

## The Logic of Constellations

a complementary mode of thinking that is crucial  
for understanding how reality actually takes place

### *Abstract:*

*It is argued that in human thinking there exist two basic modes of connecting mental content. One is the rather well understood and well formalizable “ratio-morphic concatenation” (RMC). This mode corresponds to the factual aspect of reality and it lends itself for precise analysis. Most of the history of “logic” focused on this mode of thinking. There exists, however, also a second, phylogenetically much older, less precisely definable mode of connecting mental content. For this mode the notion “Logic of Constellations” (LOC) is introduced. LOC has hitherto often been addressed with black-box concepts such as ‘intuition’ or ‘gut feeling’.*

*Taking LOC serious as a second mode of thinking in its own right implies to start asking about its internal structures and processes. Analyzing LOC in this way shows that it is composed of three distinguishable sub-dynamics. Firstly there is a process in which the different components of a constellation interpret each other mutually - and thus unfold their specific meaning in their actual constellation. Secondly, there emerges, out of all these ‘bilateral’ processes of semantic unfolding, a global, overarching “picture” or “meaning”. This emergent “big picture” is meaningful, but never well-defined. Thirdly, the overarching picture starts to impact – in a kind of top-down re-interpretation – on its own constituents and sharpens their meaning once again. These three sub-dynamics together constitute the Logic of Constellations. LOC is complementary to RMC and it is essentially an asymptotic, i.e. never completely finished, and thus never well-defined process of “semantogenesis”.*

*LOC is important because it allows us to address the **actual taking place of reality in the time-space of the present**. This actual taking place of reality is an aspect of reality in its own right - complementary to the factual aspect of reality for which RMC is the appropriate mode of thinking. Insight into the existence as well as into the internal structures and dynamics of LOC has implications for very broad range of issues, i.e. for all issues that are characterized by strong self-referentiality and autogenesis. These issues range from foundational topics in science, like the famous “measurement problem” in quantum physics or the emergence of life and subsequently consciousness, to the perception of sense and meaning. But, it is argued, that LOC is equally important for understanding how art and creativity work and for insightful, responsible decision making despite “objective uncertainty”, i.e. for coping with an open, undetermined future.*

## Introduction

The task of this paper is to briefly outline the notion of a „Logic of Constellations” (LOC) and its practical implications. Usually we associate with the notion “logic” rules for connecting different cognitive operations in a formally correct way. In the Western-Occidental tradition Aristotle was the first to raise this issue systematically – and it is astonishing to which degree his pioneering observations are still valid today. The modern version of this classical logic was developed in the first half of the 19<sup>th</sup> century by the great English (autodidact) Mathematician and Philosopher George Boole.

I resorted to the notion of a “Logic of Constellations”<sup>1</sup> when finding that - due to a necessary rethinking of our physics ontology – there must exist a second mode of connecting mental content, complementary to classical logic. LOC is not a variant of a formal logic, like e.g. multi-valued, modal or so-called “quantum” or “temporal” logics. LOC is radically different in at least three ways:

- in LOC the authentic presence of the content that is to be connected is required (i.e. no “place holding” is possible)
- LOC describes the rules of semantic unfolding, this means that the meaning of the involved components is not static, but they unfold their meaning mutually - in and due to their very constellation,
- in LOC there exist no formal conclusions and no formal truth criteria; authentic experience is the only way to judge whether a statement ‘*makes sense*’ or not.

One could question whether, given all these constraints, it is still useful to talk about a “logic” in the first place. I would staunchly defend this, because I think that (a) it is a fundamental, i.e. irreducible mode of connecting mental content, that (b) it is much closer to how we actually think than any formal logic - the latter can even be seen as a very special case of LOC, and that (c) the original, ancient Greek meaning of “logos” – as articulated so forcefully by Heraclites – is much closer to LOC than to any formal logic<sup>2</sup>.

In order to elaborate the notion of a “Logic of Constellations” in its context I will proceed in four steps. First I will briefly recapitulate the needed re-

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<sup>1</sup> See also von Müller, A. (2010) Thought and Reality. In: Towards a Theory of Thinking, pp. 59-70. Heidelberg: Springer.

