*ISSN 0897-1986, Volume 23, Combined 1-2*

Know Techn Pol (2010) 23:177–1 
DOI 10.1007/s12130-010-9108-6

SPECIAL ISSUE

# How to Design the Infosphere: the Fourth Revolution, the Management of the Life Cycle of Information, and Information Ethics as a Macroethics

**Wolfgang Hofkirchner**

Received: 29 April 2010 / Accepted: 9 May 2010 / Published online: 22 July 2010


**Abstract** The paper reconstructs the read thread that links the information revolution, the information concept and information ethics in Floridi's philosophy of information. In doing so, it acknowledges the grand attempt but doubts whether this attempt is up to the state of affairs concerning the actual point human history has reached. It contends that the information age is rather conceivable as a critical stage in which human evolution as a whole is at stake. The mastering of this crisis depends on an appropriate shaping of Information and Communication Technologies which requires ethical considerations. In this respect, Floridi's notion of the fourth revolution, his assumption of the management of the life cycle of information, and his ontocentric macroethics will be discussed in the light of the term "scientific-technological revolution", the idea of a noogenesis, a new way of thinking and new *weltanschauung*, the concept of friction in social and physical aspects, the concept of collective intelligence and its application to the Internet and last, but not least, the vision of a Global Sustainable Information Society.

**Keywords** Scientific-technological revolution · Noosphere · Self-organisation · Social friction · Collective intelligence · Global Sustainable Information Society · Meaningful technology

## 1 Introduction

Luciano Floridi's Philosophy of Information is like Rafael Capurro's lifework in the field averse to undertakings of unification as, e.g., when supporting Shannon's saying that the variety of applications forestall a single concept of information (cf. Floridi 2010, 1). Notwithstanding, both are an attempt at synthesising a bigger picture, even if, unlike Capurros's philosophy, Floridi's one is mostly done with

W. Hofkirchner (✉)
Institute of Design and Technology Assessment, Vienna University of Technology,
Favoritenstr. 9-11/E187, Vienna 1040, Austria
e-mail: wolfgang.hofkirchner@tuwien.ac.at

reliance on analytical vocabulary. However, it focuses not only on different aspects of the information concept but extends also to information society and information technology and comprises information ethics (cf. Floridi 2007). The glue that gives the enterprise coherence includes, if not boils down to, the following general argument:

1. There is a (fourth) revolution going on that by the spread of Information and Communication Technologies (ICTs) imposes on humans an unescapable infosphere turning them into informational agents.
2. The inescapable infosphere makes the management of information processes (the life cycle of information) a crucial issue for informational agents.
3. The management of information processes (the life cycle of information) requires (macro-) ethical considerations in order to shape the infosphere.

The criticism that follows endorses the entire argument as presented above—except for the specifications put in brackets. It contends, firstly, that the argument could be more specific as to knowledge available that is more to the point, at least, more significant, and easily connectable to the argument with regard to (1) and (2) and could gain from replacing the given specifications of the fourth revolution and the life cycle of information; secondly, that the argument would not need to be that kind of specific with regard to (3) when it comes to macroethics that endows all informational agents with intrinsic values, irrespective of whether being human, nonhuman living or artificial, and that the argument could improve, if that part be dropped.

## 2 Fourth Revolution or Noogenesis

It seems to have been the MIT historian Bruce Mazlish (1993) who coined the idea of a fourth discontinuity. By "discontinuity" Mazlish refers to the jolt or deracination that, as a result of a scientific insight, blows up a widely held (mis-)understanding of human's role in the world. Three of them are well-known. The first concussion is associated to the name of Copernicus and pushed Planet Earth out of the centre of the universe. A second affront is associated with the name of Darwin who made man another animal. And a third frustration is associated with the name of Freud according to whom an individual is not master of his own, since there exists the unconscious uncontrollable in the abyss of his psyche.

Mazlish sees another mortification ante portas. This concerns the relation of man and machine. While "humans have sought to define themselves as a special sort of creation", the creation of machines has "raised the question of whether animals are merely a variant of the machine and whether the machine, as a kind of Frankenstein monster, can turn against its creator and either 'take over' or make humans over into its own image" (14). The answer Mazlish gives is humans are not (anymore) distinct from the machines they construct. And this is not least so because they have an impact on humans such that a kind of co-evolution takes place.

It does not come as a surprise that Mazlish addresses information technology. Since he foresees a deadlock in implementing procedures for a biogenetic transformation of the human species—so his argument—the next step to come is

the transformation of "Precomputer Man" by means of the development of computer robot hybrids, called "combots", into "Homo Comboticus", a species of human-combot hybrids. Given this technodeterministic prospect, what, after Mazlish, is left to do in ethical respect is making that transformation as humane as possible.

It is interesting to see that each of the four discontinuities in scientific and everyday thinking supposes a continuity in real world—a cosmic continuity, a biological continuity, a psychological continuity, and a man-machine continuity. The discontinuity is a shift in the leading paradigm. The new one states that there is a continuity which connects the human condition to conditions not labelled human so far.

Now, Floridi is reproducing that argument[1] by pointing out that scientific revolution, like the four at hand, have two features: they change our understanding of the world and they change our the understanding of ourselves (cf. e.g. 2010, 8). "Since the 1950s, computer science and ICTs have exercised both an extrovert and an introvert influence, changing not only our interactions with the world but also our self-understanding" (2010, 9). What, according to Floridi, is the real-world change computers and Internet have been bringing about and what is the change in ideas?

