Energy & Information in Systems

Rainer E. Zimmermann
Hochschule München, Dachauer Str. 100a, D-80636 München / Clare Hall, UK – Cambridge, rainer.zimmermann@hm.edu

Abstract: In the following we give a formal classification of the modes of being that are related to the various stages of possible processes of emergence within the world, both observable and non-observable. In particular, we will refer this topic back to the effort of Schelling to theoretically ground nature on nothingness. By doing so, we will have to differ between emergence in the general sense on the one hand, and initial emergence on the other. We will thus find an adequate criterion in order to differ between emergence and evolution. We continue with shortly discussing Grant’s view on the relationship between non-being and nothingness as introduced in his approach to what he calls “transcendental geology”. As immediate consequences we define then what the foliations of reality may tell us about the observable states of modality, and we shortly mention aspects of the holistic logic that is derived within Morin’s theory of systems.

Keywords: reality; modality; ontological types; forms of being; ground; emergence; metaphysics of systems; transcendental geology

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1 Introduction

As it turns out, the relationship between emergence and evolution shows up nowadays as one of the central research topics that are the most promising in order to unveil further details as to the problems concerning the difference between the world as it is, and the world as it is being observed by humans, respectively. This difference also entails various other problems on similar conceptual differences such as that between macro- and microlevels of evolution, and between quantum physics and classical physics. Obviously, the eventual emergence of the latter is one of the most fundamental questions raised by modern research. This becomes particularly obvious when dealing with the presence of quantum coherence in physical processes of all possible scales and orders of magnitude, which cannot be classically observed due to a mechanism called “decoherence” (Zimmermann, R. E., 2013, in press). The consequences of decoherence are immediately illuminating many open questions from the fundamental domain of quantum gravity and quantum information up to chemical bonding and the organization of more complex systems. They include statistical methods of describing emergence as well as aspects of gauge theory. So the insight gained in this field is not at all restricted to the domain of physics alone, or even to the sciences altogether, but is instead important for a whole variety of situations some of which can be easily encountered in daily life. In philosophical terms proper, the importance of these topics centres around the questions of the founding and/or grounding of the world. Hence, they have an explicitly metaphysical and thus ontological relevance after all. And they have also decisive epistemological consequences for a unified theory of systems. If in particular, we would like to assume that the Universe is the largest possible system we can observe, then we end up immediately with the necessity of defining an environment of this system that consists of other systems (and some non-systemic rest). Obviously, this questions the original definition of system and environment, respectively, in the first place. This is mainly what we will discuss in this present paper: We start (in section 2) with a formal classification of the modes of being that are related to the various stages of possible emergences in the world. In particular, we will refer this topic back to the effort of Schelling’s to theoretically ground nature on nothingness. And we will have to differ between emergence in the general sense on the one hand, and initial emergence on the other. We will thus find an adequate criterion in order to differ between emergence and evolution. And we will summarize the insight gained then (in section 3). We continue with the discussion of Grant’s view on the relationship between non-being and nothingness as introduced in his approach to what he calls “transcendental geology” (section 4). As immediate consequences we define then what the foliations of reality may tell us about the observable states of modality (section 5), and we shortly mention aspects of the holistic logic that is derived within Morin’s theory of systems.

2 General Aspects of Emergence

At the beginning, it is useful to differ between global and local forms of emergence in the following way: On the one hand, in global terms, emergence is immediately related to initiality as its primary characteristic. In other words, if we visualize the Universe as the largest system, then its emergence is clearly an initial emergence in the sense that all what is observable for us emerges at the zero-point of evolutionary time. When starting in this way, we have at once a whole bundle of problems: If the Universe is the largest (and
earliest) system of all, then all the other systems that we can identify are necessarily subsystems of this master system. Note that as parts, these subsystems follow the emergence of the whole, and not vice versa. Hence, the Universe is a system that is obviously organized in a top-down fashion. So all the categories necessary for its description, such as space, (evolutionary) time, and (object-) matter, must probably be available from the beginning on, before subsystems have been formed. They define the conceptual frame for the concept of Universe altogether, and the subsystems come into existence by subsisting within this framework. Obviously, visualized in this manner, social systems of human beings are themselves nothing but a complex subsystem of the Universe. Hence, the final scope of their knowledge must be necessarily restricted as to the master system. In other words: We realize very soon that what we call knowledge (about the Universe) is contextual and incomplete. In order to achieve a continuous network of interpretations, it is thus necessary to add abduction to the usual modes of deduction and induction that constitute the epistemological ground of scientific methods achieved so far. So from the beginning on, human observers in the Universe have to realize the generic difference between what there really is and what there is actually observed. Obviously, by immediately dealing with the position of human beings within the Universe, this insight carries many ethical connotations of explicitly practical use.

