cosmology see Vidal 2013; in computer science, see e.g. Wolfram 2002).

Complexity science can be seen as the continuation of cybernetics and systems theory (for some history, see Von Bertalanffy 1972; Heylighen and Joslyn 2001; Pickering 2010). The complexity worldview sees the *world as interactions and their emergent organizations*, instead of seeing the world as separate particles and forces. This leads to efforts to model systems, their organizations, interrelations, coupling, etc. and is a major shift from the materialist, mechanistic, analytical, reductionist approach of Newtonian science (Laszlo 1972b; 1972a). Thus, complexity thinking emphasizes processes over static objects, relations over isolated elements, context-dependence over universality, flow over equilibrium, and wholes over parts.

This systems perspective allows us to formulate the problem of ethics in a very general way. The fundamental issue follows from the *principle of suboptimization* (Machol 1965): what is optimal for a subsystem is in general not optimal for the system as a whole. For example, for a cell or tissue it is best to be able to grow without restraint, but for the system as a whole such unbridled growth behaves like a tumor that may endanger the whole organism. This principle is a corollary of the more general principle of *emergence*, which notes that

a coherent whole has emergent properties that cannot be found in the parts. Indeed, if there were no emergence, what would be best for the parts would also be best for the whole.

A classical illustration of the principle of suboptimization is the prisoner's dilemma (Axelrod 1984), where the best option for one individual is the worst for the other, while the optimal, cooperative solution for both individuals is not achieved because the temptation to selfishly defect is too high. A similar ethical conundrum is the "free-rider" problem: for an individual it is best to profit from a collective arrangement such as the public transport system by not paying. However, if everyone would behave like that, the collective system would collapse, and everyone would suffer. Thus, the task of ethics could be defined as the formulation of rules, guidelines, and control mechanisms that reconcile the values of the whole and its different parts, so that all components work together synergetically, rather than being in conflict or opposition.

Limitations of traditional ethical frameworks

We will now argue that traditional ethical frameworks are based implicitly on the Newtonian worldview, and thus suffer from serious limitations. First, one can note that ethical theories emphasize *objectivity*, but when one views ethical issues from an objective standpoint, one fails to address the real difficulties of ethical situations that will always occur from the *subjective* point of view of an individual agent confronted with a difficult situation. As such, ethical theories are of little help in guiding actions in the midst of a real ethical dilemma. Ethics has been criticised for taking the easy option of looking down from a detached, "objective" and judgmental position rather than getting engaged in the midst of the action and decision making (see e.g. Hampshire 1949; Varela 1999; Whitbeck 2011; Sweeting 2018).

Deontology

Deontology is an ethical framework that assumes that there are unambiguous and time-independent rules, comparable to universal laws in physics. In a very stable world, with few interactions or changes, such rules might work reasonably well. This is clearly not the case of today's world with its complex and intertwined ethical issues. The *context-dependence* of ethical issues makes it unclear by which rule (or maxim) one should act. Additionally, rules may change or may become irrelevant and no longer applicable as the world changes.

It is also unclear whether any maxim could be universalized, because each situation is unique. Let us criticize Kant's famous "categorical imperative" from this perspective. It states that you should always act in such a manner that you would wish this manner of acting to become a universal rule, applied by everybody everywhere. The imperative is a powerful way to reflect on the consequences of actions, because imagining the universalization is fundamentally a two-step process: first a change of perspective to imagine what would happen if everybody was following the same rule, and second, going back to choose an action from one's own perspective. For example, if one would follow the maxim "do not hesitate to lie", the social fabric of trust would quickly fall apart. We followed the same reasoning above with the issue of free-riding and the example of the public transport: we imagined what would happen if everybody was cheating, and concluded that it would make the whole system collapse.

Unfortunately, it is totally beyond human cognitive abilities to imagine what would or would not hold for all humans, in any situation, at any given time. In the particular case of technology ethics, it is even harder to predict or imagine what effects the application of some new technology would have. In practice, there will always be exceptional situations where the generalization would not hold, situations that one cannot even imagine.

Theology

Fixed rules can be useful in a given stable context in space and time. Religions are structures that provide rule-based guidance, such as the Ten Commandments or the Jewish/Islamic injunction to not eat pork. Although the rule against eating pork may have been useful to avoid diseases carried by pigs in the historical context in which the rule was formulated, with today's high standards of hygiene, eating pork is perfectly safe. Therefore, it is for purely traditional reasons, and not anymore for health reasons that this rule is still observed. Similarly, at least half of the Ten Commandments (such as the commandment that forbids making idols) are no longer considered as moral or legal obligations in a modern, secular society.

This observation illustrates that we should be extremely wary to extrapolate moral rules, following the Newtonian example, to *any* situation, *any* context, for *all* people, and *all* space and time.

