GENERAL SYSTEM THEORY: TOWARDS THE UNIFICATION OF SCIENCE

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ABSTRACT

This paper questions two core assumptions pervading the field of General Systems Theory (GST) in order to preserve the ideal of the unity of science advocated by its founding fathers. The author claims that an ontology of levels based on unquestioned emergentist and materialist assumptions leads to a disunity of systems. A dialectical and plural metaphysics is proposed that aspires to unify science based on not on logics but on reality in order to transcend four antinomies of thought: freedom, atomism, being and mind.

It is claimed that reality is animated by an internal force that permeates the entire universe, an endless craving for being referred as the will. The will manifests in the form of substances imprinting their dialectical character and a plural personality on the universe. Besides the metaphysical law of the unity of opposites, the author postulates a set of ontological laws that regulate the manifestation of substances in the universe: individuation, continuity, linear gradation and recursivity.

In addition, each substance constitutes a different kind of being. Together, constituting the ontological levels of reality that come into being when the substance constituting a being is dominated by another substance. Furthermore, once substances come into existence in the form of beings, their craving for being is transformed into a will to immortality. However, since beings are constituted by composite substances, this gives rise to an internal conflict between beings because they all have the same hunger for immortality. Fortunately, there is always a dominant substance that provides unity to the composite.

Therefore, beings don't live autonomous or independent lives but interact with other beings constituted by other substances. This explains the interaction between the ontological levels of reality. Moreover, beings display multiple forms of interaction. There are upward, downward, sideward and outward interactions between beings of the same or of a different kind, belonging to the same or to a different unified totalities.

Finally, it is claimed that the will to immortality manifests differently depending on the kind of being resulting in different forms of individuation. However, beings will only manage to persist in their own being if they are able to preserves their own mode of individuation enacting a set of mechanism and processes.

Keywords: general systems theory, unity of science, emergence, materialism, metaphysics, substances, unity of opposites, beings, individuation.

INTRODUCTION

Broadly speaking, General Systems Theory (GST) claims that reality consists of a hierarchy of systems that constitute different levels of organization. However, this ontology of levels is underpinned by an unquestioned assumption: through evolution, higher levels *'emerge'* from lower levels. Unfortunately, though system thinkers take an antireductionist stand regarding these emerging structures, they don't question another implicit reductionism: levels of organizations emerge out of the structuring of *'matter'*.

As one of the mayor proponents of the emergentist view put it:

> 'we have to reconcile ourselves to much less unity in the external world and a much less intimate connection between the various sciences. At best the external world and the various sciences that deal with it will form a hierarchy' (Broad 1925:77).

This view takes for granted that higher level realities emerge out of lower level ones but it does not explain how higher levels arise. All it says is that each emerging "whole is greater than the sum of its parts". Moreover, it is assumed that there is a co-dependence between levels of organization, higher level systems need lower level ones to exist and once they emerge they shape lower level systems. Therefore, it seems that upward causation dissolves once the higher whole emerges and downward causation prevails thereafter. In short, emergence gives rise to autonomous and independent higher level realities seeming to contradict one of the main claims of GST: that it is necessary to reunify science.

The founding father of GST, Bertalanffy, was reluctant to accept the suggestion that the unity of science project is therefore doomed and stressed that the "unity of science [is] granted, not by a utopian reduction of all sciences to physics and chemistry, but by the structural uniformities of the different levels of reality" (1950:164). Nevertheless, by claiming the existence of isomorphic laws that apply to all fields he was in fact claiming that reality has a logical structure. In his own words, "there is a structural correspondence or logical homology of systems" (Ibid:138). Hence, he proposed the need for a "logico-mathematical field, the subject matter of which is the formulation and deduction of those principles which are valid for 'systems' in general (Ibid:139).

However, it would be unfair to forget that Bertalanffy did not believe that everything could be formulated in mathematical terms and that,

> "The world as a whole, and each of its individuals entities, is a unity of opposites, which in their opposition and struggle constitute and maintains a greater whole" (1952: 54)

It's a pity that this last point has been forgotten in the field of GST.