However, despite the fashionable and now common attitude of suggesting political implications of ethical aspects that might be raised within the context of ongoing research, I do not share the dominant opinion about this attitude’s reasonability or success. On the contrary, I think that practical implications (in the philosophical sense) that are derived from theoretical principles grounded in a metaphysical context — simply by their sheer complexity — usually do not meet the acceptance of those who are responsible in political institutions. The systemic reason for this is mainly that the two time scales of both are not compatible with each other such that any effort as to a possible reconciliation is threatened by unsurmountable difficulties. Nevertheless, there may be rare occasions from time to time that open up new pathways for practical thinking based on recent theoretical insight. Probably, hope is the best category to refer to in such cases. In so far, as we know from the philosophy of Ernst Bloch, hoping is the active grasping of the world rather than mere dreaming. It is “[…] actualization of human solidarity within the social organization of life style; as construction of the perfect living space, at the same time symbol of succeeded being within architecture, as a free unfolding of human possibilities within work and game.” (Holz, 1975, p. 102). It is indeed the research project in a quite different domain, namely concerning the structure, evolution, and design of urban social spaces (i.e. in “architecture”) that comes closest to this interpretation of the above-mentioned attitude.

On the other hand, if the Universe has emerged as a system, then it must possess an environment. Typically, the environment consists of other systems plus some excess region that is itself non-systemic. Hence, if visualizing the Universe as an emergent system, there must be other Universes, probably of different types, within its vicinity. The concept of a system thus implies — if applied to cosmological questions — what Lee Smolin once introduced as the picture of “cosmological natural selection”. But then, we end up with the

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1 As is demonstrated in appealing to the authors in this very volume to utter details of how „the foundations […] could be elaborated such as to improve their impact on society.”

2 See my contribution to symposion K of this very emcsr meeting as it is documented here.

further question for the emergence of the set of possible Universes. If we invoke the results of decoherence theories, this is even more problematic, because what we call “Universes” refers to a collection of macroscopic objects. Hence, we assume that the real world is practically a “soup of quantum coherence”, while the world as we observe it shows up in terms of decohered macroscopic structures that guarantee the classicality of everyday physics. Obviously, our human means of sensory perception, relevant for interpreting observations and modeling the world altogether, rely on a considerable amount of decoherence. Hence, we do not possess any perceptive means of grasping a world that is essentially based on quantum coherence. On the contrary, our classical world is one determined by explicit decoherence. Seen under this perspective, the problem of emergence entails the question for the pre-conditions of emerging material objects that are well-localized and well-temporalized, although the real world is essentially non-local and non-temporal. So that in the end, we have reasons to assume that the very concept of system itself refers solely to macroscopic situations and is therefore, a conceptual property of human knowledge rather than a concrete property of the world.

But, if we visualize the concept of emergence now under local conditions, applying it to the parts of the whole rather than to the whole altogether, then we encounter a large number of emergent phenomena that are quite common and well-known, even in everyday life: A prominent example is the birth and death of human beings themselves. Permanently encountered, these phenomena are nevertheless ill-understood. Note that we can in fact talk of emergence when a baby is being born, because something new is produced in the sense that the outcome is individual with respect to all the other samples already existing. Each human being is unique. Hence, a new person is a truly innovative structure in the world, although it is not undergoing initial emergence, because this would mean to ask for the emergence of the very first person on this planet. In the same sense, technologies can be innovative (e.g. one that designs virtual realities), but they carry a secondary connotation, because they are essentially produced and reproducible. We realize that in most cases, innovative structures are often nothing but differently re-combined or re-produced structures that were already at hand before.

3 Problems of Foundation

What we can see from the aforementioned is that knowledge is essentially based on the reconstruction of global and local phenomena of emergence. We can utilize Schelling’s terminology here by introducing the concepts of productivity and product, respectively, referring to the ancient aspects of natura naturans, and natura naturata, such that the former means the active, producing nature that is the material ground of what can be observed, while the latter means the passive nature that is mainly product. But note that nature as product can also be generative by producing new forms in the secondary sense mentioned above. The productivity of natura naturans, as translated into the modern context, can be visualized then as the world of quantum coherence that underlies (but also produces) the macroscopic world that can be observed. Generalizing Schelling’s discussion, what we do when conceptualizing the various stages of emergence(s), is to deal with different horizons


4 This is also true for identical twins: because they are not really completely identical in the biological terms of their genetic material, nor are they identical in social terms.

