Kant and Simondon on Hylomorphism and Individuation:

A discussion about realism, idealism, matter, and information

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ABSTRACT.
In this paper we offer a reading of Kant's schematism and Simondon's theory of individuation to draw some important parallelisms. The main goal consists of showing how both confront the hylomorphic scheme, the former within a theory of knowledge and the latter in the context of a philosophy of nature. It will be shown, however, that Kant's philosophy is not purely subjective. Not only he strived an empirical realism, but in some key sections of the Critique of Pure reason he offers already arguments to investigate the form and limits of our relationship to the real world. At the same time, Simondon will be read as a philosopher of nature that incorporates the intelligible in things through the notion of information. They key parallelism lies in the fact that they use the hylomorphic model to explain processes of unification/individuation showing at the same time its limitation. This lies in the heterogeneity of form and matter and the impossibility of imposing the former of the later without further mediation. They will have to attribute matter some form, and some materiality to form. This will lead to the creation of a third space, synthesis or result of the concurrence of disparate levels of organization. It will be concluded that the complementary reading if Kant and Simondon offer a natural realism compatible with the main exigences of transcendental philosophy.

1. Kant's realism

Kant has recently become a key figure in the idealism-realism debate. The reception of his work in the 20th century reception is far from homogenous, but one may claim that his transcendental idealism overshadowed his empirical realism. The so-called linguistic turn, according to which ontology may be reduced to epistemology and epistemology to language analysis, found in Kant a key forerunner. This interpretation is not arbitrary, for Kant himself insisted in the impossibility of reaching things in themselves. This lead early to several criticisms from figures like Jacobi and Schelling, insisting that transcendental philosophy is in the risk of losing the very real. Kant himself tried to provide arguments against unilateral readings in the second edition to the *Critique of pure reason* (*KrV*). Important in this respect is the *refutation of idealism*, a very short section which seems to contradict the more extreme claims about the inaccessibility of things in themselves. In the *Transcendental aesthetic* he defends that intuited things, included their relationships and constitution are not things in themselves, that they only exist in us (A42/B59). But on the *Refutation of idealism* we read:

> I am conscious of my existence as determined in time. All time-determination presupposes something persistent [*Beharrliches*] in perception. This persistent thing, however, cannot be something in me, since my own existence in time can first be determined only through this persistent thing. Thus the perception of this persistent thing is possible only through a thing outside me and not through the mere representation of a thing outside me. (B 276)

Also in the *Transcendental aesthetic* we read that objects [*Gegenstände*] that we represent are not mere appearances [*Schein*], they are presented as something *really given* [*wirklich gegeben*], included its constitution [*Beschaffenheit*] (B 69).

If the *Critique of Pure Reason* is an analysis of the *conditions* of knowledge, it must be assured that we actually *know* something. Otherwise, philosophy would not be different to classical rationalism/dogmatism in which knowledge is achieved through pure understanding. Kant states that things in themselves are to be regarded as =X (A 104). The ultimate possibility of knowledge depends on the I and its unity, namely, the transcendental unity of apperception. This takes the form of identity I=I. There is thus a tension between the identity required for knowledge (A=A) and the relationship of subject to object (A≠B). For Kant equality and inequality are equally originary. Fichte has the merit of stating that

the real problem of philosophy is the link between subject and object, the absolute relationship. There are two equivalent formulations for the first principle, as he states in the *Wissenschaftslehre* (Fichte 1794/1956): "I am I" and "I=I". The first has the form of predication, the second, the mathematical form of equality. For him, the real "X" of philosophy are the terms "is" and "=". Now, the "link" is double: it must relate the subject to itself and the subject to the object. Fichte reconciles subject and object in the first principle. The I is an object for itself. The otherness attributed to the object, the no-I (A≠B), appears as the second principle, *subordinated* to the first.

One may say that Kant's (read classically as some who denies the possibility of knowing things in themselves) and Fichte's philosophies remain purely subjective, that the unity provided by self-consciousness does not explain how knowledge is possible at all, i.e., how *things and their relationships* really *affec*t us. Philosophy cannot do any progress in investigating *nature*, for it stops in the conditions of access, in the conditions of possibility of science, reserving to the latter all the rights to speak about the real. Philosophy is formal, all content stems from concrete sciences, although the latter is grounded in the former. Kant himself claims that intuitions are *grounded* in things in themselves (A 49/B 66), but such a ground is not known. It is the transcendent matter of experience for the subject, which is pure form. But *within* the subject, intuitions will turn to constitute the subjective *matter* which will be formed by the pure concepts of understanding. There is, so to speak a duplication of the absolute subject-object relationship within subjectivity. As a transcendental philosopher, Fichte will make self-consciousness the precondition for all subject-object relationship. Even if we are affected by things (Fichte uses the term *Antoss* to name this encounter) what we have access to are intuitions and intuitions already possess subjective forms of intuition (time and space). But we do not know nothing about our link to nature, only what we unite in our consciousness.

One may question the alleged inaccessibility of things in themselves on two grounds. First: because we are also real, we are also nature, i.e. living and thinking nature. Second, because, as Kant himself acknowledged, nature seems to *anticipate* subjectivity in life. The section devoted to the *Refutation of idealism* in the *KrV* is difficult because it seems to require attributing to time and space some *reality* as well as to the relationship cause-effect. In this section it is claimed that all intuitions suppose something that lasts, something insisting with is presence in the midst of a constat flow of representations. This stable thing

(*Beharrliches*) has the same function as substance: it is the stable in time, the content regarding pure form. We know, however, that "substance" is but a concept of understanding. The same occurs when thinking causality, another pure concept of our reason. For Kant I am aware of myself only if my senses are determined. This determination requires something different to itself, a real thing. This real thing determines my senses through affection. Now, being affected means to be part of a real causation process. Indeed, when the sensation ceases it is because the object is longer in contact with us. It has withdrawn. But to understand how two things can enter in contact or how can they suspend it, we need to suppose some common space, another violation of Kant's radical transcendental view. Finally, if things can eventually approach or distance, we need time, the elementary condition for change in the real. In this respect it is no surprise that Kant dedicated his last investigations to matter in the *Opus Postumum*. Matter is not an empirical concept, something than can be directly investigated by science. It is a metaphysical concept as it involves the totality of nature. But it is clearly not a scientific interrogation. Despite this, the investigation of matter remains "transcendental" but in a peculiar way, not very different to Schelling's nature philosophy. The investigation of nature is not done through pure concepts of understanding, but from the scattered knowledge of matter delivered by concrete sciences. Kant could have named it reflection in a broad sense when compared to what is stated in the *Critique of Judgement* (*KU*). In it, Kant tries to thing in a single all-encompassing process natural and human history.