Another founding father, Boulding, also thought that GST had to be organized along the structural uniformities among systems in general and arranged through "theoretical constructs and constructs in a hierarchy of complexity, roughly corresponding to the

complexity of the "individuals" of the various empirical fields" (1956:202). In other words, GST had "to develop something like a "spectrum" of theories- a system of systems" (Ibid:198).

Although both system thinkers brought great insights into the nature of different types of systems, acknowledging the importance of symbolic meaning and values in human systems, their hierarchy of systems assumed an emergentist position which seems incompatible with the unity of science. Indeed, the autonomy and independence of higher levels from lower level systems seems to go against the more basic idea of the unity of systems. Should not the unity of science mirror the unity of systems? Are the structural similarities among systems enough to ensure the ideal of the unity of science (Migdley 2001) [1]? How is that approach alone going to ensure that justice is done to the unique ontological levels of reality? Can systems be united and yet unique? Maybe the key to this enigma is to base a GST not on logic but on reality, and maybe reality is not logical.

ANTINOMIES OF THOUGHT

Human thought seems to be trapped by logic, in particular, by the principle of principles in logic: the principle of noncontradiction: According to Aristotle, "it is impossible that the same thing belong and not belong to the same thing at the same time and in the same respect" (1005b19-20). Fuenmayor[2], in fact, claims that "the very roots of "reductionism," found in Eleatic thinking, dominate Western thinking (science and most of philosophy) through the principle of noncontradiction" (1991:26).

Indeed, the principle of noncontradiction has led Western thought to an unsolvable set of antinomies than need to be transcended if the ideal of unity of science is ever to be realized. The first, the *antinomy of freedom*, was discussed by Kant in his *Critique of Pure Reason* (1787) and formulated as follows:

[1]According to Midgley, "we should regard the pursuit of unity as an *ideal*. Ideals are theoretical constructs that can be used to guide critical reflection. They are principles that we aspire to, or which we believe underlie our actions in the world […] We may have to *balance* the ideal of the unity of science against the ideal of learning more about a specialized area" (2001: 384). The authors agrees that system science has to find a balance between the fragmentation of knowledge (specialized knowledge) and the imposition of a common language (isomorphies), and believes that the proposed ontological pluralism fosters both the unity of science and the plurality of perspectives. System science has to mirror the unity of systems from a diversity of perspectives.

[2]The author coincides with Fuenmayor's diagnosis that the principle of contradiction has given rise to reductionism. However, disagrees that an ontological polarity can be reduced to a unified form that results from two poles that are recursively connected (1991:23). According to his view, ontology and epistemology are recursively connected. If that was the case, ontology would still be trapped by logic, this time by the "Logic of Essential Reclusiveness" (Ibid:23). Furthermore, since the first recursive form, Subject-Object, from which he derives his onto-epistemology is not an ontological but an epistemological polarity, he is reducing ontology to epistemology.

> "Thesis:
>
> Causality in accordance with laws of nature is not the only causality from which the appearances of the world can one and all be derived. To explain these appearances it is necessary to assume that there is also another causality, that of freedom.
>
> Anti-thesis:
>
> There is no freedom; everything in the world takes place solely in accordance with laws of nature." (1998:407)

Whereas the mechanistic camp seems to believe that all phenomena in the universe can be causally determined and predicted through natural laws, complexity theory believes instead that the universe is driven by self-organized and unpredictable phenomena (Prigogine). From the latter perspective, free will is possible, but from the former viewpoint it is not. Both cannot logically by true, yet this is a struggle of worldviews that has existed for centuries and resists definitive resolution.

The second, *the antinomy of atomism*, highlights the dichotomy between reductionism and holism, and was formulated by Kant as follows:

> "Thesis:
>
> Every composite substance in the world is made up of simple parts, and nothing anywhere exists save the simple or what is composed of the simple.
>
> Anti-thesis:
>
> No composite thing in the world is made up of simple parts, and nowhere exists in the world anything simple." (1998:400)

The third, which can be named the *antinomy of being*, was mentioned by Plato in the *Timaeus* (360 B.C. E) making a distinction between what always is and never becomes and what becomes and never is (27d5–28a1). This is the classical rivalry between the ontology of being held by Parmenides and the ontology of becoming advocated by Heraclitus. Whereas Parmenides, like Plato, stressed the permanence of being, Heraclitus highlighted the impermanence of all beings, and the importance of processes giving rise to what we see as stable forms.

