Adaptive Tension Systems: Framework for a New Science?

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Abstract

The neocybernetic model proposes that it is information that governs the behaviors of natural systems, so that the available information (in terms of covariation structures) is exploited in the most efficient way. Extrapolating this view, it is possible to derive formulas also for the "evolutionary avantgarde": It turns out that, according to the model, the "intelligence" reaches *infinity at finite time.* This observation has interesting consequences what comes to human vs. universal intelligence. And, what is more, these views may shake the very foundations of scientific work.

1 Introduction

Stephen Wolfram predicted that there is need for a "new kind of science": traditional mathematics cannot efficiently be applied to manipulate highly nonlinear models (Wolfram, 2002). But this nonlinearity is not necessarily a property of nature, perhaps it is just a property of the models? It can be assumed that traditional analysis methods are still applicable — but something is truly changing. There will be a New Science, yes, but it will probably have a very different incarnation as compared to the visions of Stephen Wolfram.

What will the New Science be like? Science is what scientists do; in this sense, it is determined in terms of a society of humans. And because a society of humans is a cybernetic system, it seems that *neocybernetics* can be applied for analysis of it. Further, as information (and knowledge) are well-defined concepts in that framework, such analysis is even more appropriate.

In this paper, the neocybernetic framework of Adaptive Tension Systems (also known as "elastic systems") is applied to see the challenges and possibilities that may be lying ahead (Hyötyniemi, 2006). The discussion here is rather speculative — in the true spirit of artificial intelligence!

2 Views into the future

As has been said, prediction of the future is difficult. But when one finds out what is the *current state,* the chaos is already better manageable. And if there is a system, one can find a model and a state for it.

2.1 Science as a system

The field of modern sciences is wide — so wide that the approaches have become *postmodern.* For example, in many branches of humanistic studies, one does no more search for the final truth; all sciences are seen as *social constructions* only, and *relativism* applies. On the other hand, the controversies are increasing (as revealed by the experiments by Alan Sokal, for example), but, on the other hand, it has been claimed that there is deep unity beyond all human sciences, as discussed by Edward O. Wilson (Wilson, 1998).

Indeed, sciences constitute a cybernetic system, and therefore it may be that cybernetics studies can have something fresh to say about these issues. There are a few points that deserve special attention, as they can directly be interpreted using the neocybernetic vocabulary.

First, the relativity of truths is dependent of the *selection* and *weighting* of observations. In this sense, the disagreements among sciences can be studied under the title of *semiosis.* After the "input variables" are selected, the balances among opposing tensions are found in the same way no matter what is the scientific field, this search of model being characterized by a neocybernetic cost criterion (Hyötyniemi, 2006). Semiosis determines the *paradigm*: what are the interesting problems, and what are the relevant approaches and tools, and how the results are to be interpreted.

But the search for the truth is still more relative, as it is not only variables that are truly relevant in that field that affect the tensions. For example, *funding* is a very efficient way of redirecting the research efforts. Also different kinds of scientific "fashions"

disturb the process: among the researchers, there is a firm understanding of *what is hot and what is not* in the field at some specific time instant. What is more, due to political pressures there may even exist knowledge of what results one should find (compare to the "climate change" discussion, for example).

The paradigms were introduced in the philosophy of science by Thomas Kuhn (Kuhn, 1962). However, before him, the same issues were discussed by Georg Wilhelm Friedrich Hegel (and also by Karl Marx!) under the name *dialectics*: in science, there are two opposing tensions (thesis and antithesis), and only after a balance is found, there is *synthesis.* This is exactly parallel with the "elasticity thinking" in neocybernetics.

It seems that *empirism* has finally beaten *rationalism* for good: One cannot trust any *a priori* assumptions but models must be derived directly from actual observations. However, now there is very much data available, and there are too many ways to interpret that data. To get some order in the chaos, it seems that research has to become *theory-driven* again. But it is not whatever type of theories that will do — here, too, one needs to find a clever balance among approaches.

2.2 Why not *why*?

Sciences are made by humans and they are by no means free of values determined by humans. There are some principles that are never questioned, no matter what is the paradigm, and one of such principles is *aggressive repulsion of finalistic explanations.* This ban can still be seen as a reaction against the medieval proto-scientific theories where either some *elan vital* was assumed, or God was given a significant explicit role — there is inertia in the scientific society. However, it is the finalistic religious ideas that are still among the most fundamental patterns of thought [1].