The seed for such an enterprise lies in the fact that we appreciate in life a figure which is neither a subject nor pure mechanism. There is, in nature, something that resembles me as a subject, but not fully. Nature is not taken only as a picture of the world, as something grounded in understanding, but as something grounded in nature at the same time. There is so to speak a double grounding: in us, as beings who understand and interpret the world, and in the world, so far we are part of it, not only because we are also real, but because we are a product of nature. We appear two times: in first person, for us, and in third person, in nature. The enigma is the transit, the second person, which seem to lie in life. If subjectivity is I and everything not-I, it seems necessary to be more refined. There is the absolute no-I of things, the relative not-I of other intelligent and sentient beings and the not-I of the other, my neighbor. But at the same time as a subject there are also important distinctions: the empirical and the transcendental I, the practical and the theoretical, etc. The unity of the I is not simple, self-reference has levels and

modes. We are not transparent to ourselves, and that is what makes critique necessary. Let's remember the first lines of the *KrV* where Kant says that reason has the inevitable tendency to pose unanswerable. The enemy of reason is not sensibility or the passions or unreason, but reason itself. This is why the *analysis* of reason is made as a prerequisite to orient its *use*.

But what to do with Kant if on the one hand he prohibits all direct access to the thing in itself and, on the other, he seems to claim that time, space and at least some of the concepts of pure understanding must be considered as real relationships of the world? When Kant says that we cannot know things in themselves he is only saying that we cannot know them from the inside, but from our contact with them. But because we are part of that world out contact with them is real, understandable, for example, in terms of causation or reciprocal interaction. Intuitions are "ours" but are also "preformed" but the common space and time and set of relationships we, subjects, share with things in themselves. To cut all relationship with the world as otherness makes knowledge impossible; in this case all representation should be thus understood in terms of production or creation, as pure activity. But Kant says that sensibility is the realm of passivity and reception. How could receive something that is made of a different "substance"? Now, to solve the problem of heterogeneity, there is the temptation of unifying immanently the field of interrogation, either as pure subjectivity or as pure nature. In the first case we fail to recognize otherness of nature, in the second, we naturalize consciousness, losing its very ideal nature. *The fundamental problem of transcendental philosophy is that of the synthesis of two heterogenous yet nor fully separated modes of being: subject and object.*

Kant has shown that there is an "isomorphism" between the relationships what we find *in us*, and the relationships that constitute us. There is time and space as forms of sensibility and there is time and space as the common world we share with things and other I such that they can affect us. The same goes for other "logical" forms. They constitute the table of judgements and categories, but they have to be supposed in order to explain our very *existence*. The *KrV* divides the structure of the knowing subject in sensibility and understanding. The first provides the matter while the second provides the form. But there is already form in sensibility. It possesses an irreducible matter stemming from the world and a form provided by our senses: time and space as pure forms of receptivity. On the other side, concepts are forms applied to intuitions, but also provide the matter to the construction of higher-order judgements. From another perspective intuitions

and concepts so far they are representations (*Vorstellungen*) they constitute the matter upon which the pure I, a logical form of apperception, is applied. As we can see, there is no fixed domain to be called absolute matter or absolute form.

In the refutation of idealism Kant says that we do not only consider known objects to be real, but also their constitution (*Beschaffenheit*) that is, their relationships. Because what does it mean to know an object but to apprehend its relationships, even the simplest of substance and attributes? If we know something, we know relationships. We do not incorporate matter into us in the act of knowledge. It is a material contact that *transfers information*. This was Descartes' bafflement when observing pain: a mechanical encounter of our body with fire turned into something mental: sensation. There was a shift of nature of the phenomenon. Or the phenomenon included a shift from extension to mind. This is precisely the enigma. From the point of view of form and matter, it can be said that the object corresponds to matter and the subject to form. But there is a problem. If the object is pure matter, *materia prima*, without form, then there is nothing to know in it. We would have a brute and silent contact with things, imposing arbitrary forms from the outside. Matter must already contain form. On the other side, the subject must be both real to be able to enter in contact with real things, and ideal, to be able to think them. The global structure at stake cannot be grasped in the simple relationship A-B, but the relationship A-B<=>A'-B' (matter-subject<=>subject-matter).

2. Schematism

We have seen that in order to save knowledge, Kant requires an empirical realism, i.e. the certainty that there is a real world (not only objective, for us) and that it is knowable. The refutation of idealism, the commentaries in the transcendental aesthetics, the interest in matter in the *Opus Postumum* and in nature as it appears in the *KU* clearly shows Kant's *philosophical* interest in nature as a whole, what the *KrV* prohibited, and the *KU* confined to mere reflection. It seems that between pure objectivity and mere reflection there is third term in which we formulate global conjunctures and hypothesis which are both in consonance with concrete sciences and with understanding. It may be called reflection but not as a free play of imagination or speculation in a bad sense. There is an index of plausibility that is neither deductive nor inductive but, to use a term from Peirce: *abductive*. Nature philosophy is closer to abduction than a fiction having the form of an "as

if" (*als ob*). In nature philosophy the object is the self-configuration (its formal dimension) of matter in different domains (in which subjectivity is both a domain and the domain in which all domains appear).