Finally, the last is the classical mind-body problem or the *antinomy of mind* which has prevailed since the Enlightenment thought making a spit between two substances, the mental and the material. Over centuries, philosophers and scientists have tried to give a satisfactory answer to this conundrum. There seems to be no way out of the dualism-monism dilemma, however. Dualists claim that the mind at least in some respects independent from the material world which is governed by the laws of physics. And monists hold to one of the following views: the mind and the body are two aspects of the same reality (dual aspect theory); the mind can be reduced to the structuring of matter (physicalism); matter can be reduced to the mind (idealism); or the mind is derived from the body but has no independent causal power (the mind is an ephiphenomenon).

This last position labelled weak emergence sees the mind as an emergent property derived from the organization of matter or as supervening on the physical level in order to avoid reductionisms. In contrast, strong emergence dismisses the mind-body interaction altogether, claiming that once the mental level emerges out of the physical level it is an autonomous and independent higher level reality. However, if there is no upward or downward causation, there is no mind-body interaction. The mind-body problem, in this account is a miracle. This absurd conclusion also affects the interaction between sciences dealing with different level phenomena which GST wants to unite based on an unquestioned *emergentist materialism* that pervades the field.

In summary, a GST that aspires to the unity of science needs to transcend these four antinomies of thought. But to do so, logics cannot rule over reality, ontology needs to precede epistemology. Thus, GST needs to be based on ontology not epistemology.

METAPHYSICS: DIALECTICAL PLURALISM

Ontology: Substances and Beings

One of the first steps is to distinguish between two philosophical concepts that will help clarify a fundamental ontological distinction: substance and being. 'Substance' is the kind of stuff that reality is made of and 'being' is the kind of things that exist in the universe. For instance, GST implicitly assumes that all reality is made of 'matter' and the universe is populated by different kind of 'systems'. Basically, there is a hierarchy of systems, or levels of organization in the universe, that emerges out of the structuring of matter. Therefore, GST assumes a substance reductionism (materialism) and a being antireductionism (plurality of systems).

However, as we saw earlier, the main problem with this ontological position is how to explain the interaction between the levels of organization if they are autonomous and independent realities. Maybe we need to abandon the substance reductionism assumption and the concept of emergence if we want to understand how the ontological levels are connected. We can propose instead an ontology that does justice our basic intuitions: the universe is populated by different kinds of beings which are not all made of the same stuff.

Thus, the intellectual challenge is to transcend both the antinomies of thought and the materialist monism that pervades the field of GST in order to explain how the different ontological levels are united and, in so doing, approach the ideal of the unity of science anew.

The Will: Endless Craving for Being

Now that we have analysed the issue affecting the field of GST, we are ready to start a journey into the nature of reality. When we observe the universe it seems that all beings are self-directed, driven by an internal force. Moreover, the reality of this internal force seems to go beyond its infinite and eternal manifestations in the universe. This means that there might be more to reality than what exists in space and time. Indeed, the author's

metaphysical assumption is that this internal force transcends space and time. To avoid confusions, it should be mentioned that this internal force is not identical with the universe (Pantheism) or with God (Panentheism).

Following the great Schopenhauer, this internal force driving the universe can be named the *'will'*. In contrast to Descartes, he claimed that our inner awareness does not tell us that we have a thinking nature but that we are volitional beings instead.

> "He will recognise this will of which we are speaking not only in those phenomenal existences which exactly resemble his own, in men and animals as their inmost nature, but the course of reflection will lead him to recognise the force which germinates and vegetates in the plant, and indeed the force through which the crystal is formed […] all these, I say, he will recognise as different only in their phenomenal existence, but in their inner nature as identical, as that which is directly known to him so intimately and so much better than anything else, and which in its most distinct manifestation is called will" (2003: 198)

Heraclitus was also referring to the same reality when he affirmed:

> "This universe, which is the same for all, has not been made by any god or man, but it always has been, is, and will be an ever-living fire" (fragment 30)

This will is the first cause of all things and "gives all things, whatever they may be, the power to exist and to act" (Schopenhauer 1889: 217). The inner essence of the will is an *endless craving for being* which pervades the entire universe.