5 And in fact, for the emergence of the first person on any other suitable planet, as to that.
that serve the definition of what is possible and what is actual. Hence, we would call “cosmology” ground and reason for a Universe as it can be observed today, and how it is actually observed according to the present state of physical knowledge. What has been actualized, must have been possible before. So this field of possibilities out of which actualizations emerge is to what is observed and what thus should be at least part of what there is, i.e. to the latter domain of being, essentially non-being: it is not, but can be. (Greek: mè ón) However, what is impossible (because it cannot be actualized in principle) is nothingness. (Greek: ouk ón) Note that the field of possibilities can vary in the run of time. Hence, in fact, nothingness can be non-being of non-being, if it enlarges this field of possibilities, while under the perspective of the actualized it is still nothingness.

As an example, we think of the chain of causal events that – according to cosmological re-construction – establishes the world as it can be observed today in macroscopic terms: While re-constructing, we always ask for the condition of the possibility of what we observe or assume. So human beings for instance, show up some hundred thousand years ago on this planet, when we assume some insight from biological research. The condition of human beings is the existence of biological life (animals, plants, molecular entities…). Hence, molecular organisms are with respect to animals non-being as the latter’s explicit pre-condition, and animals in turn, are with respect to human beings non-being as their pre-condition. But molecular organisms for themselves, are with respect to human beings nothingness, because it is impossible to generate the latter without the intermediate stage of animals. In this fashion, we can always continue the chain by asking for the appropriate pre-conditions. This is in fact what we can call the “transcendental method” of re-construction.

Finally we arrive at the Big Bang as a model for the pre-condition of a Universe that can be differentiated in the way present observation suggests. So automatically, we ask for the appropriate pre-condition of a Universe as our’s (or a Big Bang as to that). But this time we leave the domain of generic conceptualization, because while the Universe can be categorically characterized in terms of space, time, and matter, its pre-condition cannot. This is because these very categories emerge together with the Universe, and they are not present before. In fact, this is not surprising at all, because – as we have noted earlier – the whole conception is due to a re-construction as permanently performed by human beings. And what does this actually mean? It means that in principle, human beings communicate their insight into the structure and function of what they cognitively perceive. In other words, re-construction means linguistic construction. But language itself is based on the fundamental categories of space, time, and matter, its pre-condition cannot. This is because these very categories emerge together with the Universe, and they are not present before. In fact, this is not surprising at all, because – as we have noted earlier – the whole conception is due to a re-construction as permanently performed by human beings.

Of course, what we can do is to extrapolate the domain described in terms of linguistic meaning by transferring the basic categories utilizing them for a procedure of metaphorization. This is what Ernst Bloch once called “phantasia kataleptiké” (referring to a concept introduced in the ancient Stoic philosophy): to utilize imagination, but not in an arbitrary manner, but such that at least all what is already known comes out as a result. At the same time, this is the principle of “speculative philosophy” as compared with “sceptic philosophy”, the former relating to the process of re-constructing the totality of what there is and its grounding, the latter relating to the process of assembling concrete knowledge about the empirical world that can be observed. What we have simply to do is to differ between two types of nothingness: one that can be expressed in linguistic terms, and one that cannot be expressed at all, because it cannot be object of reflexion in the first place. Hence, our

6 We essentially end up with a generic “sandwich structure” of three layers consisting of the actual, the possible (non-being), and the impossible (nothingness) that is at the same time non-being of non-being.
chain of inference consists of terms like being-non-being-nothingness1-nothingness2. And
the process of generation can be visualized as a regressive recursion of fractal geometry7 by
applying “non-being” as an operator acting on itself. It is in this sense that nothingness1 can
be visualized as non-being of non-being. Whether this is also true for nothingness2, is still
an open issue (see more recently Zimmermann, 2010 and in particular Zimmermann, 2013,
in press). Note finally, that the procedure of re-construction is essentially regressive, while
its subsequent narration is progressive: What has been re-constructed will be told
afterwards as if it would have been developed by starting with the beginning. But the truth is
that the sciences work primarily in a regressive way (that Schelling would have attributed to
what he called “negative philosophy”).