Now, the problem in Kant's whole philosophy systematically seen is that of *synthesis*. He is reluctant to construct an absolute system for that would annul the fundamental ontological difference between things and concepts and between intuitions and forms of understanding. But he is not dualist, for *synthesis* is the source of all knowledge and, eventually, the conjunction between natural history and human history constitutes a single horizon for humans. Science and morals, theoretical and practical reason are both interlaced and irreducible one to the other. There is also no absolute third in which both sides would lie, nor a "common ground" or a first principle providing the Kantian edifice with a global and final form. There is rather a multitude of connections to be clarified.

We have stated the importance of the real, nature and matter for Kant, but also the difficulted to treat them as real because of the transcendental precaution not to confuse things with our representations of them. Yet, there must be a connection between both or else, there is no knowledge at all. Knowledge requires both activity and passivity, something constructed, and something given. But if we say that there is an ultimate connection subject-object as thing in itself and subject, and that the subject is on one side of the equation, it is clear that there is no possibility of explaining what the other thing is in itself or without us. Even further, we are conscious of the things in singular and local encounters, but not of the structure of nature making capable such encounters. And yet, we have access. The very idea that we are subjects and that we have a representation of things from a perspective is something we have to explain. How do we arrive to the conclusion that we are subjects, different from things, if we cannot get outside ourselves? It is because we can *compare*. We compare things, we compare opinions of different people about the same object, we compare how we see things from different perspectives and different moments, we compare ourselves with other people, animals, etc. This means that we are not constituted by one single all-determining difference, but by a multitude of relationships, which we can vary to test our beliefs. Nor the object nor the subject are made of a single and solid piece. There are several relationships with varying degrees of freedom. This what makes *experimentation* possible.

We can find the same subject across Kant's philosophy: the double claim of continuity (self-consciousness, immanence) and break (separation, heterogeneity) between subject and object. It is clear that both immanence and transcendence,

simple continuity and radical break are two impossible limits for synthesis. This is why the Kantian "system" offers a plural structure that never reaches absolute unity, a first principle or an ultimate ground. But since all the parts of the system interlaced, they arrive to absolute separation. Kantian philosophy is between "the one" and "the two". This formulation is close to the philosophy of Simondon, a philosopher akin to the problems Kant is dealing with, as we will try to show below.

But let's stay with Kant for a moment. We have insisted in how the main problem for Kant is the synthesis of the heterogeneous. This is said all the time, and it constitutes the Leitmotiv of the *KrV*: knowledge results from the synthesis of concepts and intuitions, the ideal and the real. But how is this possible? How can form and matter, real and ideal get into touch if they are heterogeneous? In the transcendental deduction of the *KrV* Kant offers the reasons why we have to admit the existence and contribution of pure concepts of understanding to give account of the factum of science. Mathematics and physics deliver absolute certain objects of knowledge. Such certainty cannot be derived from our encounter with empirical objects. Every empirical encounter is locally and temporally given and bounded. As Hume claims, no necessity can be attributed to empirical successions of events. But both mathematics and physics deliver knowledge (synthetical judgements, where something new is known) and necessity. Since empirical experience cannot provide of necessity and we have necessary knowledge, such certainty must come from another place. This place is called understanding, where we find most of the classical metaphysical concepts, but know recognized as pure "logical forms", lacking any content.

But there is still a problem to be addressed. If the transcendental deduction proves the *necessity* of pure concepts of understanding to explain necessary knowledge, it is not clear how that takes place. If concepts and intuitions are ontologically different, if the have a different origin, what assures their compatibility. It is true that both intuitions and concepts are representations and that, as such, they are elements of understanding. But it is clear that concepts cannot be imposed on intuitions from the outside. This would make the application of concepts arbitrary. There must be something in the object making this or that concept or understanding more appropriate. This problem is openly dealt with in the section on the schematism. As it happens with the refutation of idealism, the schematism is both short and obscure. The extension of the sections gives the impression that they deal with mere clarifications, because the main arguments are already at hand. The schematism seems at first glance to offer an explanation

of how we can subsume particulars in concepts. We know what subsumption consists in establishing the belonging of an individual to a class in the light of some property. But Kant says that there is problem in the application of concepts to intuitions because there exists a heterogeneity (*Ungleichartigkeit*). The problem emerges when I try to gather intuitions and pure concepts of understanding. This is precisely the problem of the whole *KrV*: how to introduce form in matter, the general in the particular, the real and the ideal. How can a concept correspond to an intuition if they are so different in nature? Kant writes:

> In all subsumptions of an object under a concept the representations of the former must be homogeneous [*gleichartig*] with the latter, i.e. the concept must contain that which is represented in the object that is to be subsumed under it [...] Thus the empirical concept of a plate has homogeneity with the pure geometrical concept of a circle, for the roundness that is thought in the former can be intuited in the latter. Now pure concepts of the understanding, however, in comparison with empirical [...] intuitions, are entirely unhomogeneous, and can never be encountered in any intuition. (A 137/B 176)

Independently of the type of function we attribute to schematism in the *KrV* we can appreciate the problem. The heterogeneity between concepts and intuitions is not that radical, such that they could never enter in contact. But there is also no immediate connection such that to every intuition one and only one concept of understanding could be assigned. There is space for consideration while remaining faithful to what is given. If the transcendental deduction shows that it is necessary that concepts of understanding apply to intuitions, it is not said how, nor which types of problems we are confronted with. Kant says that a transcendental doctrine of the capacity to judge (*Urteilskraft*) must show "the possibility of applying *pure concepts of the understanding* to appearances ["*wie* reine Verstandesbegriffe auf Erscheinungen überhaupt angewandt werden können"] (A 138/B177). Kant's answer is that there is a third element a third "domain" providing some structure supplementary to that of time and space. This domain is governed by a third faculty: imagination (*Einbildungskraft*), being both sensible and intelligible:

> Now it is clear that there must be a third thing, which must stand in homogeneity with the category on the one hand and the appearance on the other, and makes possible the application of the former to the latter. This mediating representation must be pure (without anything empirical) and yet *intellectual* on the one hand and *sensible* on the other. Such a representation is the *transcendental schema*. (A 138, B 177)

One may think that imagination accomplishes the ultimate synthesis demanded by reason. But this is not obvious, because the ultimate instance of synthesis is the transcendental unity of apperception. It is not hard to see that concepts like "unity", "synthesis", "subsumption" or "gathering of the multiple" are close but not equivalent at all. We may see *unification as a type of individuation in different levels*. To provide a synthetical unity of what passes in time to deliver a unified object is the task of intuition. To provide a general space for the operation of representations is the task accomplished by understanding. What is thus the job of schematism and of imagination in general? Kant says that thinking is spontaneous, i.e. an act of freedom. But the task of knowledge lies, at the same time in establishing necessary connections between things. How can that be possible? We can identify the activity of subjectivity in judging, its active character. But it is in judgement that we also find freedom because we can decide which concepts suit better the observed material. Judging is both necessary and free, it establishes necessity but only according to a certain point of view of under certain considerations that are not obvious. What we see in the schematism is the classical problem of hylomorphism, how to bring together matter and form.

It is not violent to interpret the whole Kantian project as a display of oppositions. The *KrV* often resorts to the hylomorphic scheme. As we have argued, in the *KrV* things in themselves provide the absolute matter, while the subject provides the form. Within the subject intuitions provide the matter for thought and understanding, its form. It is repeated that they are different, but that they must come together. There is a double origin of experience a sort of "polyarchy". Subjectivity is this sense both a "formal space" where operations with representations take place, and a "focal point" where two different sources meet.

Schematism provides thus a third, both intellectual and sensible that serves as mediation for concepts and intuitions. Transcendental schemes are homogeneous to form and to matter at the same time. From this a third object comes to the fore. There is process of individuation, where intuitions are formed, and concepts are rendered sensible. But as we have noted, this would not be possible if matter hadn't any form (and it has a form provided by the a priori forms of time and space) and if concepts didn't have any matter (i.e., if they could not be instantiated in a variety of general relationships). Schematism is brought about by the transcendental imagination. The question here is the role of imagination regarding sensibility and understanding. There are at least two possible readings. Either imagination is a transit in the subsumption of intuitions in concepts. Or it is the place where

concepts and intuitions meet, thanks to a process of transformation. Elements supporting both claims can be found. Kant does not depart from the problem of subsumption, but he clearly speaks of the production of new syntheses.

Philonenko (1982) convincingly argues that the schematism is aimed at providing an answer to Berkley's objection to the possibility of general concepts. Indeed, if we introspectively search in our spirit the "general concept of triangle", it is nowhere to be found. We always find a *concrete image* of a triangle. A general concept should include all triangles without being none of them. In more contemporary terms, such a concept should include a rule to construct a general object *including all its variations*. A classic example is the symmetry group of the equilateral triangle. The symmetry group defines all the possible transformations (reflections and rotations of the figure in bidimensional space) under which the object *remains invariant*. Such a group, as the "general concept of triangle", involves "more" than a single knot, and "less" than the general concept of object. It is something in-between including real and structural knowledge of the world. By means of schematism we obtain second-order rules. We do not only construct a triangle, but the *set of all triangles* (invariance), obtained by some variation following from some operation.

3. Transcendental schemes, time, and numbers

Transcendental schemes are the work of imagination. A *third* space different to both intuition and understanding comes into play. The determination of our inner sense, which is time, offers such a space where structural elements of the perceived can be extracted approaching them to pure concepts of understanding. The task of schematism lies in *recognizing abstract relationships of things to time and within time*. As Kant says that schemes are: a priori time determinations according to rules (*Zeitbestimmungen apriori nach Regeln*) (A 145/B 185) and, following the order of the categories, they refer to; time sequence (*Zeitreihe*) time content (*Zeitinhalt*), time order (*Zeitordnung*) and the time paradigm [*Zeitinbegriff*] regarding all possible objects (A 145/B 185). In this way the synthesis of all multiplicity (*Mannigfaltikeit*) in sensibility (*Anschauung*) takes places within the inner sense, and, indirectly, thanks to the transcendental unity of apperception.

Transcendental schemes allow us to *think and perceive* at the same time objects in terms of pure concepts of understanding, like substance, reciprocal

action, or causality. Some sentient intelligence, like Husserl's categorial intuition, seems to be at stake. Schematism is exemplar in the Kantian project because it deals with the mystery of the relationship between logic and existence, form, and matter. Schemes are "the phenomenon, or the sensible concept of an object [*Gegenstand*], in agreement with the category" (A 146/B186). This is possible because all objects of sensibility, pure or empirical, are given in time, even spatial ones. Not because space relationships can be translated into time relationships, but because spatial objects are always *given in some temporal sequence*. This is why time constitutes the absolute dimension of givenness. Now, time, as Kant says in the transcendental aesthetic is a *pure form* of receptivity. In this sense, time is linear, directed, continuous and infinite. This framework allows the classification of phenomena according to time relationships. To *determine time* means only to show different possible relationships within a certain structure. We offer here a table of categories, judgements, schemes, and a modern interpretation.

We won't go into details. Let's concentrate on the category of quantity. For Kant quantity involves the schema of number. Number is thus the quantity of the phenomenon. Metaphysical concepts of singularity, multiplicity and totality are transformed by Kant into logical concepts, very close to what we today call quantification. But quantification in general, without numbers is only vaguely applied to things. Science requires numbers, what constitutes a link between abstract quantification and precise numeric determination. In the eyes of the contemporary mathematician number theory is as theoretical as logics. The obey more Hilbert's system of axiomatization and the demand of proofs than Kant's understanding of numbers.