Substances: self-sufficient, non-extensive, dialectical and plural

Moreover, this endless craving for being manifests in the universe in the form of substances. According to Leibniz's definition, "a substance is an entity [Ens] subsisting in itself […] A substance is an entity *per se*, that is, an entity naturally united [naturaliter unitum]" (cited in Garber 2009:330). In addition, later in his *Monadology* (1714) substances were defined as simple, without parts or extension, thus indivisible. Therefore, substances are self-sufficient and non-extensive unities. Moreover, like Heraclitus insisted, substances have a dialectical essence consisting of a unity of opposites, and manifest as a plurality of personalities, hence, the label of *dialectical pluralism* for this ontology.

Table 1. Subtances in the Universe

Substances	Opposites
Matter	Attraction and Repulsion (Kant 1786)
Life	Integration and Differentiation (Bertalanffy 1952)
Mind	Autonomy and Control (Beer 1972, 1979, 1985; Koestler 1978)
Consciousness	Inner and Outer (Pretel 2014)
Soul	Self and Other

It is easy to see how these substances coincide with different metaphysical doctrines.

Table 2. Types of Substances and Metaphysics

Substances	Metaphysics
Matter	Atomism/Physicalism
Life	Vitalism/Organism
Mind	Panpsyquism
Consciousness	Idealism
Soul (Atman)	Hinduism

Manifestation of Substances: Ontological Laws

As it may evident by now, the metaphysical principle informing all reality is the law of the unity of opposites instead of the principle of non-contradiction which is responsible for the unsolvable antinomies of thought. Furthermore, the manifestation of substances in the universe is regulated by four ontological laws. The first is the law of *individuation*. Substances do not come into existence until they manifest into the universe as a plurality of beings in space and time: "time and space constitute therefore the principle of individuation" (Schopenhauer 2003:201) In other words, when substances come into being, their unity is transformed into a plurality of beings. Moreover, substances don't interact before they come into being, but when they do, they fight among them to ensure their being. That is, substances subdue other substances in order to ensure their

manifestation in space and time. Second, as Leibniz asserts, "nothing takes place suddenly, and it is one of my great and best confirmed maxims that *nature never makes leaps*. I called this the Law of *Continuity*" (cited in Rescher 1991:67). Third, similar to the concept of a hierarchy of systems, the law of *linear gradation* asserts that nature displays an ontological scale. As Lovejoy reminds us, this conception of the universe prevailed,

> "through the Middle Ages and down to the late eighteenth century […] the conception of the universe as a "Great Chain of Being composed of an immense, or […] of an infinite, number of links ranging in hierarchical order from the meagerest kind of existents, which barely escape nonexistence, through "every possible" grade up to the ens perfectissimum" (1936:59)

Finally, as Aristoteles acknowledged, nature "passes so gradually from the inanimate to the animate that their continuity renders the boundaries between them indistinguishable; and there is a middle kind that belongs to both orders". Indeed, beings overlap due to the law of *recursion* that connects the entire universe together rendering a unified totality made of nested beings. Each being is embedded in a larger being and contains smaller beings, all the levels that make up a being constitute its levels of recursion.

BEINGS: UNIFIED TOTALITIES

Ontological levels of reality

Now that we have established which kind of substances make up the universe and the laws that regulate their manifestations, we can turn to the kind of beings that exist in the universe. As was mentioned, substances come into existence in the form of beings. Each substance constitutes a different kind of being. Together, the plurality of beings constitute the ontological levels of reality that come into being when the substance constituting a being is subdued by another substance.