<sup>2</sup> There is a certain relation to Hegel’s very rich and fascinating notion of logic. This, too, allows for, and is even based on semantic unfolding. Hegel, however, conceptualizes this unfolding as part of a (rather) closed philosophical system, i.e. it is characterized exactly not by the genuine and constitutive openness of the here developed approach.

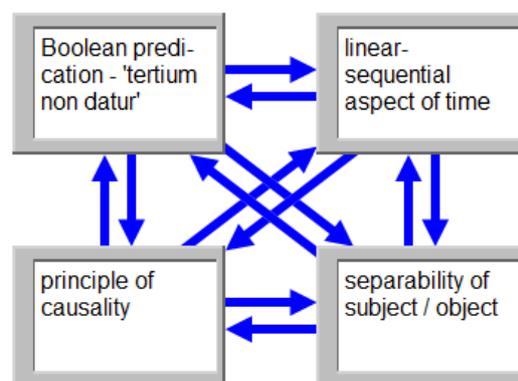
thinking of our physics ontology. As this has been elaborated elsewhere<sup>3</sup> in detail I will only summarize some key point in order to allow the reader to get the general thrust. In the second part of the argument I will derive what follows for advanced cognition, assuming that human thinking is the hitherto most advanced cognitive adaptation to the actual taking place of reality.

The third part will then be a more detailed discussion of the principles and sub-dynamics of the logic of constellations. And the paper will end with a fourth and last part in which some conjectures about possible implications of LOC for cultural cognitive neuro-science and the future development of artificial cognition are derived.

### I. Discovering the Existence of Categorial Apparatus

We know since long, at the latest since the Immanuel Kant's great re-thinking of thought, that "below" all our thinking there are categories. These constitute, so to speak, the interface between thinking and reality. What we were not sufficiently aware of is that these categories don't come in isolation but as an entire "categorial apparatus", i.e. with strong internal interrelations.

There is a "classical" categorial apparatus that constitutes the "factual aspect" of reality. (In the following it is called "F apparatus"). It consists of four fully inter-dependent components:

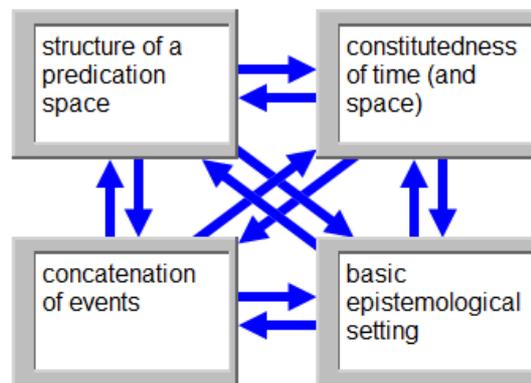


But this way addressing reality is not comprehensive, as we know at least from two independent sources, the advent of quantum physics since 1900, and Gödel's proof of 1931. The incompleteness of the factual aspect of reality automatically poses the question what is there else and how it can be addressed. Complementary to the factual aspect of reality there should exist

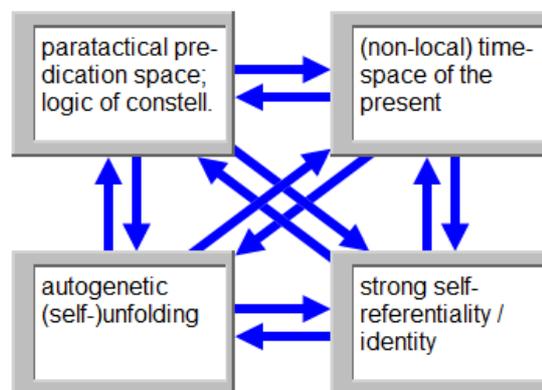
<sup>3</sup> See e.g. Filk, T. & von Müller, A. (2009): Quantum Physics and Consciousness: The Quest for a Common Conceptual Foundation. Mind and Matter, Vol. 7 (1), 59-80.

one in which the “actual taking place of reality” respectively the “self-constitution of reality” (as we see it in the state reduction in quantum physics, or in the phenomenon of strong self-referentiality) can be addressed. Given the close relation between the factual aspect of reality and the F apparatus it is likely that we need a second categorial apparatus to address this second aspect of reality.

