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Living in a world of self-organisation
Ways of thinking and world views contested[*]

The context in which all strategies for human action are formulated today fundamentally distinguishes itself from that of earlier times. We live in an age of global problems.

The impressions made by the atom bomb, industrial and agricultural catastrophes, hunger, suffering and death in the poor parts of the world, have raised consciousness of the destructive and fallible nature of the human technosphere, the fragile and finite nature of the human ecosphere, and the unsettled, unbalanced nature of the human sociosphere.

The global problems are problems concerning the survival of humanity: first, they concern humanity as a whole (as object); second, they can also only be solved by humanity as a whole (as subject).

Assuming that these problems have an anthropogenous origin in the use of technical, natural and human resources of social systems, human efforts to cope with them are purposeful.

In a sense, every action performed by a social subject, be it a nation state, societal institutions, or a single human, may be measured by what it contributes towards the alleviation or aggravation of the global challenges facing us.

Co-operation in meeting the global challenges presupposes communication of ends and means between all affected and communication, in turn, presupposes the recognition of the threat, its causes and possible solutions by all individual minds involved.

Producing and implementing strategies for dealing with the *global problematique* is a collective endeavour – so to say, an act of collective intelligence – that requires new ways of thinking and new world views.

A paradigm shift as far-reaching as never seen before is under way. It is about to change the nature of science and technology.

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, which 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.

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.

According to this thinking, all science serves to support efforts to master the global challenges. According to it, more and more researchers discover evolutionary systems no matter what real-world object they may be investigating, for the provision of specialized knowledge about the functioning of different self-organizing systems is essential to influence them in such a way as to trigger the most promising development paths. Finally, according to it, diverse methodological approaches are less and less viewed as impediments that endanger the unity of science; rather, they are increasingly regarded as useful means towards the same end and as an enrichment of science as long as the common basis of the different methods is not violated.

The basis of this shift concerns ways of thinking as well as world views.

Ways of thinking

Ways of thinking can be seen as ways of considering how to relate identity and difference.

There are, in terms of ideal types, several ways conceivable:

- one establishes identity by eliminating the difference;
- another eliminates identity by establishing the difference;
- a last one establishes identity as well as the difference.

Regarding identity and difference while approaching complexity, the question arises as to how the simple does relate to the complex, that is, how less complex problems or objects or phenomena do relate to more complex ones. Accordingly, we can distinguish between four ways of thinking:

- a first one that establishes identity by eliminating the difference for the benefit of the less complex side of the difference; it reduces "higher complexity" to "lower complexity"; this is known as reductionism (a);
- a second one that establishes identity by eliminating the difference for the benefit of the more complex side of the difference; it takes the "higher" level of complexity as its point of departure and extrapolates or projects from there to the "lower" level of complexity; it is the opposite of reductionism (a) and might be called "the projection perspective" (b);
- a third one that eliminates identity by establishing the difference for the sake of each manifestation of complexity in its own right; it abandons all relationships between all of them by treating them as disjunctive; it is opposed to reductionism (a) as well as to the projection perspective (b) and could be called "the disjunction perspective" (c);

- a fourth one that establishes identity as well as difference favouring neither of the manifestations of complexity; it integrates "lower" and "higher complexity" by establishing a relationship between them that, in particular, might be characterized by the following criteria: firstly, both sides of the relation are opposed to each other; secondly, they depend on each other; thirdly, they are asymmetrical. When all these criteria are met the relationship is usually called "dialectic" (Hofkirchner 1998). This approach opposes reductionism (a), the projecton perspective (b), as well as the disjunction one (c). It will be called "the integration perspective" (d).

World views

The most fundamental implications of ideas whatsoever, insofar as they go beyond being judgements on a particular matter that forms a single part of the world only and express an attitude towards the world as a whole, are called world views (in the sense of the German "Weltanschauung"). Theorised world views, that is, world views theoretically reflected, represent philosophy.