Table 3. Ontological Levels

Substances	Beings
Matter	Physical
Life	Living (Maturana and Varela 1980)
Mind	Viable (Beer 1972, 1979. 1985)
Consciousness	Conscious (Pretel 2014)
Soul	God

To understand the essence of beings better, we need to travel a short journey into the mind of a great philosopher and mathematician, Leibniz. But before we start, it is interesting to note that Leibniz made the last attempt in the late seventeenth century to use the concept of substantial forms that dates back to Plato and Aristotle to understand the universe, which was later discredited by modern science. In his earlier years, Leibniz described beings as corporeal substances containing further corporeal substances ad infinitum. Thus, Leibniz conceived beings as composite substances. In addition, substantial forms give beings their unity and activity**.**

However, in later year Leibniz changed his view on beings, true beings where no longer composite substances because they lacked true unity since they could be divided into parts ad infinitum, only simple substances or "monads are the true atoms of nature, and, in a word, the elements of things" (Rescher 1991:17). He argued that "if there were no true substantial unities, however, there would be nothing substantial or real in the collection" (Ibid:47)). Accordingly, only simple substances could be granted the status of true unities and hence composite substances were no longer true beings because they had parts and could be divided into further parts. But what if a part was conceived as a totality? What if totalities could be divided into further totalities and still find true unities? Indeed, the author conceives *beings as unified totalities constituted by substances*.

Types of Interaction: Upward, Downward, Sideward and Outward

Once substances enter the cosmos in the form of beings, their craving for being is transform into a will to immortality. Beings want to persist in their own being (Spinoza 1910: 91). Now that beings *are* they want to continue being. This is when conflict appears because all beings have the same hunger for immortality. But this conflict does not necessary divide beings. As Leibniz acknowledged, in beings made of composite substances there is always a *dominant substance* that provides the unity to that composite. In other words, although inside a being there can be an internal conflict between beings constituted by different substances, they are united by the dominant substance. Therefore, beings constituted by different substances interact in unified totality. Indeed, beings don't live autonomous or independent lives but interact with other beings constituted by different substances. This explains the interaction between the ontological levels of reality.

Furthermore, in a unified totality beings also interact with other beings pertaining to either the same ontological level or even to the same level of recursion. In this case, there is always a *dominant being* that directs the activity of the unified totality. In addition, beings can also interact with other unified totalities, sometimes resulting in a mutual symbiosis and other times beings become subdued, assimilated or, even, destroyed by other *dominant totalities*.

Therefore, the interaction between beings takes place in four fronts:

- Between different ontological levels

- Within the same ontological level
- Within the same level of recursion
- Between different unified totalities

To put it differently, there are upward, downward, sideward and outward interactions between beings of the same or of a different kind, belonging to the same or to a different unified totality.

Forms of Individuation

As was mentioned earlier, once beings *are* they want to continue being. They want to persist in their own being, continue preserving their individuality. However, that *will to immortality* manifests differently depending on the kind of being which results in different forms of individuation. In the case of physical beings, fractal cosmology claims that the universe displays a fractal appearance which gives us a good evidence of how the will for immortality manifests in this cases as a will for *self-similarity*. Moreover, self-similar patterns have been observed in numerous natural phenomena such as coastlines, ocean waves, crystals, snowflakes, DNA, pineapple or broccoli. It seems that where matter substance dominates we are bound to observe self-similar patterns showing up in physical beings. Therefore, self-similarity is the form of individuation of physical beings. Physical beings display their identity in the form of unique self-similar patterns.

Second, the will to immortality, however, manifests as a will for *self-preservation* in the case of living being. The life substance manifests as a plurality of life forms that don't want to cease living and thus need to feed on nutrients to continue existing. The life substance comes into being when it manages to subdue the matter substance that constitutes physical beings. Therefore, the explanation of why we don't observe self-similar patterns everywhere in nature is because another substance such as life is dominating. In this case, the form of individuation in living beings is self-preservation which results in countless forms of life that keep evolving to maintain their identity.

If we turn to viable beings, the will to immortality manifests as a will to *self-development*. When the mind substance manages to control the life substance, living beings become subdued by a viable being. This is apparent in animal colonies like ants, bees and other insect societies in which individual living beings a regulated by the viable being. In this case, the will to self-development prevails over the will to self-preservation in the quest for hegemony of the mind substance over the life substance. Therefore, self-development is the form individuation of viable beings, becoming more effective goal realizers and thus more effective in actualizing themselves to keep their individuality alive.