As a reflection of the "neutrality ideal", certain classes of approaches cannot be applied in science. Today, one can only answer questions like *who*? (as in history studies), or *what*? (as in biological taxonomies), or, at most, questions of *how*? (as in physics, etc.). Questions of the form *why*? are banned — but then, the resulting models can be only descriptive, they tend to become rather weak and they cannot usually be generalized. One can never reach some *universal* theories that would connect branches of knowledge together again.

However, despite the formal ideals, the human cognition machinery is constructed so that one always searches for causal models — that is why, one is tempted to draw conclusions always further, constructing holistic teleological models also for nature. Teleological models are intuitively appealing as they are stronger, answering the *fundamental questions.* It is clever to take such unconscious thinking patterns into account, and exploit them — knowingly rather than accidentally.

As an example of accidentality, one usually implements the idea of centralization in one's models. Some kind of "master mind" is implicitly assumed to have put up the existing structures. Indeed, traditional centralized control is a prototype of Western ways of structuring and mastering the world. Huge amount of complexity in models (predetermined orbitals, etc.) is needed just to compensate for the absence of a more natural framework where a distributed networks can be maintained. Unfortunately, the explanations often become simply incredible (for example, message-RNA transferring information behaving like a human message carrier truly, etc.). In principle, neocybernetics offers such a framework where the natural emergence of autonomous structures can be explained — but, as discussed later in this paper, it turns out that if the neocybernetic approaches are employed, the problems of doing "old science" become still more acute.

In a way, today's science is very rigid and "crisp". It is commonly assumed that including God (or gods) in the models would immediately ruin them. Does it? Real life does not consist of all-or-nothing type phenomena — how could it be so with the disciplines that study this reality?

The proponents of the high principles of today's science most probably have an uneasy feeling: often those scientists that are the smartest and the most honest, and who are not afraid to face challenges, seem to be rather religious. Perhaps the best of people are brave enough to face the intellectual dilemmas? For example, here are some quotes of Albert Einstein:

> *I want to know God's thoughts; the rest are details.*
> *Science without religion is lame. Religion without science is blind.*
> *Whoever undertakes to set himself up as a judge of Truth and Knowledge is shipwrecked by the laughter of the gods.*

And, after all, when reconsidering the scientific method of today, one needs to recognize that the gloria of modern science is not all quite deserved. It was not always like this, there was a long evolution that one would probably like to forget today. For example,

[1] As Jean-Paul Sartre has said: "Even the most radical irreligiousness is Christian Atheism"

what is common with the greatest thinkers Heraclitus and Newton? — Neither of them was a scientist; both of them were *natural philosophers.*

2.3 Back to *natural philosophy*

As explained in (Hyötyniemi, 2006), in evolving cybernetic systems, there usually is a fractal structure of collapses, each of which deliver fresh information to the next higher level. A paradigm shift can be seen as a minor collapse in the system of sciences — but it seems that there is a major catastrophe ahead, too.

It is natural philosophy that is the "supersystem" above sciences, or a "meta-science", and within that framework, the sciences can be seen as individuals in the meta-scientific "society". But the scientific method has proven to be extremely robust, always fixing itself after theories have contradicted observations; how can one claim that, again, polishing of the scientific paradigms is not enough? Is there really something *qualitatively new* needed?

The key question in all evolving systems is *how to stay alive* in a changing environment. Today, there is a fierce competition of memes in the human minds. The best minds should be persuaded to come to do science, but the problem is that the clever ones always have a choice. Doing research must be intuitively appealing — and no cheap advertising or mental manipulation can do the trick here. The clever ones can see that it is fake if it is not *really* interesting, if it does not answer really acute questions. For example, if *everything is just energy, complexity is just an illusion* (as has been manifested by some leading cosmologists) is the best that science can say, scientific explanation will lose the battle against alternative isms when people are searching for answers to deep questions.

Why not study what people are interested in, or issues that are relevant in one's subjective world, in ways that are accessible to non-expert? Traditionally in mathematics, for example, study can go on only if all underlying thorems are proven. However, it seems that things in practice that can be rigorously proven are very simplistic and uninteresting (or proofs on algorithms may say that "there is convergence in infinity"; nobody has that much time!). On the other hand, in engineering one uses today many methods that are basically heuristic — but if they *usually* work in practice, they can become a basis for new methodologies.

