The Relationship between Complex Thinking and Transdisciplinarity*

Abstract:

The key concept of transdisciplinarity is the concept of *levels of Reality*. The existing theories of complexity ignore the notion of levels of Reality. However, some of them, like the one of Edgar Morin, are compatible with this notion.

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The key concept of the transdisciplinarity is the concept of *levels of Reality*, which I introduced in 1982[1]. Therefore, if we question the relationship between complex thinking and transdisciplinarity, we have to clarify if a given theory of complexity is or is not compatible with the notion of levels of Reality.

I would like to first analyze what the word “reality” means.

Dictionaries tell us that "reality" is[2]: 1. the state or quality of being real; 2. resemblance to what is real; 3. a real thing or fact; 4. something that constitutes a real or actual thing, as distinguished from something that is merely apparent. These are clearly not definitions but descriptions in a vicious circle: "reality" is defined in terms of what is "real". In a more restricted sense, one can define "reality" as everything that has effects on something else. This definition puts the accent on causality, but one has to define what type of causality is here involved.

In order to avoid any ambiguity, I will define "reality" in a sense which is used by scientists, namely in terms of "resistance"[3].

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[1] Nicolescu, 1982.

[2] http://dictionary.reference.com/browse/reality

[3] Nicolescu, 1985, 2000.

By “reality” we intend first of all to designate that which *resists* our experiences, representations, descriptions, images, or even mathematical formulations. It puts the accent on a relational view of what "reality" could mean.

In so far as reality participates in the being of the world, one has to assign also an ontological dimension to this concept. Reality is not merely a social construction, the consensus of a collectivity, or some inter-subjective agreement. It also has a trans-subjective dimension: for example, experimental data can ruin the most beautiful scientific theory.

The meaning we give to the word “Reality” is therefore pragmatic and ontological at the same time.

We have to distinguish, in order to avoid further ambiguities, the words “Real” and “Reality”. *Real* designates that which *is*, while *Reality* is connected to resistance in our human experience. The “Real” is, by definition, veiled for ever (it does not tolerate any further qualifications) while “Reality” is accessible to our knowledge. *Real involves non-resistance while Reality involves resistance.*

I will now describe shortly some historical aspects concerning the concept of "level of Reality".

In the second part of the 20th century, two important thinkers on the problem of levels of Reality are Nicolai Hartmann and Werner Heisenberg.

Nicolai Hartmann (1882-1950) is a somewhat forgotten philosopher, who had Hans-Georg Gadamer as student and Martin Heidegger as his successor at the University of Marburg, in Germany. He elaborated an ontology based on the theory of categories. He distinguishes four levels of Reality: inorganic, organic, emotional and intellectual. In 1940 he postulated four laws of the levels of Reality: the law of recurrence, the law of modification, the law of the *novum* and the law of distance between levels[4]. The last law, postulating that the different levels do not develop continuously, but in leaps, is particularly interesting in the context of our discussion.

Almost simultaneously with Hartmann, in 1942, the Nobel Prize of Physics Werner Heisenberg elaborated a very important model of levels of reality in his *Manuscript of 1942*[5], which was published only in 1984.

The philosophical thinking of Heisenberg is structured by “two directory principles: the first one is that of the division in levels of Reality, corresponding to different objectivity modes depending on the incidence of the knowledge process, and the second one is that of

[4] Hartmann, 1940.
[5] Heisenberg, 1998.

the progressive erasure of the role played by the ordinary concepts of space and time." [p. 240]

For Heisenberg, reality is "the continuous fluctuation of the experience as gathered by the conscience. In this respect, it is never wholly identifiable to an isolated system" [p. 166]. Reality could not be reduced to substance. For the physicists of today this fact is obvious: the matter is the *complexus* substance-energy-space-time-information.