The real-world change is that ICTs are reontologising the infosphere. What does "infosphere" mean and what "to reontologise"?

Floridi tells us that he defined the term "infosphere" in analogy to the term "biosphere" (2007, 59). It is worth noting that Floridi's definition, for obvious reasons, resembles the original definition of the term "biosphere", when coined by Austrian geologist Eduard Sueβ in a treatise on the origin of the Alps (1875) and taken up and advanced by the Russian founder of biogeochemistry Vladimir I. Vernadsky some 50 years later and nowadays adopted by ecosystems ecology. For defining "biosphere" as biomass only, as the total sum of biota, that is, all living or organic substances, would be inadequate for the purpose of conceiving of the infosphere. After Vernadsky, the biosphere is made up of all living matter and its exchange with nonliving, inert matter (cf. Vernadsky 1998, Vernadskij 1997). After Floridi, the infosphere is constituted "by all informational entities […], their properties, interactions, processes, and mutual relations" (2007, 59). The latter bears a likeness to the former inasmuch as relations span the space (the sphere).

"To reontologise" is another neologism Floridi coined to do justice to "a very radical form of re-engineering, one that not only designs, constructs, or structures a system […] anew, but that fundamentally transforms its intrinsic nature, that is, its ontology" (2010, 11). This holds for ICTs in that sense "that our technology has not only adapted to, but also educated, us as users" (ibd.).

The change in the way we ought to think about this real-world change is the sudden discovery that we humans are informational agents amongst other, nonhuman, informational agents.

All of that is certainly true. It is true that we face a scientific-technological revolution that deserves its notation in the full sense of the word for the first time in the history of mankind.

First, it is a revolution. It does what revolutions in sociological terms normally do, that is, it revolutionises society. Revolutions mark the changes of quality of the

[1] Without referring to Mazlish as far as I can see.

societal system in the course of societal evolution. Revolutions change the basis of the societal system, they form a system that differs in quality from the system before. In doing so, the whole existing societal system is worked through and adapted accordingly to form the new system. In terms of a stage model that can be applied here for better understanding, this means that the lower stages insofar as they build the basis of the new stage are reworked so as to fit the emerging quality of the new whole. The new system then is permanently in the point of being formed. It might be called a "social formation". This might cover the proper meaning of "reontologisation" in evolutionary systems terms (see Fig. 1).

Second, it is a technological revolution. That is to say, it is technology that is considered the driving force behind the revolution. "Technology" need not, and indeed, must not, delimit artefacts as reified methods only nor methods as ways of doing something but needs to comprise the humans too that use these ways of doing in order to avoid blunt technological determinism. If technology triggers social change, if it is deeply intertwined with these transformations, then we would be justified in naming them "techno-social formations". There have been at least three major transformations that attracted attention for qualifying for instigating techno-social formations: the neolithic revolution, which was a shift from nomadism to sedentariness with crop growing and cattle breeding, introduced the techno-social formation of agricultural society; the industrial revolution drew upon machine tool inventions of engineers and coupled them by transmission mechanisms with energy-providing engines like the steam engine so as to result in work machines which gave rise to the techno-social formation of industrial society; and, finally, the information revolution that ushers in the techno-social formation of information society (see Fig. 2). Reontologisation happens in each case. Each new formation subjugated that one from which it departed: the agricultural society increased the control of natural resources like plants and animals, the industrial society has been industrialising agriculture, and the information society is informatising industry.

Third, it is a scientific and technological revolution, or a scientific-technological revolution, to such an extent that, as early as in the 1950s of the last century, British scientist and historian of science John Desmond Bernal (1954) called it like that. The term entered immediately Soviet political language and became, finally, famous in the year 1968 and connected to the so-called Richta report (cf. Richta 1977). It means that technology has irreversibly become science based. Several historical steps paved the way for this development. Though science can, in general, be seen as response to societal needs, science started only after the neolithic revolution when in

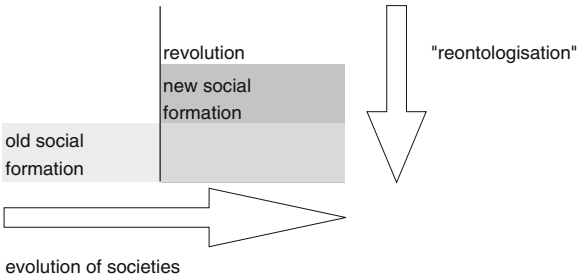


**Fig. 1** Revolution

  