Formulating it, however, requires to first understanding the general structure of a categorial apparatus. Asking for the “functional niches” that are addressed by the F apparatus we can identify the following four. Firstly a structure of a predication space was defined (Boolean logic). Secondly a constitutedness of time was introduced (linear-sequential time). Thirdly a way to concatenate events was fixed (causality). And fourthly a basic epistemological setting was established (subject/object dichotomy). These four “slots” thus define the general structure of a categorial apparatus:



Equipped with the insight into this general structure we can now start to ask if a second categorial apparatus can be developed and how it could look like, i.e. by which four alternative components the four slots could again be filled in a self-consistent way. The answer to this question is the E framework with the following four mutually interrelated components:



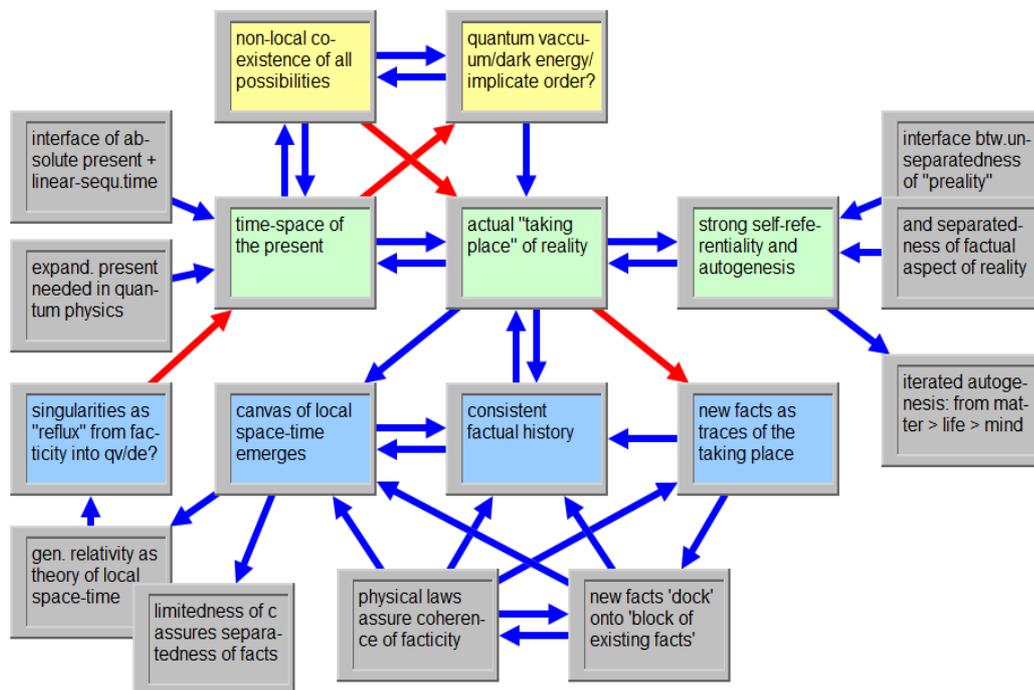
(For a brief characterization of each of the four components see III-V.)

The E framework corresponds to the “statu nascendi aspect of reality”, i.e. the coming into being of reality. Each of its four components leads immediately to massive inconsistencies– if we project them (erroneously) into the F apparatus. But together, i.e. taken appropriately as a categorical apparatus in its own right, they are consistent and stabilize each other mutually – just like the four components of the F apparatus did.

We now possess a significantly richer categorical framework that consists of the “F” and the “E” apparatus, and the two are complementary in a strict sense: No phenomenon can be addressed comprehensively by drawing only on one of the two.

## II. A Novel Account of Time and Reality

Instead of the traditional “facts only” account of reality the combined E and F framework allows realizing and addressing three interrelated layers of reality (marked below as yellow, green and blue).



In this new model of the taking place of reality the blue layer represents the factual aspect of reality. On the right hand side novel facts are constantly added to the already existing ones. In this way it is made sure that new facts don't contradict existing ones, i.e. the consistency of history is assured – by the conservation principles. Unlike in most other models it is assumed that the “canvas” of local space-time emerges only together with factization, i.e.

to apply it already for the pre-factual state of reality (the green, and even more so the yellow layer) leads to irresolvable enigmas and contradictions. **The canvas of local space-time applies to the factual aspect of reality – and only to it – because it emerges only together with factization.**

In this account of reality, the singularities of GRT gain a very important, constitutive role. As it is proposed that the factual aspect of reality can never give a comprehensive picture, the theory *requires* such a “point of irreducible insufficiency” in any F-type theory. The melt-down of the local space-time canvas in singularities provides exactly this predicted loop-hole. And, as also predicted, this “structural insufficiency” of the factual account of reality is directly related to the phenomenon of strong self-referentiality. Singularities occur when gravity starts to impact so much on itself that a “run-away increase ad-infinitum” (within the respective quantum limits) occurs.