It is useful to fill in some further references here in order to illustrate the explicit
relationship to the philosophy of Schelling in more detail: It is in the “Grounding of Positive
Philosophy”8 where Schelling defines: “Ground is against that of which it is ground, non-
being. / Grund ist gegen das, dem es Grund ist, nicht seiend.” (PP 440) This is the starting
point for this present discussion. There is a number of details that are mentioned in the
same book such as the principle of initial dissonance (PP 187), the regressive-progressive
motion of re-construction (PP 246 sq.), space as form of brokenness (PP 362), and the
difference between non-being and nothingness (PP 385 sq.). In the “Stuttgart Private
Lectures”9 we find the important passage on the definition of a system: “The system must
possess a principle which is in itself and by itself, and which re-produces itself within each
part of the whole; it must be organic: One must be determined by All and All by One. It must
not exclude anything, nor subject anything unilaterally, or even suppress it.” (SIPVL 102 sq.)

Combining the insight following from these central passages, we can say that this can
be visualized as a solution of the problem of initial emergence: only that Schelling
approaches this in terms of thinking something which is resting in itself and does not
perform a transition into motion, but falls instead into one with it (i.e. substance shows up as
a type of nothingness which is both rest and motion at the same time). Hence, if spatio-
temporality of the world is visualized in terms of an observable worldly being which is seen
under a restricted perspective, then it is at least integral part of substance. It is thus
contained in substance as a possible level of projection is contained in a higher-dimensional
geometrical form. How this can be visualized we will see later. The organization of
knowledge can be depicted then in the following way:

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7 Note that the recursion in question is based on the progression of the type nb ( […] nb), where nb refers to the non-
being. We realize that expressions of the type nb (nb) are equivalent to expressions of the dialectic type neg (neg)
( negation of negation). In other words, the whole process can be visualized as an operator sequence with nb
being the prime operator similar to the negation operation in dialectic logics. Note however that in the first case we
deal with a regression rather than with a progression (as in the dialectic case), because we talk about re-
construction in the first place.

8 This is the Munich lecture course of 1832/33, referred to here as PP: F. W. J.Schelling: Grundlegung der positiven

9 This is a course given during the period of the Freedom Essay (around 1810) referred to here as SIPVL: F. W J.
At the same time, Schelling’s approach makes a revised perspective possible onto the fundamental categories proper. As Manfred Frank points out: “For the first time in Schelling the determination of a dialectically mediated subject-objectivity derived from temporal structures is present.” (Frank, 1992, p. 324 sq). And Andrew Bowie adds: “The attention in contemporary theoretical physics to the very emergence of a differentiated universe of space and time from that which involved neither increasingly reveals the limitations of the causal model of physics that served so well until the rise of quantum mechanics (…).” (Bowie, 1993, p. 91). He continues: “If one accepts the link between Spinozism and modern science, Schelling’s continued opposition to Spinozism, the emphatic nature of which only makes sense if Spinozism entails something of fundamental importance, is linked at least by analogy to a vital shift in modern thinking.”

4 Note on Transcendental Geology

A similar attitude can be found in Iain Grant’s book (Grant, 2008) (2006)), where the author, starting from a close inspection of Schelling’s “Universal Deduction of the Dynamic Process” (1800), claims the following: “The genetic problem at its most basic consists in the attempt to discover elements from which natural phenomena are assembled; once discovered, the task is then to plot their recursion and mutation throughout each and every branch of the system of nature.” It is this perspective under which he comes to what is then called “transcendental geology”: “(…) the natural historians’ attempt to derive a history ‘not of natural objects … but of generative nature itself’ (SW III 588) entails involving the universal
bifurcations in which the universe consists (...) Natural history becomes the attempted retrospection therefore of a system of infinitely bifurcating forces that must work from a product that is transcendental with regard to the forces that produce, maintain and reproduce it."\(^{12}\) This has decisive epistemological consequences for the problem of foundation: "The grounding of the transcendental product in dynamics thus ungrounds it in natural history, insofar as this is considered a universal, rather than a particular science. Thus ground is always the ground of something, never ground in general, since the latter is Ur- or Un-grund (SW VII 406)."\(^{13}\) We can clearly recognize the explicit relationship to what has been said earlier here in this present paper.

5 Foliations of Reality

We can now develop a picture that represents the interactions of the various levels of non-being as compared with what can be observed (and is called modality here, in Spinozist tradition).

![Figure 2: Foliations of Reality](image)

\textit{Figure 2:}

\textit{Foliations of Reality} \((N \supset S \rightarrow S')\): Modalities

- \textit{Progressive} = Direction of Projecting, \textit{Regressive} = Re-construction/Intervention (Praxis) – metaphysical problem: \(S' \Rightarrow N\)?