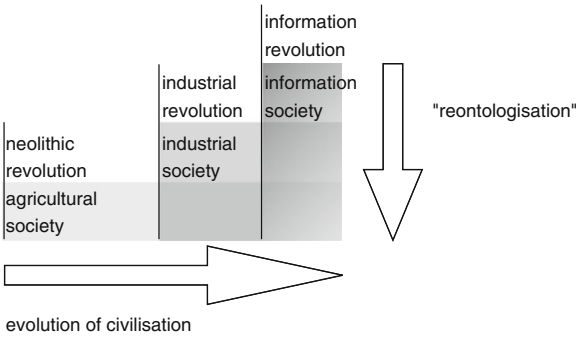


**Fig. 2** Information revolution

the course of the division of labour the creation of knowledge could take on a life on its own. Concerning the European thread of civilisation, in Antiquity, science—in the form of philosophy—was rather detached from social practice. At the turn from the sixteenth to the seventeenth century a scientific revolution occurred—a revolution in science and through science (cf. Bialas 1978 as well as 1990, pp. 146). The Copernican shift to the heliocentric planetary theory was the first act of liberation of science from being patronised by the Christian church. Francis Bacon and René Descartes followed in instaurating the new occidental science. While the industrial revolution took still place without resorting to science, industrialisation worked as a booster for it. Technological disciplines and applied science emerged. At the turn of the twentieth century, the last great independent theories were achieved by basic science. Thus, after three millennia, science was incorporated in the production process of capitalist societies. The Manhattan project that was characteristic of the last years of World War II anticipated the so-called "Big Science". By that, science and technology became immediate forces of production, technology became scienticised, and vice versa; science became technologised. The leading technology has been from that time on the computer by which activities of the human brain are delegated to a machine. This, in turn, set free a variety of new technologies that would have been unable without computers.

Computerisation and scientification may not describe the whole truth. The nature of the information revolution as scientific-technological revolution can be interpreted in an even more far-reaching context. There seems to exist an underlying process that bears a tendency towards ever higher intelligence on a planetary level. This global dimension has already been anticipated by a number of engineers, writers and academics. Samuel Morse, who sent the first message via his electrical telegraph line from Washington to Baltimore in 1844 and succeeded in connecting Europe and North America with a durable cable in 1866, had visions of a wired world, with countries bound together by a global network of interconnected telegraph networks (cf. Standage 1998). In view of the telegraph, Nathaniel Hawthorne had one of his novel characters in "The House of the seven gables" make the comparison of the globe with a head and brain. Not only palaeontologist and Jesuit priest Teilhard de Chardin regarded the "astonishing system of land, sea and air channels, the postal connections, wires, cables and radio waves, which encircle the earth more each day" as the "creation of a real nervous system of humanity, development of a common

consciousness, networking of the mass of humanity," as he wrote on 6 May 1925 (1964, 61, 62; see also 1961, 117 f.). On the eve of World War II, Vernadsky said the following (1997, 51—translation from German by W.H.): "Human life has, in all its diversity, become indivisible. An event that takes place in the remotest corner of any continent or ocean has consequences, and causes reactions in a number of other places on the earth, be they great or small. The telegraph, telephone, radio, airplanes and balloons have encircled the globe. Connections are becoming ever simpler and faster. Their degree of organisation increases every year […] this process of complete habitation of the biosphere by humans is caused by the course of history of scientific thinking, inextricably linked with the speed of communications, the success of transport technology, the possibility of instant transfer of thought, and its simultaneous discussion everywhere on the planet." Biologist and science and technology studies expert Tom Stonier considered this process to culminate in the Internet (1992, 105): "In principle, this process does not differ from the evolution of primitive nervous systems into advanced mammalian brains […] each node, rather than being a neuron, is a person comprising trillions of neurons […] coupled […] to their personal computers […] We are now dealing with the very top end of the known spectrum of intelligence".

I omit here the point of discussing whether or not Floridi's analogy between the biosphere concept and the infosphere concept is perfect, since Floridi seems to be inclined to assume the existence of an immaterial infosphere—which would reveal an idealist view in the sense of Plato or Poppper (cf. Capurro 2008)—and before the advent of modern ICTs. Anyhow, we can learn from Vernadsky how evolutionary thinking would approach the issue. Vernadsky considers life a geological force. The biosphere is then a result of the transformation of the geosphere(s) by life. And since Vernadsky's observations prove that human life on earth is a force capable of bringing about changes on the planet's surface in even shorter geological time intervals, he concludes there is a transformation of the biosphere by human work and science (cf. 1997). This is what he calls "noogenesis", the formation of the "noosphere" as another sphere.

This opens up a new dimension. Béla H. Banathy, the advocate of social systems design, takes as his point of departure a quotation of Jonathan Salk (1983, 112): "[…] human beings now play an active and critical role not only in the process of their own evolution but in the survival and evolution of all things.As Banathy adds in 2000 (203)": "If we accept this responsibility and engage creatively in the work of evolution we shall […] be the designers of our future, we shall become the guides of our own evolution and the evolution of life on earth and possibly beyond." Thus, the information revolution might mark the beginnings of a possible transformation of the evolution of consciousness into conscious evolution, into an evolution of society that does not take place behind the backs of most members of society but is consciously and commonly carried out (see Fig. 3).