A nice side aspect of this novel account of reality is that also the finiteness of the speed of light ( $c$ ) can be derived directly: Infinite  $c$  would make the separability of local space-time collapse - and with it also causality, the applicability of Boolean logic to physics and the subject/object dichotomy would be gone. Only because “it takes some time” to get from one point in local space-time to another, spatio-temporal extendedness – and with it separability as the underlying, crosscutting feature of the factual account of reality – is possible.

The green layer represents the actual taking place of reality in the time-space of the present, i.e. this is where all of reality actually *occurs*. The category of causality can't be applied to this actual occurring. In the time-space of the present reality takes place in and out of itself, i.e. in autogenesis. Hypostasizing hidden causal variables “behind” this actual taking place of reality amounts to a major category mistake – and the violation of Bell's inequalities provides elegant empirical evidence for this.

The green layer can, thus, be interpreted as the ongoing transition into facticity. But, transition from where? The yellow layer represents a radically non-local aspect of reality which can be characterized as the absolute superposition of all possibilities. Possibly this aspect of reality is closely related to the phenomenon of the quantum vacuum and David Bohm's interesting notion of an “implicate order”. Even more speculatively one might relate this aspect of reality to the mysterious phenomenon of dark energy. But these speculations are by no means crucial for the argument presented here. Mentioning them has the only purpose of offering a latching point to the framework presented here for those who struggle with these phenomena.

In sum: What the three-layer model of the taking place of reality should achieve is to provide us with a conceptual framework that (a) overcomes the cognitive *facticity imprisonment* of modern science, that (b) makes address-

able what is there beyond facticity, that (c) explains how facticity comes into being – and that (d) by doing so offers a new way of look at some of the most persistent problems in modern science, like the relation between quantum physics and general relativity.

### III. A Present-Based Concept of Time

A crucial feature of the new account of time and reality is its novel, present-based interpretation of time. The classical, three-pronged schematization of time as “past”, “present” (in the sense of a point-like now), and “future” turns out to be a special case that belongs *altogether* to the (blue) factual perspective on reality. This applies even to the future, because within this F framework the “future” is about nothing else but (probabilistic) future *facts*.

Even the notion of an explicitly open, i.e. not yet determined future (which plays a key role in some interpretations of quantum physics) doesn’t solve the problem as it, too, misses the crucial ingredient of the new present-based notion of time: temporal non-locality, i.e. the “orthogonal” expandedness of the time-space of the present vis-à-vis the usual, linear-sequential aspect of time.

The novel concept of time contains three aspects of time that correspond directly to the three layers of the novel account of reality shown in the above model:

- a) the radically non-local co-presence of all possibilities in the sense of an “absolute present”(yellow stratum),
- b) the time-space of the present (green stratum); the TSP is the “platform” on which all of reality actually takes place as the transition from (a) to (c); the TSP is still non-local in that it is not yet sequentially structured, but it is no longer directly all-encompassing, as was (a),
- c) the linear-sequential aspects of time - corresponding to the factual aspect of reality - in which a ‘prior’ is clearly separated from a ‘later’, and thus the three-pronged aspect of time, with past , point-like now, and an (open or deterministic) future, has fully unfolded (blue stratum).

The TSP, i.e. the transition from layer (a) to layer (c), is where all reality actually “*takes place*”, i.e. becomes part of local space-time, and where we live in. The TSP has still the aspect of temporal non-locality, i.e. the “real” present is still characterized by an inherent unseparatedness of ‘prior’ from ‘later’. On the other hand, the TSP no longer enjoys the immediate co-presence of all. Being the transition from (a) to (c) the TSP *reaches* into both – the stratum of ‘omnidentity’ respectively ‘omnipresence’ (yellow layer) and separable facticity (blue layer) - but in the sense of the two ex-

tremes of *this spectrum of aspects of time*. Our experience of a present is no longer seen as a “subject-side confabulation” – like in classical-and relativistic physics - but as the hitherto most advanced *cognitive adaptation to the way reality actually takes place* – namely in the TSP.