It would seem than numbers in Kant, although not psychologically defined, seem to have a foot in sensibility. This is how Kant explain the "unreasonable" applicability of mathematics in the real world. He might offer a very limited understanding of numbers, but he is right in showing the big problem of linking logics and sensibility. Number theory offers indeed a middle terrain between pure mathematics and a tool for empirical sciences. We can structure our knowledge in logical fashion in order to avoid contradictions. But the objects of science can only be modelled by specific fields of mathematics. Neither category theory nor set theory, the competing theories regarding the foundations of mathematics, suffice to describe physical phenomena. We need analysis, or groups, of topology, i.e. mathematics to model objects and, moreover, structures and systems.

Category	As pure concept of understanding	As type of judgement	Judgements	As scheme	Former metaphysical concept	In logical terms
Quantity				Magnitude as quantity (time sequence) → **Number**		
	Unity	Singular	A is B	A punctual moment in time Number 1 (count)	The singular	∃! (only one)
	Plurality	Particular	Some A is B	An extension of time Iteration of ne. 1, line segment, indeterminate addition (divergence)	Multiplicity	∃ (many)
	Totality	Universal	All A is B	The whole set, a determinate sum (convergence)	The one-all	∀ (many)
Quality				Intensity of sensation as index of existence (time content) →**Degree**		
	Reality	Affirmative	A is B	Presence of sensation in time as substance (fullness)	Being (substance or subject in predication)	Set {x}
	Negation	Negative	A is not B	Absence of sensation in time Emptiness	Nothingness (negation of the predicate)	Empty set ∅ ={}
	Limitation	Infinite	A is non-B	Range of sensation between fullness-emptiness, allowing a border (the complement of sensation may be another sensation of void)	Infinity, indeterminacy (affirmation of the negation of the predicate)	Complement A' ={x∈U| x∉A}
Relation				Correlation (time order) →**Order**		
	Substance (substantia et accidens)	Categorical	A is B	Permanence in time	Substance	Predication as *link* between subject and predicate through the copula "is" **S is P**
	Dependency (cause and effect)	Hypothetical	If A, then B	Succession in time	Causality	Conditional, implication **S⊃P**
	Community (reciprocal action correlation)	Disjunctive (inclusive)	A is B or C or D	Simultaneity	Reciprocal action	Disjunction (inclusive and exclusive) **A is (B∨C∨D…)**
Modality				Type →**Existence**		
	Possibility-impossibility	Problematical	A may be B	Compatibility of more than two elements in time	Possibility	◇ **(A is B)**
	Existence-non-existence	Assertoric	A is B	Existence in a determinate time	Existence	Predication as *affirmation* **A is B** (i.e. the case)
	Necessity-Contingency	Apodictic	A must be B	Existence in all times	Necessity	□ **(A is B)**

Fig. 1.

Concepts of understanding have no shape, like the mathematical objects mentioned by Kant, but they have *form*. We could say: *structure*. Mathematical objects, too, as well as intuitions so far they are spatiotemporally formed. Time and space have a global structure. Schemes are different elements, objects and patterns inscribed in or defined withing the structure called time. Judgements are also forms or structures that allow generalizations about mathematical objects. However, Kant says that in the architectonic of pure reason intuition provides the matter and concepts, the form. How can we reconcile both views? If we claim that intuitions, schemes, and concepts are nothing but forms, we assure they continuity. There would only be transformations or functions among them, a second-order rule taking us from one system to the other. If there is unification within intuition and within understanding, schematism would confront us with a second-order unification, namely, with synthesis. Even if Kant defines schematism in terms of subsumption of particulars (intuition) in universals (concepts), the real problem is the heterogeneity in the rules governing intuitions and concepts. Even if Kant seems to reduce schematism to a problem of rules for the application of concepts to intuitions these rules are rather obscure, for they require another faculty (imagination) and a set of radically new objects, like numbers. Matters of numbers (counting), of degree (continuity), order (ordering, series) and existence (modalization) come to the fore. Such a complex universe clearly exceeds the problem of subsuming particulars in universals, or the unification of multiplicity.

Synthesis may be understood as the unification of the multiple in three senses: as delimitation (when in intuition we constitute individual objects out of a multiplicity of sensations), as subsumption (when we unify several elements by their membership to a class), and the combination of two sources into a third (as in schematism, when we take elements of both intuition and understanding to create a new domain). The most interesting for us is the third case, for it exceeds a single plane or domain to combine two. In schematism we see the emergence of a new domain, where new things appear as they are now seen from the point of view of numbers, plenitude, order, and possibility, and not in terms of object qualities. Objects are mathematized. This is precisely the prerequisite for the access of the natural world into the realm of mathematics. We are calling the schemes mathematical structures. If pure intuitions give us mathematical objects, "things" that can be known, schemes deliver structures. Of course, they can be studied as abstract objects, but they can also be applied as structures to explain phenomena. Mathematics are both form and object. This is not surprising given the relative

use Kant gives to the concepts of form and matter. Subjectivity if purely formal regarding things in themselves. But intuition is the matter that must be formed by concepts.

It is easy to see that Kant is both operating and struggling with the classical hylomorphic scheme, where matter is defined as pure potentiality, deprived of any form, and absolutely passive; and form is understood as pure actuality, without any material component, and absolutely active. In this scheme form arrives to matter from the outside. In this secret fecundation of matter by form, the real from the ideal, form remains for itself what it always was. That is, there is no process of formation, transformation, or deformation whatsoever. Matter is also equal to the void, to pure potential, incapable of self-formation, eternally indeterminate but infinitely determinable. This is the problem that Kant unwillingly confronts. Forms cannot be applied to matter from the outside. A process of transformation is needed, such that concepts become sensible and intuitions become intelligible. This is the place where the object of knowledge really appears. In understanding there are no objects, but pure concepts and rules of connection among concepts. In intuition we have *Gegenstände*, but not thinkable objects. *If* the real object of knowledge is the synthesis of concepts and intuitions and their heterogeneity is only bridged by imagination, then schematism describes the process of emergence of the object of knowledge, namely, the actualization of the virtuality of concepts and virtualization of the actuality of intuitions.