A world view has three dimensions:

- one refers to the employment of instruments to gain knowledge; the question answered here is "How do we recognise the world?"; philosophical disciplines like epistemology and methodology are dealing with that; this dimension may be called "approaching the world" (1);
- another one refers to assumptions about the nature of the real world; the question put here is "How is the world like?"; that is what ontology is about; this dimension may be called "modeling the world", because it yields certain mental models of the world (2);
- a last one refers to the devising of guidelines for action; the question usually put by ethics is "How shall we act in the world?" or, more precisely, "Towards which ends shall we act?" which leads to the question "How shall the world be like?"; thus, this dimension is called "visioning the wolrd" (3).

These three dimensions are interlinked in the following way: a specific approach (1) is consistent with a certain variety of models (2) but excludes particular models and a specific model is consistent with a certain variety of visions (3) but excludes particular visions; a vision (3) can be based upon one certain model (2) only, and a model (2) upon one certain approach (1) only.

Ways of thinking in world views

The next step is to cross-table ways of thinking and world views and identify the paradigm that has grown obsolete inasmuch as it has proven counterproductive in respect to the global challenges and the paradigm that promises mankind remedy (see Table 1).

Ways of Thinking based upon the operation of:		World View Dimensions:		(1) APPROACHES (Epistemology/ Methodology)		(2) MODELS (Ontology)		(3) VISIONS (Axiology/Ethics)	
(A) REDUCTION				Naturalism (Technicalisation, Formalism)		Mechanism/Materialism		Modernism	
ANTI-REDUCTION	(B) PROJECTION			Anti-naturalism: Culturalism	Anthropo-morphism	Anti-mechanism: Mysticism	Idealism	Anti-modernism	Funda-mentalism
	(C) DISJUNCTION				"Two-Cultures" Thinking		Dualism		Post-modernism
(D) INTEGRATION				Unity of Methods: The Search for the Necessary Condition		Unity of Reality: The Assumption of Propensities		Unity of Practice: Evolutionary Systems Design	

Tab. 1: Ways of thinking and world view dimensions

The old paradigm is characterised by the divide of naturalism and anti-naturalism, mechanism and anti-mechanism, modernism and anti-modernism. Each of the divides prolongs an unresolved contradiction between the prevailing occidental scientific thought, on the one hand, and submerged humane feeling, on the other, that in vain has attempted to compensate for the deficiencies of the first, either in the form of humanities or in esoteric forms.

The new paradigm tries to do justice to both of the strands while overcoming their one-sidedness by promoting the idea of the unity of methods, reality, and practice.

In detail.

A fresh perspective on comprehension

Naturalism (including technicalisation and formalism) and anthropomorphism revolve around one basic method of explanation and prediction on which all rational methods of comprehension are deemed to converge (see Table 2).

	FROM NATURALISM, ANTHROPO-MORPHISM AND TWO-CULTURES THINKING...	TO THE PARADIGM OF SELF-ORGANISATION
1. epistemo-logy: approaching the world	*Principle of complete deducibility (deductivism) resp. nondeducibility*: RATIONALITY resp. IRRATIONALITY (causal expla-nation/calculation / simulation and prediction resp. "Verstehen"), ANALYSIS resp. SYNTHESIS "sufficient condition" resp.	*Principle of the necessary condition (incomplete explanation or prediction)*: EVOLUTIONARY THINKING (ascendende from the potential to the actual), SYSTEM THINKING (ascendence from the abstract to the concrete) "necessary, but

	"no condition at all"	not always sufficient condition"

Tab. 2: The paradigm shift from deductivism to dialectical reasoning

Speaking in terms of formal logic, an explanation or prediction is the deduction of a conclusion from premises such that the conclusion describes what is to be explained or predicted, and that the premises are made up of descriptions of what together is expected to do the explaining or predicting. After Hempel and Oppenheim this scheme is called deductive-nomological, if it couples empirical and theoretical knowledge by subsuming facts (empirical) under some law (theoretical) that covers those facts.

Given a universal implication as a first premise, which represents the covering law, and an instantiation of its if-component as second premise, which represents some initial or side condition, the application of the rule of *modus ponens* derives an instantiation of the then-component as a conclusion which represents just that final condition which was or will be observed. The conclusion must be realized when the premises are the case. *Per definitionem* the truth is transferred from the premises to the conclusion.