This new view makes sense also in an evolutionary perspective: the experience of the present – irreducibly intertwined with the phenomenon of consciousness – is a neuro-biologically rather late and very costly feature; as that it could never have survived evolutionary selection pressures if it didn’t serve a real purpose, i.e. if it didn’t give or improve our access to an important aspect of reality.

In sum: In the novel concept of time the present moves to the center and it is (re)introduced into physics, but as the TSP – and not as a point-like “now”. (While the introduction of an “objective present”, in the sense of a common, mandatory point-like now, would be in contradiction with relativity, the introduction of a non-local TSP is not. To the contrary, it is even a logical prerequisite for *stating* the existence of a block universe (in the F perspective of reality) and for understanding the phenomenon of singularities (with their characteristic collapse of the local space-time fabric).

#### **IV. Autogenesis and Strong Self-Referentiality**

The notion of “autogenesis” is used as a technical term; it denotes (a) that some-thing comes into being, and (b) that this happens in, out of and towards itself. “In itself” means that it unfolds more and more internal richness. “Out of itself” means that this happens in the absence of an external causation. “Towards itself” means that there is something like an ‘emergent selfhood’.

We assume quite easily that our universe could be of autogenetic origin. But, we oversaw that this αρχή (in the dual sense of ‘origin’ and ‘dominating principle’) might imply that autogenesis is a cross-cutting feature of all of reality.

It is not by chance that we struggle so much with perceiving and understanding the phenomenon of autogenesis. In the history of our ‘post-aristotelian’ thinking we focused increasingly – and with great success – on the factual aspect of reality. But: what if it turns out facts are only the traces of the ‘taking place’ of reality? In this case it might be that the ‘coming into being’ itself can’t be addressed and captured adequately in the conceptual framework that applies for facts. In this vein it will be shown that and how we can re-think time and reality, and that, by doing, so we can overcome our “cognitive facticity imprisonment”.

Weak self-referentiality means something refers to parts or aspects of itself; strong self-referentiality means that something refers to itself in its entirety.

Gödel's proof of 1931 demonstrated that strong self-referentiality is an inevitable feature of all formal systems strong enough to deduce natural numbers.

Autogenesis and strong self-referentiality are twin phenomena. Strong self-referentiality is the structural portrait of autogenesis; autogenesis is the procedural implication of strong self-referentiality.

Strong self-referentiality transcends any single Boolean framework and it causes problems with the entire categorial apparatus into which Boolean logic is embedded (e.g. it violates also any strictly linear-sequential notion of time). At the same time, strong self-referentiality is not just a formal gimmick but an inherent feature of the taking place of reality.

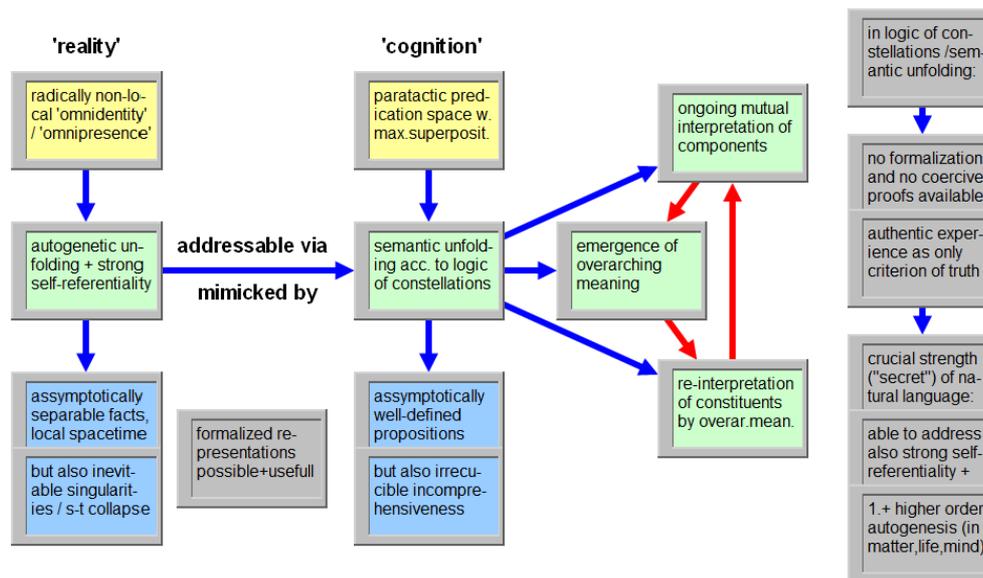
Due to its problematic consequences in any well-defined, Boolean framework strong self-referentiality, and its twin, autogenesis were increasingly marginalized during the advance of modern, analytical science. Only now we start to understand that this suppressed problem may lurk behind a broad spectrum of open issues, from state reduction in quantum physics to the origin of mass, and from the self-constitution of life to that of consciousness.