Evolution to be conscious is the more needful, the more we take into consideration that human history has reached the point of possible self-extermination indicated by the so-called "global problems". The global problems are global in a twofold sense: first, they concern humankind as a whole (as object); second, they can also only be solved by humankind as a whole (as subject). The risk this crisis carries is that humankind may be wiped out. The chance it offers,

  

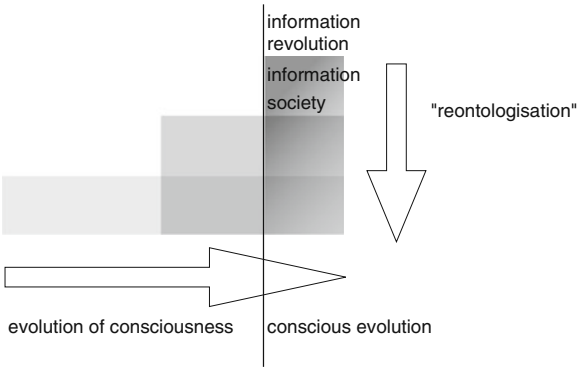


**Fig. 3** Information revolution as qualitative leap from evolution of consciousness towards conscious evolution

however, is that humankind may be raised to another level of humanity. Seen that way, the information revolution just comes in time to start an attempt to manage this crisis.

Summing up, Floridi's basic idea that ICTs are reontologising the infosphere is true but foregoes reflecting the state of affairs to which it should respond. By including the global challenge of extermination the information revolution would become more meaningful.

## 3 Fourth Revolution or Thinking in Complexity

In doing so, the consequences for human self-esteem—Floridi's second criterion for revolutions—would become more meaningful too. It is true that we humans (by and by) discover ourselves to be informational agents. But, given the unique point of evolution of humanity we have reached, we can, in addition, discover the imperfectness and futility of our ambitions as long as we do not face up to the challenge. In order to be able to face up to the challenge, we need a new way of thinking and a new world view that make us understand that the causes of the crisis are to be found in the development of society itself as well as the possibilities for ways out are to be found by ourselves with the help of our creative mind.

A gap appeared between, on the one hand, the technological potential humanity developed to intervene in the world and, on the other, the social maturity to keep pace with that development and harness it for the common good. According to Western thinking, since the days of Francis Bacon, the role science and technology have been thought to play in society may have been to better life. But now that the apparent effects have come to jeopardise the aims in pursuit of which inventions and innovations were originally carried out to such an extent that civilisation is at stake, the programme of Bacon must be overhauled in the light of Bacon's ideals and rationality must be criticised from the angle of reason (cf. Schäfer 1993).

This has become apparent by the scientific-technological revolution of today. Banathy says (2000, 193): "While our recently emerged communication capabilities created the potential and the conditions for global human community, our

consciousness is still locked within ethnocentric, racial, and national boundaries. […] Furthermore, the technological revolution, while giving us an earlier unimagined power, has accelerated to the point where we have lost control over it." "We have simply failed to match the advancement of our technological intelligence with an advancement in socio-cultural intelligence, and advancement in human quality and wisdom" (1996, 315).

What is needed is self-reflection in scientific and technological progress, that is, the application of scientific endeavour to scientific endeavour itself, in order to redirect scientific-technological progress and help to overcome the fundamental failures of modernity, the application of research and development methods to science and technology for the purpose of their own control. Science and technology can do justice to their original purpose—to alleviate human life and generally make that life more pleasant—only if they are no longer left to pursue their seeming natural course. Instead of being left to their own dynamics, they should be deliberately put into operation after appropriate reflection and careful consideration, and should be managed with conscious control, i.e., if their programme is executed with respect to the ideals of the survival of humanity in a future that is worth living in, and if a constant control of the results of the implementation of the programme is instituted. That means, that science must devote careful consideration to its technological consequences in society, must anticipate possible desired or undesired effects, and must carry out any appropriate readjustments or reorientations.The foundation of technology assessment and its development up to now might serve as a litmus test of how far this process of self-reflection has been implemented throughout the sciences (cf. Hofkirchner 1994a).

As it is in the nature of the challenges to be complex and global, they have to be approached in a similarly complex and global fashion. The split into disciplines which are both alien and deaf to each other is an obstacle for consistent comprehension that takes into consideration as many of the manifold aspects as are necessary in order to take measures to reach the desired goals without being frustrated by undesired effects. The urge, however, to transcend the borders of the disciplines, the trend towards transdisciplinarity, and the search for a base of understanding between the domains of science, has been growing. Eventually, after centuries of predominance of the modern, Western-controlled (natural) sciences, a paradigm shift as far reaching as never seen before is under way. However, this new view does not need to, indeed must not, be a return to pre-modern contemplation. What is known as sciences of complexity, theories of dynamic, open, non-linear systems, second-order cybernetics, self-organisation theories, is an element, if not the core, of this overall shift. This thinking in complexity cuts across the natural and social sciences. It is about to change the nature of science and technology and to close the gap between technological and social evolution. As French philosopher and sociologist Edgar Morin put it: "It means understanding disjunctive, reductive thought by exercising thought that distinguishes and connects. It does not mean giving up knowledge of the parts for knowledge of the whole, or giving up analysis for synthesis, it means conjugating them. This is the challenge of complexity which ineluctably confronts us as our planetary era advances and evolves" (1999, 19).

According to this new complexity thought—and paraphrasing Floridi—we find ourselves as self-organising systems amongst other self-organising systems, trying to

make us distinct from them by capacitating ourselves to avoid a self-inflicted (in our case, anthropogenic) breakdown of the suprasystem (ecology) we are subsystems of. This is missing in Floridi's characterisation of the introvert aspect of the information revolution.