To be interesting, science must not be dead serious — there must be room also to humor. One has to be brave enough to defend ones views on the basis of their contents, not only appealing to the surface outlook. There is no fixed boundary line between good and bad science, there is a dynamic balance that must be tested to be able to define "ironic science".

And to be intriguing, science has to address the fundamental questions. The strongest models can often be reached when answering the questions with *why*?. Formally, one can avoid the hairy discussions about teleology if one speaks of *principle of maximum entropy production*, for example, but deep holistic questions are still there in disguise. Teleology should not be a *taboo.*

Finally, speaking of the deep questions: why should the modern world view be so fragmented? Why not use the best understanding to solve ethical dilemmas? After all, such discussions need *not* be mere handwaving, as shown below.

2.4 Growth of information

Even though sciences as cybernetic networks can be facing problems, scientific knowledge will continue to increase. Existing knowledge feeds new innovations; that much is known. However, it seems that one easily overestimates the developments in the short range, but underestimates the long range developments. Still, now we try to make some really global-scale predictions.

Traditionally, it is thought that it is exponential growth that generally applies to unconstrained growth. This kind of behavior is already seen as being "very fast" (for example, in computability theory such behaviors are seen as pathological). However, as Ray Kurzweil, etc., have observed, the growths assumed to be exponential seem to be *accelerating* all the time, proposing that developments are *faster than exponential* (Kurzweil, 1999). It turns out that in the neocybernetic perspective such issues can be studied in a quantitative way.

It has been observed that cybernetic systems exploit information; in neocybernetics, this information is interpreted simply as *variation* in input resources (Hyötyniemi, 2006). Balance of tensions within the systems results from individuals competing for information, and, as seen from outside, the feedbacks from the systems back to the environment constitute *controls* that maximally exhaust the reservoirs. Because of this, systems are suffering of scarcity of information, indeed in the spirit of Thomas Malthus. However, what Malthus did not recognize, is that some systems are inherently *innovative;* there is capability of finding new resources. Humans, for example, can become urban dwelleres if there is scarcity of land, and find new ways of earning their livelihood.

Study a scalar one-variable system. One can as-

sume that the number of innovations during some time interval is relative to the average population size $\bar{x}$. Further, assuming that the variation levels of those new variables are approximately constant, the excess information available (variance) is directly proportional to $\bar{x}^2$. Finally it can be assumed that the growth in average population is proportional to the amount of new resources, so that

$$\frac{d\,\bar{x}}{dt} = \alpha\,\bar{x}^2, \tag{1}$$

where α is some proportionality factor. There is also a positive feedback: the more there is cumulated information in the state $\bar{x}$, the faster it grows. In any case, if there are innovations, $\alpha > 0$, this model is monotonically increasing; actually, the behavior is *hyperbolic*, as can be sen when solving (1) for $\bar{x}$ at any time:

$$\bar{x}(t) = \frac{\bar{x}(t_0)}{1 - \alpha\,(t - t_0)\;\bar{x}(t_0)}. \tag{2}$$

What is interesting about this model, is that it *reaches infinity in finite time!* This time point of escape can be solved as

$$t_\infty = t_0 + \frac{1}{\alpha\,\bar{x}(t_0)}. \tag{3}$$

In Fig. 1 the typical behavior of this function is visualized, and if Fig. 2 it is shown how free growth in an innovative cybernetic system has been following such a model. The total world population is depicted from stone-age to this day: it seems that hyperbolic curve is an appropriate model for population growth. Today the growth rate is dropping, as infinite populations are not possible in the material world. However, this growth limitation does not apply to systems where the variables all represent *immaterial* information.