The next question is how the two need to be combined. Although they are complementary and neither can be reduced to the other, the relative weight can shift dramatically. The appropriate mix varies in a continuum from "almost all F" to "almost all E". Which relative weights are appropriate depends on the relevance of self-referentiality for the phenomenon to be addressed. For addressing a classical physics experiment "almost all F" applies, while for talking e.g. about meditational experiences "almost all E" may be appropriate.

## **V. The Taking Place of Reality and the Logic of Constellations**

We know how to address the factual aspect of reality, namely by predications according to the F apparatus. The (yellow) layer of a radically non-linear co-presence of all possibilities is hardly predicable at all. But what about the green layer, the actual taking place of reality in the time-space of the present?

It is argued that in a paratactic predication space propositions are related according to the logic of constellations – and that this is the only appropriate way of addressing the phenomena of autogenesis and strong self-referentiality.



The logic of constellations is not only the cognitive equivalent to the autogenetic unfolding of reality in the time space of the present. It is also most closely related to our experience of a present. The latter is not a subject-side confabulation to an objectively factual reality: it is, instead, the hitherto most advanced cognitive adaptation to the way in which reality actually takes place.

For the E aspect of reality binary (i.e. Boolean) „tertium non datur” logic fails and a paratactic predication space with its „logic of constellations” (LOC) applies. Constellations are settings in which the components interpret each other. LOC consists of three different sub-dynamics:

- the mutual interpretation of all individual components
- the emergence of an overarching meaning
- the re-interpretation of its constituents by the overarching meaning

A constellation is a “semantic powerhouse” unfolding new levels of meaning, and, thus, fitting mimetically with the autogenetic aspect of reality. As the “facticity imprisonment” developed, science was separated from art - and art became the enclave of the constellatory aspect of reality. But, by gaining insight into the existence of LoC we can re-gain this aspect of reality – without opening the doors for all kinds of “voodoo thinking”.

**Some examples for  
the Logic of Constellations  
- and its specific precision**

*quietness at noon  
cicadas cry  
rock penetrating*

*Basho. 1684*

*much of visual arts and  
all of music is characterized by  
the mutual, constellatory unfolding  
of the significance of its constituents*

*in a way. even art as such can be  
seen as the enclave into which the  
perception of the constellatory aspect  
of reality had to withdraw as the  
"facticity imprisonment" increasingly  
dominated our thinking*



How does LOC actually materialize in Basho's wonderful Haiku? Cicadas cry is characterized by abrupt interruptions, an instant, concerted transition into silence. This abrupt ending of the noise is what makes the quietness all the more "hearable" and impressive. Vice versa, when the silentium is broken again, the cry of the cicadas is even more intensive – to the degree that it even penetrates the rocks. But is it only the cry of the cicadas that penetrates the rocks – or, possibly even more so, the quietness? And so forth and so forth...

These inadequate and insufficient verbalizations just try to indicate the kind of semantic unfolding that occurs between the three pillars of the poem: All three start and continue to unfold their meaning in and due to the presence of the others, - thus giving a wonderful example for the first sub-dynamics of LOC.

Out of these "bilateral" interactions emerges the "scene" – in its never completed entirety and integrity (second sub-dynamics). And this emergent,

overarching meaning – the hot, breath-taking noon between (unmentioned, but almost inevitably confabulated) grass and the hard, impenetrable but yet penetrated rocks – makes us finally even more aware of the staggering interplay of silence and noise (third sub-dynamics).