The same holds for mathematical or computer operations. Calculations and simulations transform initial data into results in an unambiguous and repeatable way.

Naturalism assumes an extra-human way to look, be it physicalistic or biologistic, for example. In any case, it reduces phenomena of higher complexity in the conclusions to phenomena of lower complexity in the premises.

Anthropomorphism takes the human being as point of departure. This leads to anthropomorphic subsumptions. Thus, the premises of the argument are made to contain projections.

Naturalistic and anthropomorphistic deductivism holds that all phenomena can be explained and predicted likewise. But this is not always so. Because there are cases in which such explanations and predictions do not work – and the reason why they do not work is not ignorance, that is, missing observations or missing hypotheses, but overlooking of the differentiation between necessary conditions and sufficient conditions –, a so-called two-cultures thinking tries to find the solution in a different way of understanding (German "Verstehen") which is a central term in the tradition of phenomenology and hermeneutics.It offers a quite different option and postulates a quite different approach of comprehension which is distinct from the "nomothetic" way: an "idiographic" way. Sectors of reality that can not be explained shall be described and interpreted according to some sense. Since this sense can be any one, this touch of arbitrariness leaves this two-cultures thinking open to criticism for lacking of rational substantiation of its background ideas.

According to the method of explanation and prediction preferred, deductivism stresses analysis by means of dissection as appropriate method of recognition. Non-deductive culturalism, on the contrary, has a rather synthetic approach.

Summing up, naturalism and anthropomorphism can be characterised by the principle of complete deducibility and two-cultures thinking by the principle of nondeducibility.

A fresh look is needed to get out of the trap.

In contrast to the view imposed by naturalism, it is not unscientific to get by without experimental or mathematical methods; in contrast to the anthropomorphistic globalisation of cultural thinking, explanations of natural science are not merely a misunderstood variety of traditional understanding in the humanities; and in contrast to the dualistic culturalism, it is not sensible to divide the applicability of scientific methods along the line dictated by the differentiation of nomothetic and idiographic. Both the naturalistic and culturalistic philosophies are concerned with the description of events and the comprehension of their arising, be this in the form of explanation, prediction or understanding. Such comprehension is achieved when a demonstration of those conditions succeeds, to which a participatory role can be attributed at the onset of the events. Sometimes, such conditions may constrain to precisely one case. The onset of events is then a sequence, which happens out of necessity. What happens out of necessity must of course be possible. Other times, the conditions may constrain to a number of cases. The sequence of events is then a process that happens randomly, but which would be made impossible in the absence of the conditions. The appropriate conditions may thus be described as necessary conditions, which create the possibility of all conceivable cases.

Thus, that immediate necessary condition is sought that makes possible what shall be comprehended. Having found it, explanation and prediction, as a rule, remain incomplete. There is a leap from potentiality to actuality which can only be covered if the necessary condition does at the same time suffice.

Acknowledging historicity, as a maxim, means, accordingly, showing the preconditions of what evolves by showing the possibility of the real. That is, it has to be demonstrated that in the case of comprehending something actual the *status quo ante* includes the actual as a potential or in the case of forecasting the *status quo* includes something to come as a potential.

Acknowledging complexity, as another maxim, means to ascend from the abstract to the concrete, which is no deduction in the formal logical sense. Step by step the reproduction of the object of comprehension is enriched with newly added specifications.

In contrast to the old approach whose leitmotif is looking for the "necessary and sufficient condition" resp. looking for anything else because there is "no condition at all", the new principle is the search for the "necessary, but not in all cases sufficient condition." This principle will garantee the unity of methods.

A fresh perspective on our real world

Mechanism is the ideal toward which mainstream thinking in the (natural) sciences tends. This is materialism in that it denies ideal causes. All phenomena are explained by reducing effects to causes that are sufficient to produce those effects. If cause and effect are related in such a way that each cause is related to one, and only one, effect, determinism is held to be complete (see Heylighen 1990). This view is considered to be that of strict determinism (see Table 3).