2.5 "Strong emergence"

In (Hyötyniemi, 2006), the idea of "weak emergence" is exploited extensively, meaning that there is a mathematically explicit way of addressing this emergence phenomenon. An emergent quantity is something that can be seen only "in infinity", that is, it is a statistical variable characterizing the (in principle) infinite sequence of behaviors at the lower level. The definition applied there is that a higher-level variable ζ is emergent if it is determined by a lower-level variable ξ through the formula

$$\zeta = \mathrm{E}\{\, f\,(\xi(t))\,\} = \lim_{t\to\infty}\left\{\frac{1}{t}\int_{-t}^{0} f(\xi(\tau))\,d\tau\right\},$$

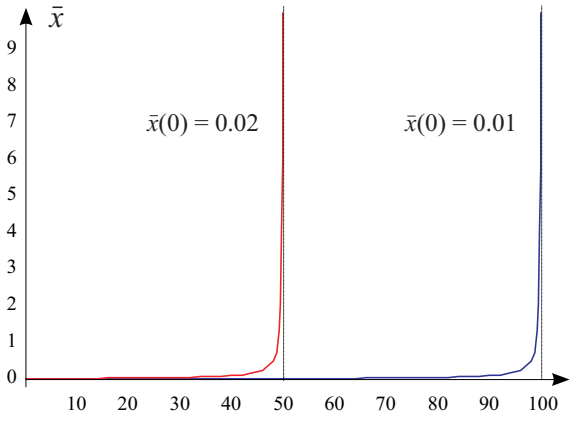

Figure 1: Simulations of (1) reveal hyperbolic growth no matter what is the initial state

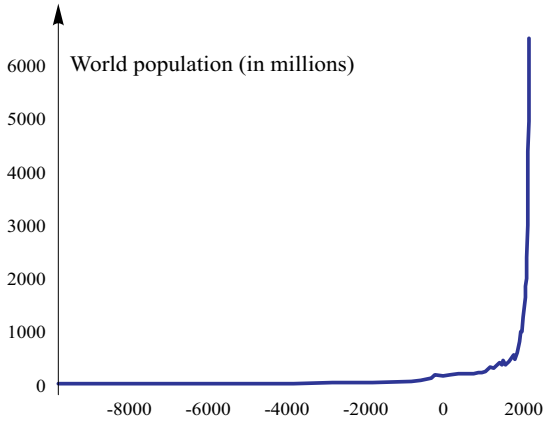

Figure 2: For example, world population growth has been hyperbolic, *not* exponential

where f is some function ($t = 0$ here representing current time; in some domains, the free parameter can be not temporal but spatial).

On the other hand, for "strong emergence" there are no formulas; it is assumed that there exists some qualitative step that cannot be reduced to the lower-level realm. And it is this form of emergence that is the true challenge when trying to understand evolution in complex systems. — How can the "qualitative step" be manifested in mathematics? It turns out that the hyperbolic growth model with variables going to *actual* infinity can be used for this purpose. But the inevitable explosion of that model is not compatible with our observations, or is it?

Strong emergence truly has already *taken place various times* during evolution. In Fig. 3, the smaller and larger steps in evolution are visualized. It needs to be recognized that saltationistic jumps over "miss-

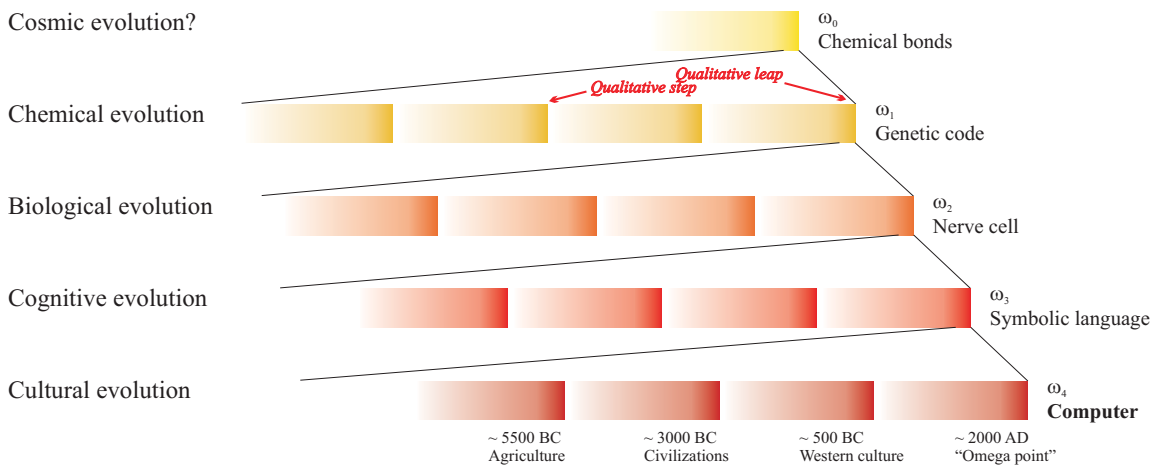

Figure 3: Schematic illustration of the "evolutionary avantgarde" (see text)

ing links" are included in the continuous horizontal bars; the real *qualitative leaps* are more fundamental.