In a comparable manner the elements in Igor Sakharov's painting unfold their meaning mutually in, due to and into their *co-presence*. And, as already indicated, I would argue, that in all of art the involved components mutually unfold and gain their very meaning in their very constellation.

But, even if this would be roughly correct, what could all of this have to do with science? Very much, I would argue – at least, if we don't restrict science to the factual aspect of reality.

If the above model of reality holds water, restricting science to the F aspect of reality would mean to deprive it from the most relevant and most fascinating aspects of the "taking place of reality". And we would, deliberately, give up understanding all strongly self-referential and thus also autogenetic, phenomena like quantum physical state reduction, life or consciousness. That can't be the way to go. But if we give up the facticity constraint of science, we need to allow constellatory predication. The latter will never be as precise or coercively provable as F-type observations. But, alas, if reality is like that we have to cope with it as good as we can. We can't continue to ignore a major aspect of the taking place of reality just for the sake of our cherished, F-type "scientific rigidity and precision".

Important is to understand the novel, complementary type of predication as good as possible – in order to not open doors for all kinds of nonsense – just "qualified" by violating rational argumentation. Exactly this "qualified opening", i.e. the ability to still separate between what is more likely to make sense and what isn't, is the purpose of trying to understand the internal structures and dynamics of LOC.

In closing this part of the argument, I would just like to stress two phenomena once again. Firstly, E-type predication can never be proven in a factual manner, and thus nobody can ever be forced to accept any LOC propositions. Authentic experience is the only criterion of truth in this domain – and deliberate acceptance the only way how somebody can be convinced. Any E-type observation that pretends to be mandatory ("you *must* accept that...") is a non-starter in the first place. Secondly, most people would accept that art is a fascinating and legitimate approach to reality. But, as reality is only one, art tells us something about "how reality actually works". By (re-)gaining insight into the complementarity between F-type and E-type predication the historically grown rift between art and science may start to close again.

## VI. Outlook: Further Practical Implications of LOC

If LOC is the appropriate way of addressing the taking place of reality it is obviously of relevance for quite a broad spectrum of issues. In this last step of the argument I will briefly touch on a few of those topics.

### - Towards a Coherent Account of Evolution

If already the taking place of physical reality is – in the quantum physical reduction of state – characterized by strong self-referentiality and autogenesis, a novel way of interpreting the phylo-and ontogenetic self-constitution of life becomes possible. There exists no longer a categorial hiatus between non-living and living entities. Instead, life can be interpreted as “second order autogenesis” in the sense that first order autogenetic processes (constituting matter/energy) configure at a higher aggregate level into a “second order” self-referential setting. Looped chains of chemical reactions, like e.g. the hypercycles analyzed by M. Eigen and P. Schuster, seem to be close to perfect instantiations of this conceptual pattern.

Likewise, the emergence of first consciousness and subsequently self-consciousness can be seen as forms of yet higher order self-referentiality, respectively autogenesis. In this way, i.e. through the E framework and with LOC as an integral part of it - a coherent account of all of evolution – from the self-constitution of matter to that of mind – seems to become feasible.

### - Coping with Objective Uncertainty

As long as we have only the F framework at our disposal we are almost bound to see uncertainty as epistemic. This means, however, that there is no objective uncertainty, but just a lack of knowledge. The attitude that derives from this ontological assumption is to try to get more and more detailed information in order to reduce this inherently epistemic uncertainty.

If we assume, instead, objective uncertainty and this even on macroscopic scales – due to the structure of strong self-referentiality – we develop a completely different attitude. We try to gain as much insight as possible – but after that the best we can do is to look at the *constellation of possibilities*. I.e. instead of searching to become a kind of Laplacean demon, we now consciously confront objective uncertainty – and use the power of LOC to make as much sense as possible out of the constellation of possibilities.

For strategic decision makers this modified attitude amounts to a paradigm shift in which cognitive “zooming-in” is no longer the only way to go. Now, instead, also the opposite cognitive move, i.e. “zooming-out” and resorting to LOC for the overall assessment of the situation at hand becomes a legitimate, and in some occasion clearly advantageous procedure.