Heisenberg does not speak in an explicit manner about "resistance" in relation with reality, but its meaning is fully present: "the reality we can talk about – writes Heisenberg – is never the reality 'in itself', but only a reality about which we may have knowledge, in many cases a reality to which we have given form." [p. 277] Reality being in constant fluctuation, all we can do is to understand partial aspects of it, thanks to our thinking, extracting processes, phenomena, and laws. In this context, it is clear that *completeness is absent*: "We never can arrive at an exact and complete portrait of reality" [p. 258] – wrote Heisenberg. The incompleteness of physics laws is hereby present in Heisenberg, even if he does not make any reference to Gödel's theorems. For him, the reality is given as 'textures of different kind connections', as 'infinite abundance', without any ultimate fundament. Heisenberg states, in agreement with Husserl, Heidegger, Gadamer and Cassirer (whom he knew personally), that one has to suppress any rigid distinction between Subject and Object. He also states that one has to end with the privileged reference on the outer material world and that the only approaching manner for the sense of reality is to accept its division in regions and levels.

Heisenberg distinguishes "regions of reality" (*der Bereich der Wirklichkeit*) from "levels of reality" (*die Schicht der Wirklichkeit*).

"We understand by "regions of reality" – writes Heisenberg – [...] an ensemble of nomological connections. These regions are generated by groups of relations. They overlap, adjust, cross, always respecting the principle of non-contradiction." The regions of reality are, in fact, strictly equivalent to the levels of organization of the complex thinking.

Heisenberg is conscious that the simple consideration of the existence of regions of reality is not satisfactory because they will put on the same plane classical and quantum mechanics. It is for this essential reason that he was regrouping these reality regions into different levels of Reality.

Heisenberg regroups the numerous regions of reality in three distinct levels.

"It is clear - wrote Heisenberg – that the ordering of the regions has to substitute the gross division of world into a subjective reality and an objective one and to stretch itself

between these poles of subject and object in such a manner that at its inferior limit are the regions where we can completely objectify. In continuation, one has to join regions where the states of things could not be completely separated from the knowledge process during which we are identifying them. Finally, on the top, have to be the levels of Reality where the states of things are created only in connexion with the knowledge process." [372]

The first level of Reality, in the Heisenberg model, corresponds to the states of things, which are objectified independently of the knowledge process. He situates at this first level classical mechanics, electromagnetism and the two relativity theories of Einstein, in other words classical physics.

The second level of Reality corresponds to the states of things inseparable from the knowledge process. He situates here quantum mechanics, biology and the consciousness sciences.

Finally, the third level of Reality corresponds to the states of things created in connexion with the knowledge process. He situates on this level of Reality philosophy, art, politics, 'God' metaphors, religious experience and inspiration experience.

Let me define now the word "transdisciplinarity".

Transdisciplinarity is defined through three axioms[6]:

i. **The ontological axiom**: *There are different levels of Reality of the Object and, correspondingly, different levels of Reality of the Subject.*

ii. **The logical axiom**: *The passage from one level of Reality to another is insured by the logic of the included middle.*

iii. **The epistemological axiom**: *The structure of the totality of levels of Reality appears, in our knowledge of nature, of society and of individual human beings, as a complex structure: every level is what it is because all the levels exist at the same time.*

By "level of Reality", we designate a set of systems which are invariant under certain general laws: for example, quantum entities are subordinate to quantum laws, which depart radically from the laws of the macrophysical world. That is to say that two levels of Reality are different if, while passing from one to the other, there is *a break in the applicable laws and a break in fundamental concepts* (like, for example, causality). Therefore there is a *discontinuity* in the structure of levels of Reality. Every level of Reality is associated with its own space-time.

[6] Nicolescu, 1996.

Based upon our definition of levels of Reality, we can identify other levels than the ones in natural systems. For example, in social systems, we can speak about the individual level, the geographical and historical community level (family, nation), the cyber-space-time community level, the planetary level and the cosmic level.

The introduction of the levels of Reality induces a multidimensional and multi-referential structure of Reality.

Our approach is not hierarchical. *There is no fundamental level*. But its absence does not mean an anarchical dynamics, but a coherent one, of all levels of Reality, already discovered or which will be discovered in the future.