	FROM MECHANISM, IDEALISM AND DUALISM…	TO THE PARADIGM OF SELF-ORGANISATION
2. ontology: modeling the world	*Principle of complete determination (strict determinism)* resp. *indetermination*: COSMOS vs. CHAOS (preformationism/merism and teleo-logism/holism resp. dichotomism: necessity – "clockwork" – resp. chance – "clouds") "nothing new" resp. "bolts from the	*Principle of propensities (less than strict determinism)*: CHAOSMOS: OPENNESS, HOLONS (emergentism: evolving system hierarchies) "great oaks from little acorns"

	blue"	

Tab. 3: The paradigm shift from strict determinism to less-than-strict determinism

Strict determinism assumes that the causal relations in the universe are as compellingly interconnected as are the logical and mathematical relations in our minds

In strictly determined events, mechanisms are said to be at work that necessitate the transformation of particular causes into particular effects. Here *causa aequat effectum* or *actio est reactio* – as Newton's dictum may be interpreted (Fleissner and Hofkirchner 1997). Popper (1973) called this a clockwork view of the universe which the Demon of Laplace is likely to fancy. It takes the original meaning of the term "cosmos" seriously: total order.

As to the evolutionary character of the world, the new is completely determined by the old so that there is nothing new at all. Evolution is understood as the unwrapping of something that is already there before it is unwrapped. Preformationists claim just that.

As to the systemic character of the world, the whole is completely determined by its parts. There is no whole that is "more than the sum" of its parts. The world is explained by summarising all its parts. This may be called merism (e.g., atomism).

The opposite of the mechanistic view is idealistic determinism. This determinism may be as strict as that of mechanism; the difference is that the causes do have an idealistic element. Some of the humanities tend to be biased this way.

Evolution of whatever is said to evolve seems to be strictly governed by a *telos* that determines current developments by future. It is a pull-model, in contrary to the push-model of mechanism. This is known as teleology.

Moreover, systems seem to exert a strong pressure by way of downward causation on their elements. This is called holism.

The opposite of both materialistic mechanism and idealistic determinism is dualistic indeterminism. It denies that effects are caused and holds that therefore there is no sense in ascribing cause-effect-roles to events or entities. From this perspective the world is heterogeneous, fragmented and disintegrated, and it falls apart in disjunctive sets. Dualism overlooks continua and is neglectful of the old and of parts which dichotomises old and new as well as parts and wholes. Old and new do not depend on each other; neither do parts and wholes. Evolution is as undetermined and history as arbitrary as the order and the logic of the structure: it is chaos, total disorder. Becoming and being is like with "clouds" (as Popper put it) which are unpredictable and irreducible.

The unity of reality, however, can be established by decently interpreting and generalising the results of research into self-organization that make clear that mechanical systems represent a subset of all real-world systems only. Put more

precisely, they are systems at or near the point of thermodynamic and chemical equilibrium. In the case of systems that are far removed from such equilibrium (i.e. in which they are exposed to fields where the unequal distribution of free-energy flux density has exceeded a critical value), the well-known phenomena of self-organisation appear.

In the case of self-organising systems, events are not strictly determined, the effect is not predictable because it is the system that intervenes in the chain of cause and effect and introduces a degree of freedom that cannot be forced into a single alternative. The effect is emergent, promoted by the self-organization of the system, that is, it produces something new or some whole. Thus, *causa non aequat effectum, actio non est reactio*. This is neither strict determinism nor indeterminism, but a less than strict determinism. It attributes cause-effect-roles, but does so without coupling them unambiguously so as to let causes have different effects or to let effects have different causes (see again Heylighen 1990).

Emergentism paints a new picture of the world: it is neither cosmos nor chaos, but bears features of both; it is "chaosmos" – a term coined by the French philosopher Edgar Morin (1998).

Regarding the aspect of becoming, of process and evolution, the universe and its constituents are considered open in the sense that future is not predestinate. Systems realise possibilities of further development, and, when the carrying-out of system-specific functions reaches its limits, they may or may not switch over to a higher level of organisation and thus to a new quality of existence in form of a metasystem. Diachronous emergentism holds that the old is only the necessary condition for the new, i.e. the new cannot come into existence unless the old provides the preconditions for the start of the new. But the new is not completely determined by the old. There is a degree of freedom in the new that cannot be reduced.