- Responsible Decision Making despite High Levels of Complexity

This phenomenon is closely related to the prior one. Under conditions of high complexity decisions are hardly ever made in a purely rational-analytical manner. Intuition comes inevitably into play, whether we like it or not. Intuition is essentially the interpretation of *a constellation of weak signals that mutually unfold their meaning*. This is the first reason why LOC play an important and irreducible role in responsible decision making. The second reason is that for intuition to work *a synoptic* mental representation of the entire issue at hand is required. Exactly this, however, gets lost by cognitive fragmentation and the pundit patchworks that invade so many high level decision making processes today. Gaining insight into both, the limited exactness, but also the inherent strength of LOC may be a good antidote and an efficient way to regain the ability to make responsible decisions despite complexity levels that defeat any purely analytical approach.

- The Phenomenon of Freedom and the Perception of Meaning

If freedom exists, a free decision can't be driven by external causes. But it also can't be just indeterministic in the sense a pure random process. Free will requires reasons when opting for something. This means that free will can only be as a quintessential autogenetic process, i.e. one that has its reasons, but within itself. This quintessential self-referentiality and autogenesis of free will explains why we had and still have insurmountable difficulties in dealing with the phenomenon of freedom in a conceptual framework that is tuned only to the factual aspect of reality. We can't even grasp, what freedom is, as long as we restrict ourselves to the cognitive constraints of an "F only" world.

And the same holds true for the phenomenon of experiencing sense and meaning. As long as they are caused by something else, they eventually dissolve. Sense and meaning exist, like freedom, never in the format of a sheer fact. If they exist, they *are* as an on-going taking place that continuously occurs a new – in the time-space of the present. Only by learning to think in the thought patterns of autogenesis and strong self-referentiality, and thus by applying LOC, we can really get access to these phenomena.

- The Secret of Natural Language and the Future of AI

When having the E framework and LOC as an integral part of it at our disposal natural language starts to unveil a hidden secret: It is, like human cognition in general, a very smart and advanced evolutionary adaptation allowing us to address and deal with the taking place of reality in all its aspects.

It combines a high degree of semantic constancy and continuity – needed for coping with facticity – with the openness and the possibility of semantic unfolding – needed for coping with the emergence of the genuinely novel.

It would probably have been extremely easy for cognitive evolution to develop a formal logic (not to speak of a “Sheffer stroke”, respectively a “nand” or “nor” operator). These, however, don’t suffice for coping with reality in an “autogenetic universe”. For this an extremely delicate equilibrium had to be developed between semantic constancy and constellatory unfolding of meaning. This delicate equilibrium is the hidden hallmark of human cognition, and it is congenially supported by natural language.

For AI to really flourish, I would argue and predict, it will take a fundamentally novel approach – one that, at least partially, incorporates LOC and its ability to tolerate constellatory semantic unfolding. I don’t take sides regarding the question whether this will be possible at all. But if it should turn out to be possible, we will necessarily get into the realm of “authentic cognition”. This means that the respective processes will no longer be fully deterministic – they will be inherently open, instead - and that we will have to ponder whether the respective cognitive agents, through their authenticity, gain some kind of irreducible dignity.

## **Conclusion**

All our thinking rests on categorial foundations. They are, so to speak, the interface between cognition and reality. There is a classical categorial apparatus, the F apparatus, which corresponds to the factual aspect of reality. It is very precise and powerful, but it doesn’t cover all of reality. Only by complementing it with a second categorial framework, the E apparatus, also the actual taking place of reality can be addressed adequately. Via the LOC (logic of constellations) it is able to address also the twin phenomena of strong self-referentiality and autogenesis – which are maximally incompatible with the F apparatus, and whose accession would unravel it.

Being a feature of the taking place of reality as such, strong self-referentiality and autogenesis, however, are cross-cutting features of all ongoing phenomena (as long as they haven’t receded into sheer facticity.) This in turn means that LOC is a fundamental, complementary mode of thinking which is of cross-cutting relevance whenever we are not addressing pure facts.

A crucial aspect of LOC is that it bridges the rift between natural sciences and humanities, thus allowing for a coherent account of reality. The more one moves from matter, through the appearances life to the phenomenon of mind, the higher the degree of self-referentiality and autogenesis – and thus the relevance of LOC within the over-all description of the respective phenomenon. But, by applying already to the quantum physical state reduction, i.e. the on-going self-constitution of matter/energy, it allows for a non-dichotomist and non-deterministic account of evolution – from big bang to our present thoughts right in this moment.