\textit{Energy and Information and their (meta-}phorical\textit{) equivalents live on the sheets of the foliation, but not on \(N\)!}

The arrows give the direction of inference. In other words, the process of re-construction is essentially regressive, while the narration is practically a mapping of a projection that is progressive. The foliation gives the various sheets that are aspects of reality. One such sheet is selected in order to determine the present state of viewing one’s own modality. Note that (potential and actual) energy and (potential and actual) information can be visualized as the entities that live on the sheets of the foliation, while at least one such sheet is embedded into an orientational framework that reflects the fundamental categories of space, time, and matter. Here, energy that has acquired mass is called matter. Hence, energy-matter and information-structure function as the two attributes of original reality (which is called \(N\) in the diagram). The metaphysical problem is then to refer back and interpret information from one sheet onto \(N\). (Information that has been actualized is called structure.\(^{14}\) Note also that (physical) unification in the scientific sense can only be achieved for the attributes. Beyond the physical unification (what is usually referred to as a TOE\(^{15}\)), it is proper to think of unification in the strict sense as intended in Morin’s approach: in the sense of a theory of

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12 Ibid., 203 sq.
14 This has important consequences for the balances of energy and entropy. In principle, positive entropy has to be reduced by virtue of the information that is stored within structures that can be observed in macroscopic terms.
15 Theory of Everything
everything what there is including what is emergent with respect to the physical substratum and including its own cognitive meta-theory (which tells how to actually create theories in the first place).

6 Holistic Logic

It is in fact in the 1977 book of Morin’s that a holistic logic is being presented that might be eventually able to provide sound criteria for such a cognitive meta-theory. It essentially starts with four basic rules that can be summarized as follows:

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<th>Table 1: Holistic Logic</th>
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<tr>
<td>Holistic Logic:</td>
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<tr>
<td>• The whole is more than the sum of its parts.</td>
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<tr>
<td>• The part is more than the part. (relation between micro- and macro-emergence)</td>
</tr>
<tr>
<td>• The whole is less than the sum of its parts. (inhibition of degrees of freedom = constraints)</td>
</tr>
<tr>
<td>• The whole is more/less than/not the whole. (relation between opening and closing = only action can stabilize a system)</td>
</tr>
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On the one hand this implies an onto-epistemic cycle of reflexion that grounds the three epistemic elements of any systemic approach to the world: (1) The network as the system’s dynamical nucleus providing a skeleton or a circulation of the system and its space of interactions, at the same time representing the system in terms of communication. (2) The space as the range (or mean free path) of the interactions of the system and thus of its domain of actions, at the same time representing the system’s oriented cognition. (3) And the system proper, as the network dynamics plus that sort of bulk matter (stuff) that is not communication, thus representing the part of cooperation among the system’s agents. (Note that within this context, agents are subsystems that by themselves can form hierarchies of systems.)

Note finally that there are more reminiscences in Morin relating to the afore-mentioned line of Spinoza – Schelling – Bloch: So Morin’s rotational vortex reminds us of Schelling’s that informs into a loop initiating the first generative feedback and by recursion grounds more loops of action and retro-action. There are also aspects that point to Stuart Kauffman’s fundamental autonomous agents that are capable of performing one thermodynamic work cycle.16 These reminiscences are not trivial at all, because Morin’s theory, developed long before systems became fashionable in the sciences, incorporates genuinely new aspects of systems such as the transformation of the Se (Sich, One-Self) into the Self (as in Self-Organization). In fact, also in Morin a threefold sandwich structure is present when noting that this transformation is actually achieved via the mediator Morin calls “autos”, parallel to a transition from non-being to being. Also, within the cycle of generation and re-generation in self-organizing systems, the concept of information is taking a special position, because information shows up as something that allows the negentropy to re-generate organization that allows information to re-generate negentropy.17

16 These aspects deal chiefly with the question of the emergence of dynamics, which is a problem in its own right. This will be discussed elsewhere.
17 In fact, Morin still works with the somewhat old-fashioned difference between entropy and negentropy, respectively, that according to Weizsäcker is dispensable, if talking of potential and actual types of information.
References


About the Author

Rainer E. Zimmermann

Studied physics and mathematics at the university of technology as well as Free university of Berlin and as DAAD scholar at Imperial College London. Did his first PhD in mathematics and his second PhD in philosophy. Did his habilitation at the university of Kassel on Schelling’s philosophy of nature. Is professor of philosophy at the university of applied sciences in Munich from 1995 onward. Was guest professor in Cambridge (where he is a life member of Clare Hall), Bologna, Salzburg, and Berlin. Is elected member of iascsys (Vienna) and the societas Leibniz (Berlin). Is co-founder and scientific director of the Munich institute of design science. Works on a holistic system of his own called transcendental materialism. Has published about 350 works, among them 25 books.