In the light of this discussion the first part of Floridi's whole argument could be rephrased as follows:

(1) There is a scientific-technological revolution going on that by the spread of ICTs enables humans to build up a noosphere in order to meet the challenge of possible extermination (extrovert aspect), and there is a scientific revolution being part of it that enables humans to recognise they are self-organising systems amidst self-organising systems (introvert aspect).

## 4 Managing the Life Cycle of Information or Reducing Social Frictions by Raising Collective Intelligence

What has been discussed so far concerning the first part of Floridi's argument on the information revolution and its repercussion in thinking and world view is consequential for the second part of the argument which highlights the cruciality of managing information once humans, as informational agents, are connected to the infossphere. For if the information revolution expresses the needs of a unique evolutionary stage of humanity, then the general depiction of managing information—which presupposes entertaining the connection to the infosphere—as crucial seems underdetermined. Such a depiction does not suffice to characterise the specific possibilities of dealing with information in the perspective of noogenesis.

It is true that "future generations will increasingly feel deprived, excluded, handicapped, or poor whenever they are disconnected from the infosphere, like fish out of water" (2010, 12). It is true that with the rise of the infosphere "human progress and welfare begun to depend mostly on the successful and efficient management of the life cycle of information" (2010, 4). And it is true that because of the ontological convergence between digital information technology and real-world objects that by and by get digitised "there is a gradual erasure of ontological friction"—another neologism that "refers to the forces that oppose the flow of information within […] the infosphere" (2007, 60)—such that, metaphorically speaking, information tends to flow more and more freely.

However, if the survival of human civilisation is at stake, then it might become clear that it is, in the first instance, the survival of human civilisation that depends on the successful and efficient dealing with information processes, and that the issue of a good life comes only second. And the successful and efficient dealing with information processes is, in turn, not a technological problem of reducing frictions but a societal one.

Cybernetician Francis Heylighen points to the homology between physical and social friction. He says, referring to Carlos Gershenson (a PhD dissertation from 2007, published 2010): "Initially, interactions tend to be primordially competitive, in that a resource consumed by one agent is no longer available for another one. In that respect, interactions are characterised by social friction […], since the actions of one

agent towards its goals tend to hinder other agents in reaching their goals, thus reducing the productivity of all agents' actions. Note that the two common meanings of the word 'friction'—(physical) resistance, and (social) conflict—describe the same process of unintended obstruction of one process or system by another, resulting in the waste of resources. […] Like physical friction, social friction creates a selective pressure for reducing it, by shifting the agents' rules of action towards interactions that minimally obstruct other agents. Interactions, however, do not only produce friction, resulting in a loss of resources, they can also produce *synergy*, resulting in a gain of resources. Actions are defined to be synergetic if they produce more benefit when performed together than when performed separately" (2007, 9-10).

Collective intelligence is a synergetic phenomenon. It names the problem-solving capacity that results from synergetic effects of interacting intelligent agents. It was the "philosopher of the cyberspace", Pierre Lévy, who developed the concept with regard to the infosphere in 1994. His basic assumptions are these (http://www.planetwork.net/2000conf/presenters/levy_text.html): "First proposition: there is a cultural evolution. Second proposition: the cultural evolution is the continuation of the biological evolution. Third proposition: the unfolding of cyberspace is the latest step of the cultural/biological evolution and the basis for future evolution. What is the role of collective intelligence in this theoretical framework? I would like to say that each step, each layer of the evolutionary continuum brings an improvement and a new realm of collective intelligence." And he goes on saying: "Cyberspace will finally deserve its name ('piloting space' if we follow the etymology) because it will become the driving tool (the dashboard and the wheel) of our voyage towards a conscious biobrainsphere. The closer we get to this goal, the wider freedom will open its space, and the more we will need to run a multidimensional collective intelligence in real time."

What does all that mean?

Drawing upon Heylighen and Lévy, we might, first of all, be inclined to interprete "the global problems […] as frictions in the functioning of the information generation of those systems that make up world society", as the author wrote in a paper some 10 years ago (published as Hofkirchner 2000). Those systems are physical, biotic or social systems that are affected by the overall societal suprasystem of humans and made subsystems of it. Humans, by way of the suprasystem, are constantly engaged with those systems and they can do nothing but intervene in those systems. This intervention might be in accord with the self-organisation capacities of the systems or might be dissonant and tending to disable their self-organisation capacities. In the first case, frictions will be decreased or, at least, not increased, while in the second case not, eventually running the risk of damaging the system. Since self-organisation is very intimately coupled to the information systems generate, the same holds for the information generation.

Second, it is, in the final analysis, social frictions that tend to multiply and propagate throughout the subsystems of the societal suprasystem and become manifest in frictions of all kinds—social, biotic, physical. Thus, frictions in those systems can be reduced by reducing the social frictions on the level of the suprasystem.

Third, reducing frictions is equal to optimising the process of self-organisation in the respective system. In human systems, self-organisation is mediated via consciousness which is the special form information processes assume in human

systems. Thus, conscious intervention can optimise human self-organisation as well as self-organisation in other systems in which it intervenes and reduce frictions.

Fourth, human collective intelligence is a specific form of consciousness. It is not only the result of less friction in social terms but is, in turn, the starting point for reducing social as well as other friction which is needed to allow for a sustainable future of the suprasystem.