Every level is characterized by its *incompleteness*: the laws governing this level are just a part of the totality of laws governing all levels. And even the totality of laws does not exhaust the entirety of Reality: we have also to consider the Subject and its interaction with the Object. Knowledge is forever open. *The root of uncertainty in knowledge resides precisely in this incompleteness.*

The zone between two different levels and beyond all levels is a zone of *non-resistance* to our experiences, representations, descriptions, images, and mathematical formulations. Quite simply, the transparence of this zone is due to the limitations of our bodies and of our sense organs, limitations which apply regardless of what measuring tools – internal or external - are used to extend these sense organs. We therefore have to conclude that the topological distance between levels is finite. However this finite distance does not mean a finite knowledge. Take, as an image, a segment of a straight line – it contains an infinite number of points. In a similar manner, a finite topological distance could contain an infinite number of levels of Reality.

The unity of levels of Reality of the Object and its complementary zone of non-resistance constitutes what we call *the transdisciplinary Object.*

Inspired by the phenomenology of Edmund Husserl[7], we assert that the different levels of Reality of the Object are accessible to our knowledge thanks to the different levels of perception which are potentially present in our being. These levels of perception permit an

[7] Husserl, 1966.

increasingly general, unifying, encompassing vision of Reality, without ever entirely exhausting it. In a rigorous way, these levels of perception are, in fact, *levels of Reality of the Subject*.

As in the case of levels of Reality of the Object, the coherence of levels of Reality of the Subject presupposes a zone of non-resistance to perception.

The unity of levels of levels of Reality of the Subject and this complementary zone of non-resistance constitutes what we call the *transdisciplinary Subject*.

The two zones of non-resistance of transdisciplinary Object and Subject must be identical for the transdisciplinary Subject to communicate with the transdisciplinary Object. A flow of consciousness that coherently cuts across different levels of Reality of the Subject must correspond to the flow of information coherently cutting across different levels of Reality of the Object. The two flows are interrelated because they share the same zone of non-resistance.

The zone of non-resistance plays the role of a *third* between the Subject and the Object, an Interaction term which allows the unification of the transdisciplinary Subject and the transdisciplinary Object while preserving their difference. In the following we will call this Interaction term the *Hidden Third.* It is hidden because it refuses any formalization. The Hidden Third is rational but not rationalisable.

Our ternary partition { Subject, Object, Hidden Third } is, of course, different from the binary partition { Subject vs. Object } of classical metaphysics.

The transdisciplinary Object and its levels, the transdisciplinary Subject and its levels and the Hidden Third define the transdisciplinary Reality or *trans-Reality* (see Fig. 1).