Regarding the aspect of being, of structure and systemic hierarchy, the entities of the universe are essentially "holons" (as Arthur Koestler described, e.g. 1989). That is to say, as a rule, the systems have subordinate subsystems and are themselves components of supersystems. Together they form a layered structure in which the systems that arose in later stages of the evolution process are found on higher levels, the older systems on lower levels. Synchronous emergentism holds that the parts are only the necessary condition for the whole, that is, without parts there is no whole, but the parts alone do not necessitate the existence of the whole. The whole, being not completely determined by its parts, does in turn not completely determine its parts. An irreducible degree of freedom resides in the whole as well as in the parts.

Thus, contrary to the strict determinism of mechanism and idealism and contrary to the indeterminism of dualism, ontologically, the core of the paradigm of self-organisation is the principle of less-than-strict determinism which can be characterised by the assumption of "propensities" rather than eternal "laws" or the lack of any regularities. This is an idea of late Popper (1997). The motto is neither "same results from same conditions" nor "bolts from the blue", but "great oaks from little acorns."

A fresh perspective on strategies

Modernism is the ideology of modernity. Modernity is that age of history of mankind in which a particular type of civilisational development is said to predominate. This mode of civilisation has its roots in the Christian-occidental mode of science and technology whose innovations are seen as the driving force of society. Today, the western type of science and technology, the related industrial and computerised takeover of the natural world, and the resulting uniform culture of capitalism, democracy and human rights are the main features of modernity.

The conviction of modernism is that progress in science and technology is automatically translated into progress in society. Thus everything that can be made shall be allowed for. And, in principle, there is no such thing that is not capable of being made (at least, there are only few of them). Nature, e.g., can be changed as humans like.

This modernist view may be traced back to the Bible. It can be called "dominionism", because it aims at erecting a dominion over the world we live in. It is an optimistic view for those who are in power: it implies that everything can be managed, steered, planned, that is to say, everything can be controlled totally, if there is the will to do that (see Table 4).

	FROM MODERNISM, FUNDAMENTALISM AND POST-MODERNISM…	TO THE PARADIGM OF SELF-ORGANISATION
3. axiology: visioning the world	*Principle of complete controllability (dominionism) resp. uncontrollability*: EXPENSIVE INTERVENTIONS (steering, planning; functionalising cause-effect relations as if linear) resp. NON-INTERVENTION "management" vs.	*Principle of evolutionary systems design (governance):* MAKING USE OF THE INHERENT DYNAMISM (facilitating or dampening), INFLUENCING THE GENERAL SET-UP (concretisations by lower levels) "smart, fuzzy, indirect control by irritation",

	"inviolability"	"partnership"

Tab. 4: The paradigm shift from dominionism to evolutionary systems design

Interventions aim at producing final states which are desired by functionalising cause-effect relationships in that way that the causes equal the initial states from which you depart and the effects equal the desired states at which you will arrive. Interventions are operations linearly sequenced.

Interventions may be expensive in that the means used is not as efficient though they are effective in that they yield the desired result. But it may be a big effort to put the means at work. And the means may yield undesired results, too.

Anti-Modernism in the form of fundamentalism, can be characterised by the same belief in intervening in the world. It can be said to differ from modernism only in emphasising the final cause, for it prioritises values, ethics and morals opposite to those of modernity.

Anti-Modernism in the form of the ideology of postmodernity, refuses interventions at all. From the experience of modernity being confronted with all the undesired results – side-effects in other domains of our world, local and far-distance effects, and short- and long-term effects – which are detrimental to our survival it concludes the imperative of non-intervention: the world is taboo. Nature, Creation, fellow humans are treated as inviolable.

Hence, the principle of complete controllability resp. the principle of uncontrollability are typical of modernism and fundamentalism resp. postmodernism.

Both principles, however, are counterproductive. They do not assure the unity of practice. They do not show a way of how to get a grip on the complex and global problems.