Altogether that means that the infosphere inheres a potential for enhancing human collective intelligence that is required to cope with the global challenges by reducing imminent frictions.

Having discussed the second part of Floridi's argument, I conclude that it would gain from specifying the management of the life cycle of information. An appropriate reformulation could be:

(2) The emerging noosphere makes human collective intelligence a crucial issue for human self-organisation that needs to reduce the frictions in systems that are in danger of breakdown but the functioning of which is essential for human self-organisation.

## 5 Ontocentric Macroethics or the Vision of a Global Sustainable Information Society

Now let us turn to the last part of Floridi's argument.

Floridi is quite aware about the moral implications of the advent of the infosphere. He rightly acknowledges the deep ambiguity of ICTs. So, on the one hand, he recognises a possible positive impact of ICTs: "ICTs can help us in our fight against the destruction, impoverishment, vandalism, and waste of both natural and human resources, including historical and cultural ones" (2010, 121). But on the other hand, existing social disparities would be amplified, "if we do not take seriously the fact that we are constructing the new environment that will be inhabited by future generations. […] the digital divide will become a chasm, generating new forms of discrimination […] We are preparing the ground for tomorrow's digital slums" (2010, 18). Hence, we would have to build, shape, regulate the new infosphere.

The concrete ethical perspective Floridi develops is, surprisingly, not anthropocentric but "as non-anthropocentric as possible" (2010, 113), even beyond different kinds of bio- and ecological ethics. The basic idea of that perspective is that the infosphere will be inhabited not only by human informational agents but also by other entities and that "every entity, as an expression of being, has a dignity" (2010, 113), that "all entities, *qua* informational objects, have an intrinsic moral value" (2010, 116), that "also ideal, intangible, or intellectual objects can have a minimal degree of moral value" (2010, 116-117). This perspective is "info-" and thus "ontocentric" (2010, 116). This is what Floridi calls "macroethics" comprising the "ecology of the infosphere" (2010, 18).

However, it is doubtful whether the "emergence of the infosphere […] explains the need to enlarge further the conception of what can qualify as a moral patient" (Floridi 2010, 118). This looks like the notorious naturalistic fallacy that tries to

draw an evaluating conclusion—an Ought—from a factual premise—an Is. But, actually, it is rather the other way round. Informational agents and other informational entities are endowed with values which after these values have been projected onto those entities are said to be intrinsic. This qualifies as anthropomorphistic fallacy (cf. Hofkirchner 1994b) and is, to say the least, dispensable, or it might be highly misleading.

It is dispensable because in order to arrive at guiding principles that regulate the conduct vis-à-vis, other inhabitants of the infosphere you need not to postulate intrinsic values of all the entities to be morally guided to respect them. It suffices to take an anthropocentric stance and evaluate all entities according to their role in supporting human, and a humane, life. The global challenges of today did not occur because the intrinsic value of nonhuman self-organising systems was not respected. They occurred because the value of the role nonhuman self-organising systems play in supporting the overall suprasystem was not respected, and this value is due to an evaluation from an anthropocentric point of view. This is not to be mixed up with a short-sighted anthropocentric view.

Otherwise, Floridi's anthropomorphistic fallacy might be highly misleading. If all informational entities are endowed with the same rights, then it seems more than a difficult task to decide what should be done by which agent in which situation for whose interest. Anyway, Floridi seems to accept there are different values for different entities. But where do the different values come from if not from evaluations regarding their role in the suprasystem that is and will always be human?

We need not to think of the question of the moral status of artificial agents (cf. Capurro 2009, 2008). Just let us think of machines and the interaction of man and machine, as is the case with ICTs. ICTs receive their meaning by the very act of being instrumental in human self-organisation. And this meaning is related to the purpose for which ICTs are made and to the purpose for which they are used and to the good or evil that is associated with their non-intended consequences in the social, biotic, physical subsystems. Without their embeddedness in human self-organisation, in the suprasystem of societies, they would be meaningless. And therefore it is of utmost importance to consciously and cautiously integrate ICTs in the bigger picture.

Roughly speaking, there are two ways to integrate them that more often than not contradict each other and an ethical decision has to be made. The ethical decision is whether we cede the bringing about of an infosphere to the forces of economic development disguised as technological determinism and increase the probability of social friction by the openness to profit-making of a few or head for a Global Sustainable Information Society (GSIS) instead. By "GSIS" I understand a society that is

1. capable of making use of knowledge
2. for fighting the dangers of breakdown due to anthropogenic causes
3. on a global scale.

Sustainability denotes a society's ability to perpetuate its own development. I suggest that sustainability be broken down into

1. a social part, called "social compatibility", which is inclusiveness and fairness – to be broken down, in turn, into equality in cultural terms, political freedom and solidarity as to economy –,

  

2. an ecological part, called "environmental compatibility", and
3. a technological part, called "technological compatibility", by which I mean a balanced relationship of new with old technologies—to be broken down, again, into usefulness, usability, efficiency, reliability, security, safety and other values.

The main argument is that not only a society that exploits nature (as was found with reduced notions of sustainability) but also a society that does not meet the criterion of social compatibility because of the exclusion of have nots (who are excluded from the usage of commons) or a society that does not abide by technology assessment would in the long run break down and not qualify for being sustainable.