It is true that the transcendental deduction, as we have seen, shows why to explain the universality and necessity of mathematical knowledge (and mathematicised natural sciences) *we have to suppose universal a priori concepts as well as its applicability to intuitions*. But this is an *indirect proof*, so to speak, a sort of *reductio ab absurdum*. Because the alternative hypothesis, namely, that mathematics obey psychological or empirical rules is impossible, we have to admit the existence of pure concepts of understanding. But the *constructive proof* is missing, we have to show *how* to effectively construct an object of knowledge from intuitions and concepts. It is only here that heterogeneity becomes a problem to be solved. The rules demanded by schematism are the operations and procedures to construct objects of knowledge in a "third space", where intuitions and concepts are approached.

Schelling says in his *System of transcendental idealism* that transcendental philosophy starts with an I possessing a complete system of categories to think nature as phenomenon. The I imposes its forms to nature from the outside,

doubting eventually about the reality of the external world, but assuring things as representations certain for subjectivity. But, as we saw already, *knowledge* of the world, must assure that it is knowledge *of the world*, i.e. of the real. *Naturphilosophie* follows the opposite way, as Schelling states in his *System of transcendental idealism* (SW03: 342). That is, if transcendental philosophe follows a top-bottom approach, from the I to nature and its constituent matter, nature philosophy starts with matter and ascends (constructs) to subjectivity. Here there is no application of subjective forms to natural indeterminate matter (Fichte), nor a mere self-relationship of the I to the I (Hegel), but a self-formation of matter, where intelligence is a product. This follows a bottom-top approach. As we tried to show, the investigation of thins in themselves is not something that exceeds human capacities, but only their knowledge. We do not have experiences of the totality of things, i.e., we do not have access to the set of all things, and not even to the totality of a single thing, for we may always discover new properties or qualities. But this does not mean that we do not have access to them. We do, but partially. We should rather say that we do not have complete or total access to things in themselves, but only partial, spatially, and temporally conditioned. Now, categories are not external forms to be applied arbitrarily to some indeterminate matter. Otherwise, no schematism would be needed. Schematism must do justice to both the traces of things in themselves left in us as sensations, and our rational unity of self-consciousness. This is the tension of knowledge and the reason why it demands adequation to the thing and good judgement; to recognize necessity but putting into play freedom.

But since things and thought are liked, we can never claim that our cognitive apparatus is separated from the real. It is both real for itself and real as natural phenomenon; and it also ideal, not a thing, and an instance giving form to nature. In other words, because there is a (complex) frontier or border between nature and mind, we can *construct* our idea of nature by exploring subjectivity. As we saw, Kant finds a relative symmetry of problems regarding nature. In order to be affected by things, we saw that we must be inscribed in the same time and space as things, and that there must be some substance, i.e. something that lasts, and that encounters between things must follow the law of cause and effect, etc. We have to *suppose* all this to avoid an objective idealism. In this sense, nature philosophy is fully conjectural but still transcendental, for it provides the (real) conditions of possibility of actual thought and its temporal emergence in the universe. For this reason, schematism becomes paradigmatic, because it shows the problem of

individuation (the emergence of individuals called objects of knowledge) which actualize or instantiate concepts but also virtualize and liberate intuitions from their particularity. It is paradigmatic because it tackles the abstract solution provided by hylomorphism to explain the emergence of actual individuals.

In the next section we sketch some general ideas of Simondon presented in his seminal work *The individuation in the light of the notions of form and information* as he tackles explicitly the problem of individuation in objects of natural sciences, especially physics and biology. For him hylomorphism is a weak solution to the explanation of how concrete individuals emerge and last in the world. As we will see, he finds a similar problem found by Kant in schematism, namely, that forms cannot be applied from the outside to some undifferentiated matter, and that the latter must already have some form as well as the former be materially instantiated. For this purpose, I will present some arguments given by Simondon in the first chapter of the mentioned book.

4. Simondon, hylomorphism and individuation

As we have seen, Kant *both* resorts to the hylomorphic scheme to explain the encounter of concepts and intuitions and criticizes it. It uses it, for concepts are understood as pure forms of understanding, while intuitions are seen as the matter of understanding. But he is also critical of the scheme as he acknowledges that concepts and intuitions are not immediately homogeneous. The object of imagination is the result of the combination of concepts and intuitions, provided concepts need to become sensible and intuitions must become intelligible. Kants must concede, however, that intuitions are the matter of understanding, but they are already representations, i.e. elements at hand for reason, and they possess also a form provided by the pure forms of understanding: time and space. At the same time, concepts may be universal, but not any concept can be applied to any matter. Concepts are arranged in four groups, which reflect different perspectives of objectivity. They are not absolutely content-free. An absolutely free form, with no relation to matter would be arbitrary. At the same time, concepts can be seen as matter used by the form of all forms, i.e. the transcendental unity of apperception. There is never matter without some form, nor there is useful form without some material relationship. Now, all these distinctions are grounded *in subjectivity*, *pure form regarding things in themselves*, which would constitute pure matter. But again, *if there is knowledge* and not arbitrary and exterior application of

forms to some indifferent matter, then matter must possess some experienceable form, and the subject must be somehow a real thing capable of experiencing real material things.