Of course, religions are much more than a set of rules. Religions are cultural systems that morally orient and socially bind human groups

through historically extensive networks of ritual practices, beliefs, values, institutions, and narratives (Hogue 2010). In practice, religions do not follow their millennia-old rules algorithmically, but apply them flexibly while providing adaptive mechanisms such as conversation during confessions, community support, dialogues with religious authorities or wise people. This adaptivity is necessary to guide action in tricky situations and this largely explains the continuing success and relevance of religions even in an age of science (Sosis 2019).

Consequentialism

Consequentialist ethics proposes that we should choose actions based on their practical consequences rather than on *a priori* rules. As such, it may seem more appropriate to the messiness of the real world. However, consequentialism implicitly assumes that one can unambiguously deduce the consequences of actions, just as one can predict the future positions of planets using Newtonian mechanics. Of course, things are not as easy as that! Perfect predictability in science is only possible in narrowly defined, specific cases. In the psychological or sociological realms where ethical behavior is situated, one can only predict statistically at best.

Consequentialism also fails at taking into account creativity, emergent features, or context-dependence. It states that we should choose the action that maximizes some overall criterion of goodness or benefit, such as “the greatest happiness for the greatest number”. This assumes that we can formulate some clear, unambiguous, and unchanging measure of benefit—which in mathematical models of decision-making is called a “utility function” (see also Vodonick 2016). One might somewhat generalize this requirement by considering multiple criteria at multiple levels, but even this would fail to take into account the fact that goals or criteria can become irrelevant during a course of action. Also multiple criteria optimization leads to different equally good solutions, so one could not easily decide between different ways to satisfy many criteria.

Additionally, there is a fundamental impossibility in the consequentialist dream of mapping and evaluating all possible trees of possible actions, because this would be impossible to compute, as it would quickly exhaust all the computational resources of the universe (it would exhaust the bremerman limit, see Ashby 1968).

Interestingly both deontology and consequentialism emphasize different aspects of the same Newtonian worldview: deontology

emphasizes laws, while consequentialism emphasizes predictable consequences from such laws. But their underlying worldview remains the same Newtonian one.

Virtue Ethics

Virtue ethics states that we should maximally try to develop good qualities (virtues) in ourselves, such as wisdom, empathy, and moderation, while minimizing negative qualities (vices), such as jealousy, stinginess, or prejudice. As Sweeting (2018, 14) noticed, virtue ethics is one of the ethical frameworks most compatible with cybernetics and the complexity worldview. As a matter of fact, Chambers (2001) has argued that Aristotle's Doctrine of the Mean, where each virtue is considered a virtuous mean along a spectrum between two opposite poles (e.g. courage is in between cowardice and foolhardiness), can be seen as a learning process driven by trials and errors and negative feedback until the right virtue is acquired.

The limitation of virtue ethics is that it is focused on making virtuous *people*, not virtuous organizations, technologies, or systems. In a subsequent paper, we plan to explore more universal, cybernetic virtues that could apply to any moral agent.

Also, even if virtue ethics helps to make better people, it does not help us to make a good decision in a real ethical dilemma involving a choice between incompatible virtues.

Evolutionary Ethics

Evolutionary ethics is the position that our moral rules and values have their roots in human evolution, which has given us instincts to recognize "fit" behaviors that promote the survival of the group in the long term, and "unfit" behaviors that are detrimental to this. Evolutionary ethics has a bad reputation among social scientists mostly because it tends to be associated with the outdated ideology of social Darwinism. However, as argued by David Sloan Wilson (2019, chap. 1), this rests on a misunderstanding:

> If grave social injustices were committed in Darwin's name, such as withholding welfare from the poor, forced sterilizations, racial discrimination, and outright genocide, then this is truly dangerous territory. But this rendering of social Darwinism is largely a myth and the true history is far more interesting and complex. Darwin's theory, properly understood, is centered on cooperation, and Darwin and others were clear about this from the beginning.

A desideratum of an ethical theory is that it can apply to the *past*, to judge or justify past courses of actions, as well as to the *future*, to choose a future course of action. Another common misunderstanding about evolutionary ethics is that it could be used to justify primitive selfish behavior, but this is not the case. For example, an attorney arguing in court the following would not gain much traction: "It's true that my client raped this young girl, but really it came from his biological reproductive instinct, so he should be forgiven".

Descriptive evolutionary ethics as developed in the field of moral psychology has made much progress and has led to deep insights about where our morality comes from and why we have such or such moral instincts (see e.g. Rai and Fiske 2011; Graham et al. 2013). However useful and insightful, such descriptive ethics does not tell us what to do and how to act. It is a scientific, objective, detached way to study morality, rather than a normative ethics that can guide action effectively.