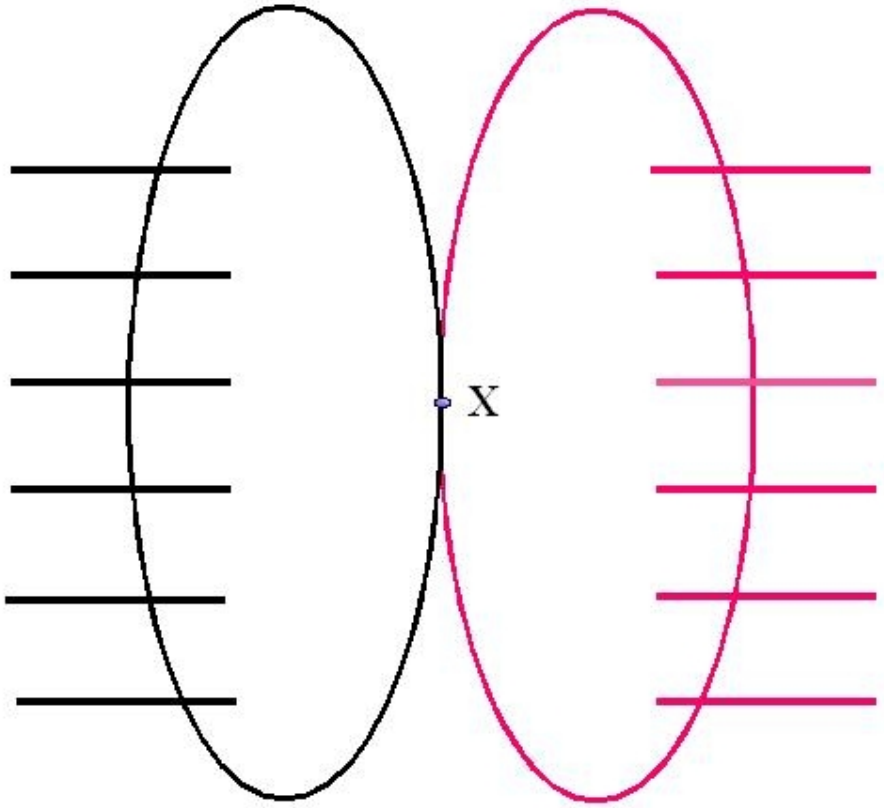

Fig. 1 : Transdisciplinary Reality

The incompleteness of the general laws governing a given level of Reality signifies that, at a given moment of time, one necessarily discovers contradictions in the theory describing the respective level: one has to assert A and non-A at the same time.

It is the included middle logic[8] which allows us to jump from one level of Reality to another level of Reality.

All levels of Reality are interconnected through complexity. From a transdisciplinary point of view, complexity is a modern form of the ancient principle of universal interdependence. The principle of universal interdependence entails the maximum possible simplicity that the human mind could imagine, the simplicity of the interaction of all levels of Reality. This simplicity can not be captured by mathematical language, but only by symbolic language.

[8] Lupasco, 1951; Badescu and Nicolescu (ed.), 1999; Brenner, 2008.

The transdisciplinary theory of levels of Reality appears as conciliating reductionism and non-reductionism[9]. It is, in some aspects, a multi-reductionist theory, *via* the existence of multiple, discontinuous levels of Reality. However, it is also a non-reductionist theory, *via* the Hidden Third, which restores the continuous interconnectedness of Reality. The reductionism/non-reductionism opposition is, in fact, a result of binary thinking, based upon the excluded middle logic. The transdisciplinary theory of levels of Reality allows us to define, in such a way, a new view on Reality, which can be called *trans-reductionism.*

The transdisciplinary notion of levels of Reality is incompatible with reduction of the spiritual level to the psychical level, of the psychical level to the biological level, and of the biological level to the physical level. Still these four levels are united through the Hidden Third. However, this unification can not be described by a scientific theory. By definition, science excludes non-resistance. Science, as is defined today, is limited by its own methodology.

It is obvious that a huge work remains to be performed in order to formulate a unified theory of levels of Reality, valid in all fields of knowledge, which involve, at the beginning of our 21st century, more than 8,000 academic disciplines, every discipline claiming its own truths and having its laws, norms and terminology.

In this context, the clarification of the relationship between transdisciplinarity and complex thinking is of a crucial importance.

As we know, there are several theories of complexity. Some of them, like the one practiced at the Santa Fe Institute, with the general guidance of Murray Gell-Mann, Nobel Prize of Physics, are mathematically formalized, while others, like the one of Edgar Morin are not.

[9] Nicolescu (Ed), 2008.

In the context of our discussion, it is important to note that the existing theories of complexity ignore the notion of levels of Reality. However, some of them, like the one of Edgar Morin[10], are compatible with this notion.

It is therefore useful to distinguish between *horizontal complexity*, which refers to a single level of Reality and *vertical complexity*, which refers to several levels of Reality. It is also important to note that *transversal complexity* is different from the vertical, transdisciplinary complexity. Transversal complexity refers to crossing different levels of organization at a single level of Reality.

If we wish to establish a link between the two main approaches of complexity – the restricted one and the generalized one -, the bridge would be precisely the notion of levels of Reality.

I believe that a future transdisciplinary complex theory of levels of Reality is a good starting point in erasing the fragmentation of knowledge, and therefore the fragmentation of the human being.

Let me finally note that a unified theory of levels of Reality is crucial in building sustainable development and sustainable futures. The present considerations in these matters are based upon reductionist and binary thinking: everything is reduced to society, economy and environment. The individual level of Reality, the spiritual level of Reality and the cosmic level of Reality are completely ignored. Sustainable futures, so necessary for our survival, can only be based, I think, on a unified theory of levels of Reality. We are part of the ordered movement of Reality. Our freedom consists in entering into the movement or perturbing it. Reality depends on us. *Reality is plastic.* We can respond to the movement or impose our will of power and domination. Our responsibility is to build sustainable futures in agreement with the overall movement of reality.

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[10] Morin, 1977, 1980, 1986, 1991, 2001, 2004.

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