A symmetrical problem appears in the work Simondon. In his work *Individuation in Light of Notions of Form and Information* (Simondon 2013) he presents his philosophy as a systematic interrogation on how to understand *individuation*. Atoms, cells, organisms, persons, or thoughts are individuals in different domains; everything that can be counted as one. But all these are examples of individuals *come to be*, they are the result of a process, not its point of departure. Individuality is a result, thus demanding a "pre-individual" realm different from unity (both global as totality and local as element). This is why *being* must be seen un Simondon as being more-than-one, differing from itself. But it is also less than an accomplished individual, devoid of all possibilities to keep changing. Now, the preindividual must already include form and difference, for individuals cannot come from the absolute void. Atomism looked for the first elementary components of the metaphysical universe: the atoms of Democritus and Epicurus (and the doctrine of the clinamen), Leibniz' monads, Frege's and Russell's logic atomism, or Badiou's set theory are examples of such metaphysical primitives. And they are primitives because they do not have an origin, they are there before time itself. They are thus indifferent to relationships, for the arrive from the outside and do not modify their essence. Substantialism is similar to atomism for it takes individuals to be the only real. They are individual substances, *hypokeimenon*, or a subject capable of receiving all possible attributes. But again, substances do not come to be, they are eternal. In some interpretation of Aristotle, however, substances (the *ousía*) may be regarded as the result of the combination of form and substance. There is, in the limit, some *materia prima*, pure potency, deprived of all attributes, and some form, pure actuality, capable of determining abstract matter. But here, as in the former examples, there some individual already constituted: forms. They remain unaffected when applied to matter. And matter is formed, but from the outside. In Simondon forms must undergo a process of transformation and instantiation in order to be effective in the world. This is *mutatis mutandis* what Kant observes. Pure concepts of understanding cannot be applied *directly* to intuitions, some judgement is required. But also forms must be transformed to be applicable. A scheme or schema is the result of a transformation of pure concepts, retaining only *some structural trait*.

Standard hylomorphism represents the classical solution to individuation.

When individuals are not seen as simple and elementary, they are considered the result of some *principle of individuation*. But such a principle takes really existing individuals and tries to understand them by some decomposition. Individuals are taken as ends. But to ask about individuation means to ask how real existing individuals emerge out of a process. Now, if individuals are not given *ab ovo*, and they are not the *end* of some process, then there are, *stricto sensu*, no individuals. There is individuation and different levels of individuality. This ensures that individuals never "die" by reaching their "perfection" or "proper place" or, in physical terms, they never find a final state of equilibrium, a state of maximum entropy. But they are also not unstable. Individuals, last, above all. They endure. They are produced as individuals and they contribute, in different extent, to the maintenance of such individuality. Now, Simondon will follow a very similar approach as Kant, not on the side of subjectivity, but on the side of nature. He will concede that several forms in nature repeat in different matters. But he also recognized that not every matter may take every form.

To approach this problem, Simondon revives the classical example of form and matter in human creations. He does not take the example of a statute and its idea in the mind of the sculptor. He will resort to a mor humble one: a brick. Bricks are in the middle ground of nature and culture; they are fully material, but also designed by human intellect. The lie in the very link between the natural and the cultural, offering thus a possible way to investigate the obscure copula between subject and object. He starts by stating the obvious: it seems that a brick results from the combination of some undifferentiated matter like clay, and some ideal form, like a parallelepiped:

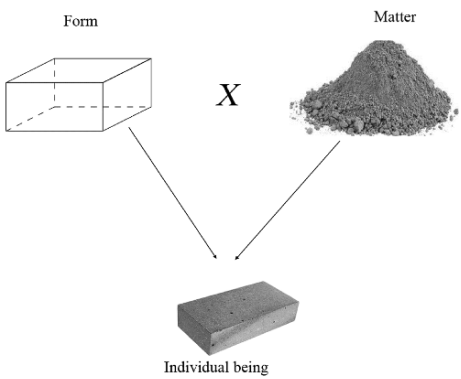

Fig 2.

But Simondon asks a classical question of philosophy: how can a form touch matter? The answer is simple: it can't. Unless we are missing some something. We have no access to things in themselves fully and from the interior to tell how this happens. But in technical processes we assist to a combination of matter and idea. Simondon says that the hylomorphic scheme is "abstract" because a) it makes abstraction of several traits of the material clay and the ideal parallelepiped; b) it does not say anything about the process by which the brick comes to being. To "see" the form in clay we have to change of scale. We cannot make a brick out of any material: some are too soft, others, to hard; some break, others are to heavy, etc. We need a very special type of clay. Its properties (like viscosity, hardness, temperature, etc.) depend on its *molecular arrangement*. At the same time, we cannot produce bricks with the idea of a parallelepiped, we need a material mold.

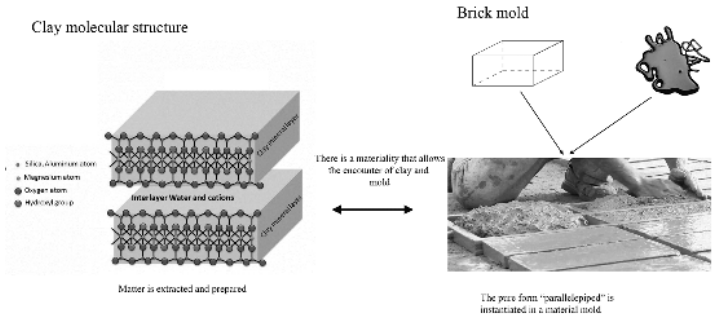

Fig 3.

There has already been a process: clay has been selected and prepared to become suitable clay for bricks. And the form parallelepiped has been instantiated of "actualized" in a mold. Formed matter and instantiated form exist before the encounter. Now, the process of formation involves three elements: matter, form, and energy. The inner structure of clay allows certain viscosity such that it can take the form of the mold. The mold forms by applying a structured *force* through its walls, limiting the dispersion of the clay. The mold conveys a form acting on the structure of clay (existing at a sublevel). But none of this could take place without a material encounter. Matter forms of *informs* other matter through energy.

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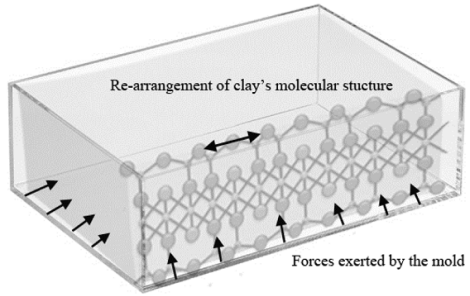

Fig. 4.