It is worth noting that it is only a vision of the good society like the GSIS that gives a defensable reason to technological developments that are senseless in themselves unless coupled to humane values which makes them a more or less proper means to a justifiable end.

Take the following three developments representing the spearheads of the ICT-shaped infosphere, classified according to the realms of prebiotic matter, nonhuman life and human society:

1. Pervasive or ubiquitous computing or ambient intelligence: technologists promise to make our human habitat smart, that is, equipped with chips linked to a net to become, in a tailored way, responsive to individual needs like switching off the light and turning on music;
2. in analogy to this Internet of things, an Internet of living beings, of organisms, that are inhabitants of our *umwelt* as kind of an artificial web of life—we would not lose our pets anymore;
3. and the Internet on the level of the networked individuals of a Facebook society, a society of self-advertisement.

Floridi calls the first kind of inhabitants of the infosphere "ITentities": "more and more objects will be *ITentities* able to learn, advise, and communicate with each other" (2007, 61). The second and the third kind of inhabitants are called by Floridi "inforgs": "We are all becoming connected informational organisms (inforgs)" (2007, 62).

But what for? All of these developments are devoid of sense like those resulting in gadgets we know from our experiences as participants in the network society as long as there is no safeguard that they serve a humane purpose. Applying a GSIS perspective can, however, set the stage for the development of meaningful technologies in an evolutionary context (see Fig. 4).

The *x*-axis describes the dimension of virtuality and the *y*-axis the dimension of sociocomplexity. Virtuality means space of possibilities, sociocomplexity the complexity that arises when individual systems form a suprasystem. In the course of evolution, the space of possibilities might rise as well as the level of complexity of the systems. Physico-chemical entities, once exclusively defining the space on Planet Earth as geosphere, turn, with the rise of biota, into matter that is cycled and recycled by biota and become part of a biosphere, then turn, with the rise of human societies and the transition from biosphere to an anthropo- or sociosphere, into inert artefacts as which they form the so-called techno- or infrastructure of human societies, and turn finally, with becoming "intelligent", "smart", by means of

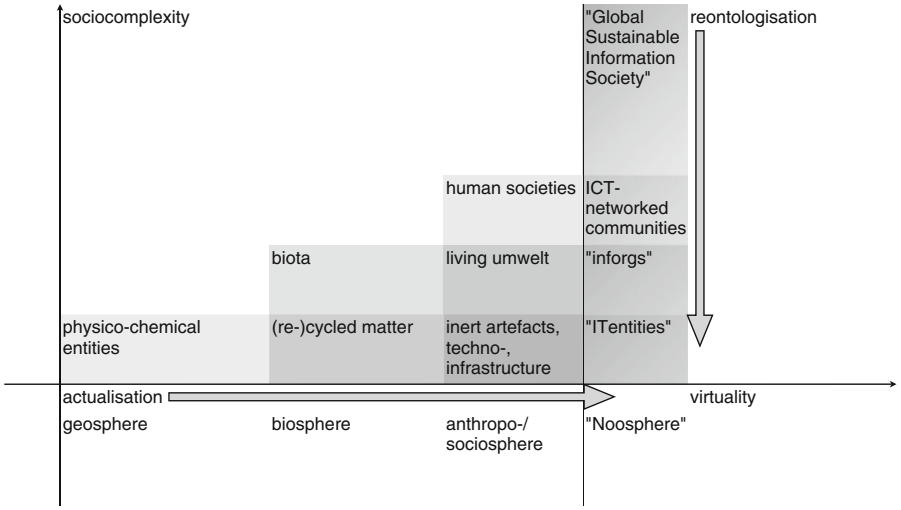


**Fig. 4** Global sustainable information society makes ICTs meaningful

ubiquitous computing into ITentities. Biota turn, with the rise of human societies into the living *umwelt*, and turn, with becoming connected to the informatised infosphere, into inforgs. Human societies turn, with becoming connected to the informatised infosphere, into communities networked by ICTs.

The question is whether or not the technological trends described above and to be found at the respective levels are tantamount to a real reontologisation of human societies. I contend the position that it is only under the conditions of a GSIS that the actualisation of virtuality through ICTs can be said to be tantamount to a qualitative leap onto a new level that reontologises the whole anthropo-/sociosphere and transforms it into a noosphere. Without the shaping of ICTs in accord with the requirements of a GSIS the technological future will be thumb and dull and, eventually, lead to extermination.

Hence, macroethics should include the necessity of a vision where to go from here like that of the GSIS and not conflate this with the postulate of a non-anthropocentric angle. The third part of Floridi's argument would then look like:

(3) The realisation of an increase of human collective intelligence and a decrease of frictions detrimental to the survival of humanity requires an ethical approach laying the foundations for a vision of a Global Sustainable Information Society.

## 6 Conclusion

The glue of Floridi's philosophy of information that connects to information society and information technology considerations as well as to information ethics was discussed in detail. Floridi's notion of the fourth revolution was confronted with the idea of a noosphere that might be the result of the ongoing scientific-technological revolution and with the paradigm shift towards a new *weltanschauung* instigated by insights in complexity. His concept of managing the life cycle of information was

compared to the concept of frictions, be they social, biotic, or physical, and to the concept of human collective intelligence. It was argued that Floridi's assumptions seem by far too general, given the state of affairs of human evolution. Finally, Floridi's delineation of a macroethics for designing the infosphere was contrasted with an approach revolving around the vision of a Global Sustainable Information Society. In particular, it was criticised that his ethics of everything that exists as part of the infosphere being a patient is too narrow to be of great help, if any, to shaping ICTs.