Next in line of succession come conscious beings. When the consciousness substance rules over the mind substance, viable beings become directed by conscious beings. That is, goal realizers are subdued by meaning seekers. The will to immortality manifests now as a will not to self-development but to a will to *self-transcedence, a* will to *meaning* (Frankl 1946). A conscious being is a "being reaching out beyond himself" (Frankl 2010:125), realizing and actualizing values rather than himself and this is his form of

individuation. Indeed, a conscious being transcends its self-referential nature (Beer 1985:4) because it "is oriented towards the world, towards the world of potential meanings and values which so to speak are waiting to be fulfilled and actualized by him" (Frankl 2010:95). Therefore, paraphrasing Leibniz, conscious beings do have windows.

Lastly, in the case of God, the will to immortality manifests as a will to *other-integration*. When the soul substance dominates over conscious being a being called God is constituted which has the power to integrate all being in a unified totality. The will to other-integration results in a form of individuation that brings forth the hidden harmony of the universe. In fact, this was one of the main teaching of Heraclitus, "opposition brings concord," and "out of discord comes the fairest harmony" (cited in Wheelwright 1966: 77).

Table 4. Forms of Individuation

Beings	**Forms of Individuation**
Physical	Self-similarity
Living	Self-preservation
Viable	Self-development
Conscious	Self-transcendence
God	Other-integration

Modes of Individuation

Finally, no matter how intense is the will to immortality is, beings will only manage to persist in their own being if they are able to preserves their own mode of individuation enacting a set of mechanism and processes which are listed in table below.

Table 5. Modes of Individuation

Beings	**Mechanisms**	**Processes**
Physical	Self-Replication	Electromagnetic Force Gravity Force Strong Force Weak Force
Living (Maturana and Varela 1980)	Self-Production (Autopoiesis)	Epigenesis (Aristotle 1942) Natural Selection (Darwin 1859) Symbiogenesis (Margulis and Sagan 2002) Structural Coupling (Maturana and Varela 1980)
Viable (Beer 1972,1979, 1985)	Self-Learning	Production (S1) Coordination (S2,S3) Adaptation (S4) Policy (S5)
Conscious (Pretel 2014)	Self-Knowledge	Orientating Centring Acting Transcending
God	Other-Understanding	Goodness Truth Beauty Justice

SYNTHESIS

The following figure is a whole that represents all the elements of the dialectical pluralism proposed by the author to base GST. The self-sufficient and non-extended substances are inside the inner core coming into existence in the form of unified totalities constituted by composite substances that constitute together the ontological levels of reality. In turn, unified totalities are nested beings of the same or different kind that are recursively connected. Finally, the inner core represents the soul substance and the outer core God.