On the one hand, carrying on along the path of modernity cannot make itself plausible (in the way that a simple increase in science and technology with the same economic drives and political framework conditions could bring about a qualitatively changed situation), if the present situation is in debt to a lower quantity of the same development. In this conservative variant, continuity is made absolute and the necessity or possibility of a jump in quality is denied. Either the solving of global problems is seen as something with which, in the framework of the modern age, can be coped with, without needing any modifications of civilisation's development, or the existing situation is attributed with a problem-solving capacity on a vastly different scale, because obstacles are not recognised. In neither case is there a need for action.

On the other hand, the call for a U-turn would throw the baby out with the bathwater if it proposed something radically different here and now, without consideration of development so far. It believes it would have to do without any modern science or technology, just as it would have to forego modern economy and politics. This radically utopian form of socio-political guidelines makes discontinuity absolute, and

denies the possibility or necessity of the continuation of certain relationship structures in societal development, it dualises the bad reality and desired good to the point that every possible course of action becomes superfluous.

Apart from these two alternatives, there is a way out that stresses the possibility and necessity of both discontinuity and continuity in the scientific-technical development which is enclosed in the societal one. Eventually, after centuries of predominance of the modern, Western-controlled (natural) sciences, a paradigm change is on the way. However, this new view does not need to, indeed must not, be a return to pre-modern contemplation.

The global problems have their cause, finally, in socio-political developments, but they are accelerated by scientific technological progress, and they can also only be brought towards a solution when social and technological changes are interconnected. Science and technology can do justice to their original purpose – to alleviate human life and generally make that life more pleasant – only when 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., when their programme is executed with respect to the ideals of the survival of humanity in a future in which it is worth living, and when 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.

This is the principle of evolutionary systems design. Taking into account that reality is something emergent and therefore something contingent, it may take advantage of the fact that little causes may have big effects and may ascribe to irritations to which self-organising systems are exposed the role of triggers only, thereby making use of the inherent dynamism of the system in trying to facilitate the original process or to dampen it. So, it is not complete control and it is not no control over self-organising systems, it is a kind of smart, fuzzy, indirect control. It sets the stage for self-organising processes by influencing the general set-up only, regarding the hierarchical levels of encapsulated systems.

In treating the world we live in alike, governance will arise.

Objects of action, of reality and of consideration

Having dealt with the paradigm shift from the reductionistic, projective and disjunctive way of thinking to the integrative one in all three dimensions of the world view, it is worth underlining the close relationship between the dimensions within each paradigm.

Let us distinguish between objects of action, of reality and of consideration. Objects of action (O_a) are the ones which are acted upon. Objects of reality (O_r) are the ones existing as such. And objects of consideration (O_c) are the ones in our heads. Eventually, they are identical.

And let O_x^1 and O_x^2 indicate either the same object at two different points of time or two different objects at the same time and let the arrow indicate a linear transformation and the broken arrow a transformation involving ambiguity.

According to the way we (think to) act on objects, we fancy how they exist independently of our actions. And according to the way (we think) the objects exist, we apply methods of investigation and representation to them.

And according to the way we (think to) link objects in action, (we think) they are able to be linked in reality, and according to the latter (we think) they have to be linked in our cconsiderations.

Now, the paradigm which is to be overcome can be characterised in the following way (see Figure 1): given dominionism, the action is a linear operation which leads from one object to another like an initial state leads to a well-determined final state; this corresponds to reality, given strict determinism, in which one object is connected to another like a cause that is connected to its necessary effect; this, finally, corresponds to consideration, given deductivism, for which one object necessitates the other like premises that necessitate the conclusion in a compelling inference.
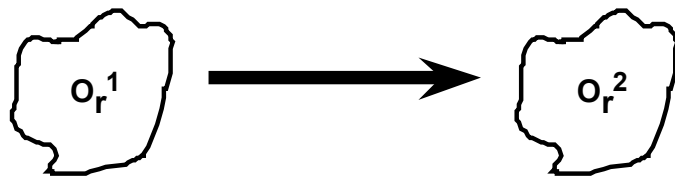
objects of
consideration
O_c^1, O_c^2