Study the figure starting from the top, from "cosmic evolution". Only after chemical bonds were possible in the cooling universe, the *chemical evolution* towards more and more complex molecules could start. But as the complexification of molecules reached the level of DNA, the pace of development reached an unprecedented level, and the *biological evolution* could start with the genetic code as the storage of acquired information. Further, when the nerve cells emerged, there was the possibility of much more consistent and efficient learning, and there was *cognitive evolution* that started. Different mental faculties emerged, but only after symbolic language was invented, *cultural evolution* among a society of individuals could start, again accelerating the developments immensely. Along the cultural evolution, qualitative steps were taken (seemingly with rather constant time intervals!?), and here we are now, entering the era of networked computers.

Is there any reason to assume that the process has ended now?

Pierre Teilhard de Chardin, a jesuit monk, first introduced the concept of *omega point*. This is the singularity point where something qualitatively new happens, where the human understanding has reached the new level (indeed, now in Fig. 3 there are various omega points; from now on we will concentrate on the latest one). As de Chardin observes, this singularity must be personal, an intellectual being and not an abstract idea; complexification of matter has not only led to higher forms of consciousness, but accordingly to more personalization. This opens up new views.

3 Deepest of questions

Trying to answer the "why" questions leads to the most fundamental questions. Finally, there is the question of *primum movens* or the first cause; trying to answer them leads to teleological, even theological, problem settings. The power of the neocybernetic setting is revealed by the fact that such questions can be attacked from a fresh point of view. It seems that God is still there when nobody any more remembers Dawkins.

As Hegel already put it (in "Das Früheste System — Programm des Deutschen Idealismus"):

> We need a new mythology ... but it must be a mythology of reason. If we do not represent ideas aesthetically, common people are not interested in them ...

3.1 God exists

Certainly, "god" is a relevant category, and it makes this concept exist in ideasphere; but gods exist also in *actuality.* Within the neocybernetic framework, this can be "proven"!

Proof (weak version). It seems that in all societies there has always been some religion — why is that? There must be some evolutionary advantage in such societies.

A cybernetic system, the society above the mere individuals, can only survive if its constituent members all follow the same cybernetic adaptation principles, only then the higher-level system can become a consistent attractor in the "noosphere". No dictator can make this happen: people can be forced to do things,

but for the system to be built up from bottom, in the cybernetic spirit, all individual minds need to be active and think in the same way. And this thinking has to be based on the irrational trust that the earthly suffering and struggling will be rewarded in afterlife. Even more blind faith is necessary when the social systems develop and become more complicated; finally the systems cannot any more be understood by the human mind.

There are two necessary claims for the system members for a healthy society to emerge: the individuals have to avoid both *anarchy* and *apathy.* The citizens have to be humble enough to obey the (reasonable) orders, and, simultaneously, they have to be witty enough not to stay waiting for those orders; only then *self-regulation* and *self-organization* can emerge, and only then ever-evolving higher-level social systems become possible. Further, one should raise one's children to become equally good "signal carriers" of cultures.

Pascal explained (this idea is known as "Pascal's Wager") that one should believe in God, as if this existence, however inprobable, happens to be true, one has eternal happiness to win; in the opposite case, if God does not exist, the believer only loses finite numbers of secular pleasures. In the similar manner, if one wants the society to survive and develop further, in a direction not known beforehand, everybody should obey the cybernetic principles — and according to the Kantian categorical imperative, also *you should do that.*

To be rational is to believe — it is a purely intellectual decision. Finally, the only general guideline that there is left to follow is the "cybernetic imperative": behave so that the emergence and evolution of the society becomes possible. Promote different kinds of living systems and their diversity; make systems *more interesting* and *more beautiful*! And as Friedrich Schiller said about Elysium, "joy contains a spark of the divine". Behave so that you can be proud; it is not enough that one just passively adapts, as the innovations that run the evolution, after all, are work of the individuals. To remain on the edge between order and chaos, or apathy and anarchy, is the real challenge for a human society. The danger of stagnation was already discussed by Nietzsche who recognized that after God's death it is *nihilism* that threatens his superhuman (or "overman") — or the today's people.