Can or should we use evolutionary ethics normatively? This is not straightforward. The first answer appears to be "no" because the adaptive solutions found by past biological or cultural evolutionary wisdom are adaptations to biological or sociological ecologies *at that time in the past*. There is no guarantee that they would still prove adaptive in present or future situations (Campbell 1979).

So one has to use evolutionary wisdom wisely, as knowledge that may help us to design solutions to complex problems (ethical or others) by applying evolutionary mechanisms that have shown to be successful, while being aware that, like in the stock market, past performance is no guarantee of future results.

A general inspiration for an evolutionary ethics that is more future-oriented is the postulated direction of evolution towards increasing complexity and adaptivity (e.g. Dawkins 2006; 2003, sec. 5.4; Stewart 2000; Heylighen 1999; Vidal 2014, 286–89). Most evolutionary theorists know that evolution cannot move in any direction, and is constrained in many ways. However, the topic remains controversial even today because publications about the direction of evolution were initially banned by evolutionary scientists to build their discipline and profession (Ruse 1996).

Of course, we should be wary of the specter of the naturalistic fallacy (you cannot derive "ought", i.e. ethical injunctions, from "is", i.e. facts about evolution). Yet, we can note that the issue is analogous to the problem of induction in epistemology (Hume 2005). Just like induction cannot lead to absolute truths in science (Popper 1959),

induction cannot lead to fundamental moral laws in ethics. Nevertheless, the discovery of the impossibility to fully validate inductive reasoning in science did not stop science from progressing through induction. Likewise, the discovery of the impossibility to fully validate moral reasoning does not preclude ethical naturalism (see also Curry 2006). The problem of induction and the naturalistic fallacy are salient only if one holds an epistemic realist or a moral realist position, i.e. the assumption that scientific theories and moral rules reflect a reality independent of the observer. In a constructivist or cybernetic vision of knowledge and morality, scientific models and moral laws are both constructions, so these critiques do not hold.

Pragmatically, if one can find or design solutions to difficult ethical issues inspired by evolution rather by alternative sources, then evolutionary ethics is worth using.

Pragmatic ethics

Pragmatic ethics states that our moral rules and values need to be tested out and if necessary revised in practical situations. If a rule consistently produces undesired effects, then we should replace it by a better rule, thus continuously improving and updating our ethical system. This is similar to how science continuously improves its theories through reasoning, observation and experiment. Pragmatic ethics is arguably the most flexible framework to deal with ethical issues, because it has no fixed rules or values. It is thus naturally context-dependent, fluid, open to changing situations, and ready to transform itself.

Note that this “rule of self-improvement” is a meta-rule, so there is no contradiction here. Knowing the history of ethical principles and rules could certainly help to first realize that rules, norms, principles *did change* throughout history, as we saw with the example of the injunction against eating pork. If we apply this remark to the future, this suggests improving and possibly going beyond any existing rule.

However, the question of how, when and why to improve on moral rules or strategies remains difficult and open to debate. An analogy with scientific progress is to keep moral rules that “work best”, and reject or modify the ones that do not. However, the analogy with science is not straightforward. How should we perform “ethical experimentation”? Would it even be ethical to conduct such experiments? It also leaves open the question what we mean by “working best”? When do we decide that moral rules are unfit and

should be rejected? What are the selection criteria for ethical rules, norms or theories?

One could also object that pragmatism is rather a bottom-up approach, which seeks to solve problems as they appear. As such, it seems to lack top-down, universal or overarching values. This would lead pragmatists to care mostly for a shortsighted time-horizon.

Conclusion

The Newtonian worldview is so deeply entrenched in any rational endeavor that it is easy to overlook how constraining its influence is, even for a domain seemingly far removed from Newtonian mechanics like ethics. We have spelled out its fundamental assumptions, and shown how they have been largely refuted by modern physics. Unfortunately, ethical frameworks have become disconnected from modern science, ignoring in particular the lessons of the new science of complexity. This makes them largely unapplicable to our fast evolving socio-technological society, in which developments such as transhumanism, autonomous AI, and cyborgizations open up a wide range of novel ethical issues. Just as it takes years for school textbooks to become up-to-date with current scientific knowledge, ethical frameworks are largely out of date with modern physics and the complexity worldview.

A common reaction to the rigidity and absolutism of the Newtonian worldview is to fall into the other extreme, and endorse a postmodern, relativistic philosophy in which anything goes. This is not our stance. In this paper we criticized the basic assumptions of standard ethical frameworks from the complexity perspective. In a subsequent paper, we also plan to propose methods, principles and strategies from cybernetics, system theory and complexity science that may provide foundations for a new ethics. Our aim will be to discuss constructive strategies for dealing with wicked, changeful, and complex problems that may offer guidance to any moral agent, whether it is an individual, an AI-agent or an organization.

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