o_c^1 → o_c^2
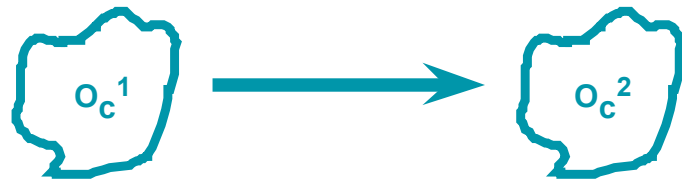
DEDUCTION
(NATURALISM,
ANTHROPO-
MORPHISM)

premises   (compelling)
inference   conclusion

- - - - - - - - - - - - - - - -

*objects of
reality*
O_r^1, O_r^2

o_r^1 → o_r^2

*STRICT
DETERMINATION
(MECHANISM,
IDEALISM)*

*cause   (pure)
necessity   effect*

- - - - - - - - - - - - - - - -

**objects of
action
O_a^1, O_a^2**

o_a^1 → o_a^2
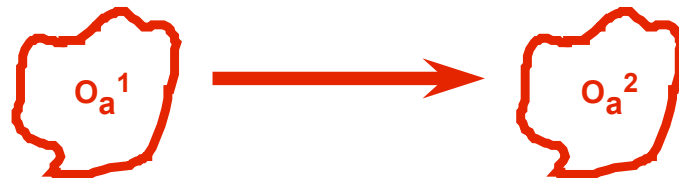
**DOMINION
(MODERNISM,
FUNDAMENTA-
LISM)**

**initial
state   (linear)
operation   final state**

Fig. 1: Objects of consideration, reality and action according to the old paradigm

Contrary to that, the paradigm of self-organisation may be characterised as follows (see Figure 2): the objects of consideration are coupled in a dialectical manner, the first one representing the necessary condition for the second, and the second representing a new quality (sublation after the Hegelian "Aufhebung" means abolishing as well as keeping as well as raising); this corresponds to the first object of reality being the base for the second one that emerges in a contingent way like propensities suggest; this, finally, corresponds to objects of action that are designed by triggering facilitating or dampening processes so as to arrive at desired outcomes.

objects of
consideration
O_c^1, O_c^2

DIALECTICAL
REASONING

| | ne-cessary condition | sublation | new quality |

objects of
reality
O_r^1, O_r^2

REAL-WORLD
PROPENSITIES

| | basis | emergence | contingent reality |

objects of
action
O_a^1, O_a^2

EVOLUTIONARY
SYSTEMS
DESIGN

| | trigger | facilitating or dampening | desired/ undesired outcome |

Fig. 2: Objects of consideration, reality and action according to the new paradigm

Thus, strategies in the new millennium have to be based upon the real-world implications and comprehension implications of the paradigm of self-organisation.

References:

Fleissner, P., Hofkirchner, W. (1997): Actio non est reactio. An extension of the concept of causality towards phenomena of information. In: World Futures 49/50, 3-4/1-4, 409-427

Heylighen, F. (1990): Autonomy and Cognition as the Maintenance and Processing of Distinctions. In: Self-Steering and Cognition in Complex Systems, Toward a New Cybernetics, Heylighen, F., Rosseel, E. and Demeyere, F. (eds.), New York, 89-106

Hofkirchner, W. (1998): Emergence and the Logic of Explanation. An Argument for the Unity of Science. In: Acta Polytechnica Scandinavica, Mathematics, Computing and Management in Engineering Series 91, 23-30

Hofkirchner, W. (1999): Ways of Thinking and the Unification of Science. In: Proceedings of the 43rd Annual Conference of ISSS (The International Society for the Systems Sciences), Allen, J. K., Hall, M. L. W. and Wilby, J., (eds.), ISBN 09664183-2-8 (CD-ROM)

Hofkirchner, W. (2001): The hidden ontology. Real-world evolutionary systems concept as key to information science. In: Emergence 3.3, 22-41

Koestler, A. (1989): The Ghost in the Machine. Arkana Books

Morin, E. (1998): Homeland Earth. A Manifesto for the New Millennium. Hampton Press

Popper, K.R. (1973): Objektive Erkenntnis. Hoffmann und Campe, Hamburg

Popper, K.R. (1997): A World of Propensities. Thoemmes Press