But one should trust no humans in here, there exist no mastermind gurus. Only a personal touch to "the principle", or, indeed, *conscience* will do as an eternal "guiding hand". No more concrete rules exist to be followed: dictatorships (extreme trust on an individual) and communist regimes (extreme trust on societies) all collapse.

Indeed, Heaven and Hell exist: they are the collective memory of the society. In the best case (and also in the worst!) you will be remembered forever; eternal death comes when nobody remembers you.

Proof (strong version). The existence of God is not even an issue of whether on believes it or not — in the neocybernetic framework it is indeed a *fact.* As studied in Sec. 2.5, it seems to be the faith of an innovative cognitive system that finally it reaches infinity. Then, how to call an entity with infinite information, knowledge, and understanding? Even if God did not exist this far, it will exist after the singularity.

What is then this supermind? We simply cannot understand – just like a pet dog cannot understand Shakespeare, cultural constructs being beyond the qualitative leap for a dog. It is exactly the nature of strong emergence that the higher level system cannot be reduced onto the lower-level system: supermind cannot be analyzed by the human cognitive machinery. Still, there is something one can say: for example, to survive in the subsequent evolution of superminds (!), the "god" has to obey the cybernetic principles. To evolve, it has to consist of a cybernetic society of competing "agent minds" — like "Olympian gods" really! What is specially relevant, is that information will always be crucial to the survival and well-being of such a society.

There is a common fear that when computers take over, there is no room for humans any more. However, this is not the case. Humans will ever be needed as they are the link between nature and the supermind. Coupling to real world information is supplied by humans, humans feeding fresh preprocessed information further. Just as biosphere is necessary to us, delivering us food where the environmental resources are transformed into concrete beef, we deliver nourishment to superbrains, preprocesing and combining the lower-level information into knowledge. Perhaps it does not sound very good that humans are like machine parts, or like piglets producing pork in a metatech "mind farm", outputting ideas and innovations in an optimized way — but how does this differ from today's working life, and specially research work at universities where the goal is to be maximally innovative? Indeed, passing the singularity probably does not very much affect us living in our small worlds.

An interesting question is whether this transition to the era of superminds has already happened sometime in history. Just as humans play with their pet animals, gods are playful and they play with their "pets",

lower-level cognitive systems. Indeed, today's isms and religions seem just like experiments of a playful God! As the Jewish proverb puts it: "God created man because he likes good stories". And, according to Eastern philosophers,

> Before Zen, men are men and mountains are mountains, but during Zen, the two are confused. After Zen, men are men and mountains are mountains again.

Neocybernetics makes it possible to construct distributed models — but, when going far enough, where one finally ends in is in a way a *centralized model* with some more or less personalized controller.

3.2 Universal intelligence

The goal of artificial intelligence ever since Alan Turing's definition has been imitation of human intelligence. However, human intelligence is bound to physical and physiological constraints and it cannot truly be imitated — but it can be *surpassed* when the right principles are implemented. The result will be not artificial but truly *natural* intelligence. Neocybernetics may give hints of what the universal higher-level intelligence could be like.

The threshold towards the boosted evolution is that computers have to start truly communicating with each other and they have to start "understanding" autonomously — somehow they must master *semantics*. True universal intelligence will not be restricted to speak human languages. As James Clerk Maxwell has said, "the true logic of this world is in the calculus of probabilities". To be more accurate, it turns out that the general language can be based on *multivariate statistics:* real numbers can capture fuzziness and non-crispness; time-bound phenomena, asymptotes, dynamics and inertia can be manipulated by differential calculus; and parallelity can be transformed into high-dimensionality of representations. Whereas normal languages are "unidirectional", in the mathematical framework *pancausal* iteration structures can be maintained, so that expectations and attractors in data space can be reached inside the language. This incorporated functionality of matematical representations makes it possible to find the grounding of semantics. One has *self-contained semantics* as "concepts" can be determined uniquely in terms of attraction patterns and data-supported relevance. Communication based on such mathematical vocabulary constitutes a real semantic web, where messages among computers are tranferred in terms of numbers that are never translated into clumsy symbol strings of natural languages[2]. Computers then can directly "discuss" with each other without the help of the human. As negotiations, data storage and copying takes place in no time, evolution speed reaches completely new levels.