Summing up, the argument might be reconstructed in a different way:

1. The informational turn (information revolution and thinking in complexity) might, by the spread of ICTs, bring about the emergence of a noosphere which is inhabited by self-organising systems of all kinds in a way that the future of humanity is taken care of (the global challenge of extermination).
2. The needs of this unique evolutionary stage of humanity (the global challenge of extermination) can be met, if a sufficient level of collective intelligence is provided in order to minimise the frictions of information processes maintained by self-organising systems.
3. A sufficient level of collective intelligence to minimise the frictions of information processes requires a wise design of the infosphere (Global Sustainable Information Society).

## References


Banathy, B. H. (1996). *Designing social systems in a changing world*. New York: Plenum Press.

Banathy, B. H. (2000). *Guided evolution of society. A systems view*. New York: Kluwer.

Bernal, J. D. (1954). *Science in history*. London: Watts.

Bialas, V. (1978). *Wissenschaftliche und technische Revolutionen in Vergangenheit und Gegenwart*. Köln: Pahl-Rugenstein.

Bialas, V. (1990). *Allgemeine Wissenschaftsgeschichte*. Wien: Böhlau.

Capurro, R. (2008). On Floridi's metaphysical foundation of information ecology. http://www.capurro.de/floridi.html. Accessed 21 April 2010.

Capurro, R. (2009). Towards a comparative theory of agents. http://www.capurro.de/agents.html. Accessed 24 April 2010.

Floridi, L. (2007). A look into the future impact of ICT on our lives. *The Information Society, 23*(1), 59–64.

Floridi, L. (2010). *Information. A very short introduction*. Oxford: Oxford University Press.

Gershenson, C. (2010). *Design and control of self-organizing systems: facing complexity with adaptation and self-organization*. Saarbrücken: Lambert Academic Publishing.

Heylighen, F. (2007). Accelerating socio-technological evolution: from ephemeralization and stigmergy to the global brain. http://pespmc1.vub.ac.be/Papers/AcceleratingEvolution.pdf. Accessed 23 April 2010.

Hofkirchner, W. (1994a). On the philosophy of design and assessment of technology. In S. Katsikides (Ed.), *Informatics, Organization and Society* (pp. 38–46). Wien: Oldenbourg.

Hofkirchner, W. (1994b). Öko-Ethik: Von Spinoza zum New Age? In E. Balibar, H. Seidel, & M. Walther (Eds.), *Freiheit und Notwendigkeit, Ethische und politische Aspekte bei Spinoza und in der Geschichte des (Anti-)Spinozismus* (pp. 241–249). Würzburg: Königshausen & Neumann.

Hofkirchner, W. (2000). Tin hoc va xa hoi [Informatics and Society]. In J. Becker & Dinh Dang Ngoc (Eds.), *Internet o Viet Nam va cac nuoc dang phat trien [Internet in Vietnam and other developing countries]* (pp. 73–84). Ha Noi: Nha Xuat Ban Khoa Hoc Va Ky Thuat.

Lévy, P. Cyberspace as a metaevolutive step. http://www.planetwork.net/2000conf/presenters/levy_text.html. Accessed 23 April 2010.

Mazlish, B. (1993). *The fourth discontinuity. The co-evolution of humans and machines*. New Haven and London: Yale University Press.

Morin, E. (1999). Seven complex lessons in education for the future. Translated by Poller Nidra. http://portal.unesco.org/en/ev.php-URL_ID=2735&URL_DO=DO_TOPIC&URL_SECTION=201.html. Accessed 21 April 2010.

Richta, R. (1977). The scientific and technological revolution and the prospects of social development. In R. Dahrendorf (Ed.), *Scientific-Technological Revolution, Social Aspects* (pp. 25–72). London: Sage.

Salk, J. (1983). *Anatomy of reality: Merging of intuition and reason*. New York: Columbia University Press.

Schäfer, L. (1993). *Das Bacon-Projekt. Von der Erkenntnis, Nutzung und Schonung der Natur*. Frankfurt: Suhrkamp.

Standage, T. (1998). *The Victorian Internet. The remarkable story of the telegraph and the nineteenth century's online pioneers*. London: Weidenfeld and Nicolson.

Sueß, E. (1875). *Die Entstehung der Alpen*. Wien: Braumüller.

Teilhard de Chardin, P. (1961). *Die Entstehung des Menschen*. München: Beck (French: Le groupe zoologique humain).

Teilhard de Chardin, P. (1964). *Auswahl aus dem Werk*. Freiburg: Olten(French: La vision du passé).

Vernadskij, V. I. (1997). *Der Mensch in der Biosphäre. Zur Naturgeschichte der Vernunft*. Wien: Peter Lang.

Vernadsky, V.I. (1998). The biosphere. Foreword by Lynn Margulis and colleagues. Introduction by Jacques Grinevald. Translated by David B. Langmuir. Revised and annotated by Mark A.S. McMenamin. New York: Copernicus (Springer).