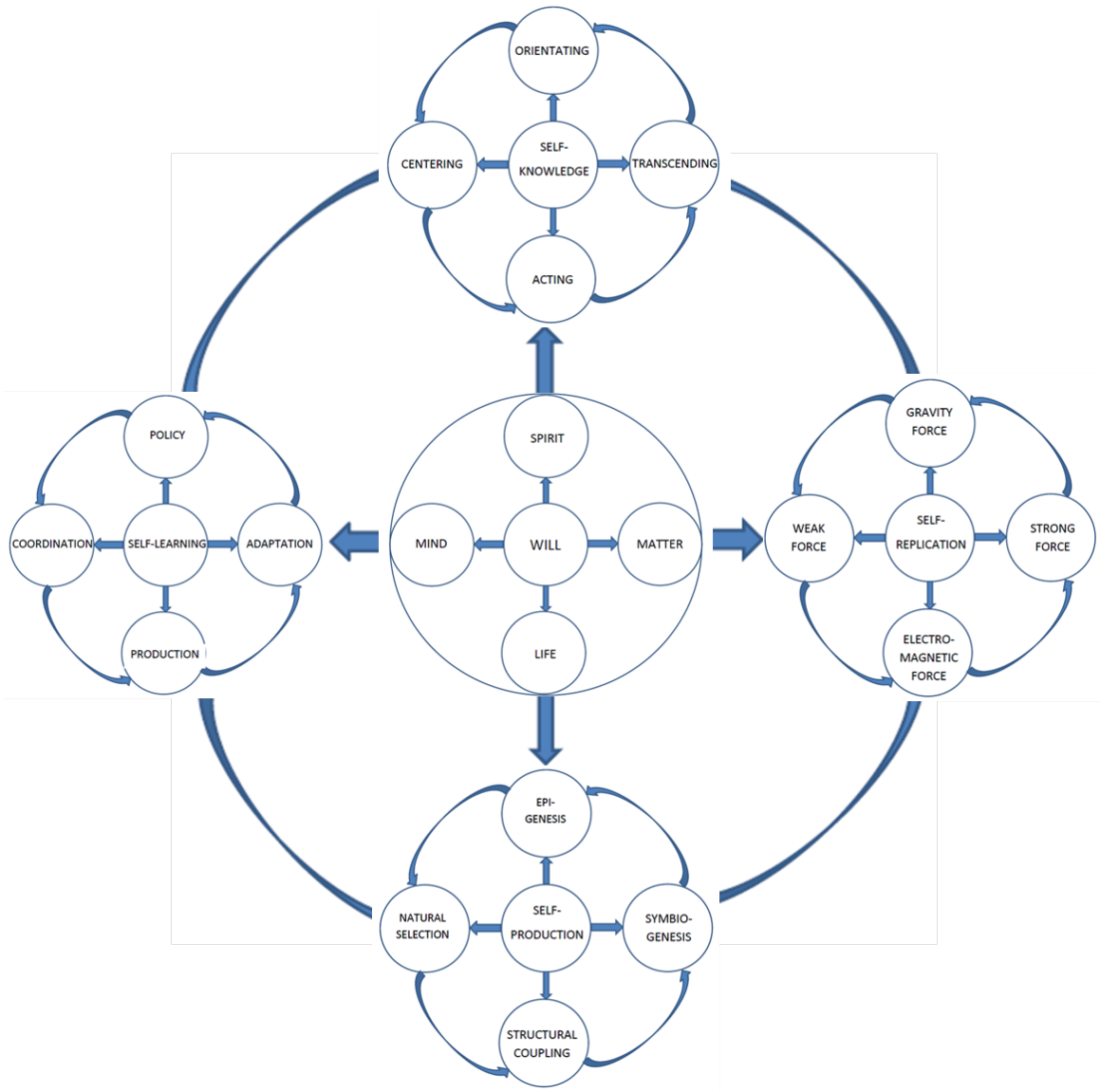

Figure 1. Dialectical Pluralism Synthesis

CONCLUSION

As this paper has tried to argue, if the discipline of GST still believes that it is necessary to reunify science as was advocated by its founding fathers, it needs to reconsider two core assumptions: emergence and materialism. Otherwise the resulting picture is not a unity of systems but a hierarchy of autonomous and independent systems. The concept of emergence fails to explain how higher level of realities arise from lower level ones and how different levels of organization interact. In addition, GST implicitly assumes a substance reductionism (materialism) that seems to contradict the different ontological levels of reality constituted by a plurality of substances.

However, just by saying that the emerging whole is "more than the sum of its parts" and that there is a co-dependency between levels of organization does not seem to be a good answer. If higher level wholes emerge that shape lower level ones, it seems that the upward causation dissolves once the higher whole emerges and downward causation prevails thereafter. Instead, the author claims that the ontological levels of reality are constituted by different kinds of substances and come into being when the substance constituting a being is subdued by another substance. Moreover, beings display multiple forms of interaction. There are upward, downwards, sideward and outward interactions between beings of the same or of a different kind, belonging to the same or to a different whole.

Maybe if the field of GST accepts that the universe is constituted by different ontological levels that are not autonomous and independent realities emerging from matter but unified totalities constituted by composite substances, the ideal of the unity of science will be realized one day.

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