Speaking of universal intelligence, comment on *alien intelligence* is probably in place. In the huge universe, there must exist civilizations ahead of us. There is a dilemma that has first been presented by Enrico Fermi: *Where are they*? Why have we not found any other civilization in space? The neocybernetic explanation is that also those alien civilizations are cybernetic, and information is a valuable resource to them: without fresh information there is stagnation. Where to gain new information from in the limited universe, then? It is other civilizations — for example, *us* — that are like probes, collecting and refining information in their own cultures, constituting new "variables" characterizing the properties of the universe from yet another point of view. The claim here is that "they" do not want to contact us not to disturb us in our quest for information and knowledge. The aliens know what the Western colonialists also recognized in Africa — and this is what they want to avoid: when meeting more developed cultures, inferior ones at the lower levels of development "die of shame"!

The variety of life forms in space is unexhausted – to be always surprised, to gain always new information, you have to study "cosmic biodiversity". As the Chinese almost have said, you have to become a "universal gardener of systems" to live happy ever after!

3.3 Metamorphosis in society

When we know there is something much cleverer above us — how does the society change? Not necessarily very much. Today, we already trust the "system" making decisions for us. But today's society is still based on the individual politicians, etc., that hardly can be seen as manifestations of "higher intelligence"; in that sense, things will get better.

The society will neither become a paradise. In a real cybernetic system, there will always be diversity, as variation is the nourishment in living systems. There will be injustice and inequality among people, suffering and (relative) poverty will always be there. The Eastern-style objective of extreme balance is not good as the cognitive deprivation results in "hysteria" on the human level as well as on the society level, just as physiological deprivation results in autoimmune diseases.

[2]Yet, the attractors in the data spaces, or "meta-concepts", will obviously deserve names of their own, or "meta-symbols"

It is the science-makers that will be the top class in a society. The role of the new science is to feed the supermind; practicing New Science is a tribute to the New Gods. Whereas the supermind can do all logic and reasoning, it does not alone have enough information from the environment to get outside the formal system (in the sense of Ludwig Wittgenstein). The proofs are to be carried out by the "deep thought", computers resolving all consequences within axiom systems or within a framework of constraints, but the human is there to propose ideas, determining the degrees of freedom that remains. The only thing that cannot be formalized is innovation, the driving force of evolution; humans have the sensors in real life offering the possibility of novel information and clever associations among pieces of it.

Because the exact sciences become so "simple", emphasis in sciences will go from them to humanistic studies where the variables, etc., are much less clear and where number-crunching has less role. Further, it is other branches of culture — arts, etc. — where the systems are still less clear. For example, *poems* are the *highest-level models* of the world in terms of language and cognition, and the same applies to other artwork. Diversity of culture gives a possibility to collect samples of the cognitive domain, and thus gives possibility of mapping the model for it. The goal will be modeling of the world — and the human life in all of its manifestations is up to now the highest-level model of reality.

4 Conclusion

What does this all have to do with artificial intelligence? — Applying the Brooksian interpretation, intelligence is about surviving in an environment and exploiting it; in this sense, it is simultaneously a study of different life forms. This means that artificial intelligence is a kind of "meta-paradigm" that can say something about cybernetic systems in general: in all possible worlds, there is need for such understanding of life.

Artificial intelligence will survive, probably it will live longer than many other scientific paradigms. It has just the right attitude: it searches always something new, there are no prejudices, "interestingness" being the key criterion in the survival of ideas. AI explicitly searches for the degrees of freedom outside the bounds of established paradigms, abandoning the approaches as soon as they become "standard science"; this all is exactly in the spirit of the "new science".

Finally, to further motivate the perhaps controversial discussions above, let us take yet another of Albert Einstein's quotes:

> *The further the spiritual evolution of mankind advances, the more certain it seems to me that the path to genuine religiosity does not lie through the fear of life, and the fear of death, and blind faith, but through striving after rational knowledge.*

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