The parallelism between Kant's schematism and Simondon's individuation is justified so far both are confronting the hylomorphic scheme in a fundamental level. It might be said that Kant offers the "subjective" side of a hylomorphic synthesis, while Simondon shows the "objective" side of hylomorphism in the process of individuation. But, as we have said, Kant's subjective synthesis includes the real *in intuition*. At the same time, Simondon is not only concerned with the individuation of a physical object, because he includes the "ideal" side of a geometric form. The relationship subject-object should be rather seen as double relationship: object-subject ↔ subject-object. But we must not consider the terms as points or positions of a square. On the contrary, every term possesses some complexity, and cannot be considered a trivially connected space, capable of being contracted to a point.

What lessons can we derive from this comparison, if any? First, that we never find unqualified matter (*materia prima*). It possesses necessarily some form but, this is important, such a form exists at another scale or level of organization. Molecular structure and the form of the mold correspond to different orders. The form of intuitions, i.e. its material *organization*, including all its richness, does not belong to the same order as conceptual forms. Second: form and matter are

not points or simple elements of a dual relationship. That is: we do not have a simple opposition between form and matter. What counts as matter and what counts as form possess different *structures*, i.e., they are *multiplicities* or *varieties* distributed in different levels. Relationship between different structures may be interpreted as *functions*.

A *function* is nothing but a rule assigning elements of one structure (domain) to another (codomain). A function is a transformation. More general than a function is a *morphism*, namely, a *structure preserving map*. A morphism is the natural generalization of the concept of function. Cassirer argues (1910) that the concept of function displaces that of substance, upon which classical logic and ontology were based. In predication we assign attributes to substances, the only thing we consider real. Predication subsumes a particular in a more general category or class. But in modern mathematics a radical shift takes place in the consideration of its objects. They are not treated as *substances*, but as elements of a system of relations. There are not atoms, metaphysical, linguistical or mathematical, but relationships in which every individual is inscribed. Science establishes laws of nature as relationships between variables and constants. A law is thus expressed in mathematical terms as an equation, that is a *connection* between terms. But -and this is the most important thing- such terms are not things or concrete values but *sets of possible values*. Variables allow things to appear along a series of *possible values*, as objects distributed in "regions" of time and space. Objects emerge in the real and for us in relationships. Relationships are as real as individuals. Individuals are actualities but they "live" in relationships, actual and virtual, upon which a possible being-other is assured. In other words, *determination* does not preclude the possible, but on the contrary. The set of relationships among ever-forming individuals are responsible both of actuality and virtuality, the determined and new possibilities. This is what Simondon calls "metastable equilibrium" (Simondon 2020: 5), a state different to disequilibrium (where individualities cannot last) and equilibrium (a state of "death" for no change is possible anymore), a state of dynamical equilibrium.

But what *maps* are involved both in the individuation of the brick and the individuation of our object of knowledge? Clay has so to speak two levels of existence: molecular structure and amorphous clay. The latter has possibilities, both micro and macro, that depend on local and global structures. At molecular level possibilities are given by the relationships between atoms and other molecules. The "properties" of an individual are the result of micro relationships.

Possibilities are created in-between, among individuals of some level and do not derive from some originary chaos or the void. Even the void or the preindividual (where individuals have not yet been formed) has a *proto form*, a set of differences and relationships. Possibility and becoming do not rest in an indeterminate origin, but in determination, because all determination in the actual real supposes a "reserve" of virtuality. There is no first transit from the virtual to the actual; all virtuality is attached to the actual as its *spectrum*. Possibility is in the world and not outside it. The world does not need an "event" or the effects of exteriority to be different. It is immanently capable of being-other precisely thanks to this reservoir of potentialities lying between individuals, in and through their relationships.

Now, the possibilities of clay to become a brick are both internal and external. Internally they depend on molecular reciprocal relationships. Externally, on the relationship *between clay and mold* (here operating as an environment). Possibility lies both in a preindividual region and in the relationships with other elements of the same level. Intuitions present similarly two levels of structure. We have on the one hand, material-based-patterns found in intuition; and, on the other, a global spatiotemporal form assured by the forms of intuition. Concepts are materially based because they cannot be applied to *any* matter arbitrarily. But they also have a global logical form. The "application" of concepts to intuitions is also partial because *intuited things are conceptualized regarding a particular perspective*. They are subsumed but only according to certain traits. Just as clay may adopt different forms, the same intuition or set of intuitions may be ordered by different concepts, depending on what trait we are investigating. But again, not any clay is apt to build a brick. Simondon remembers how modern technology is abstract as it tries to impose ideal forms to matter without consideration of its structure. Not any type of wood is good to make a table; and not any cut will render equally useful, flexible, or long-lasting wood planks. Regarding our capacity to judge, there is, for Kant, no fixed rule, no metarule to use our rules (A 134/B 173). But it is not arbitrariness what decides which forms are to be used, but the attention to matter and its structure and behavior. A good sculptor does not impose an imagined form to a piece or rock. He or she chooses the type of rock, it prepares it and starts a process of negotiation between idea and matter.

We have claimed that matter should be attributed some structure. There is never pure amorphous matter. At the same time, there is never pure subjectivity, because it exists also as body, both sentient and capable of being affected. Now, the introduction of the concept of information by Simondon dispels the questionable

consideration of some "ideal" dimension of matter. The existence of information in nature is already sufficiently credited. And theories like the 4E (embedded, embodied, enacting, and extended) cognition also point at this distributed existence of thought. As a final remark we want to mention Simondon's concept of transduction, for it allows to understand both processes of being, of thought and of transition between being and thought:

> By transduction we mean a physical, biological, mental, or social operation through which an activity propagates incrementally within a domain by basing this propagation on a structuration of the domain operated from one region to another: each structural region serves as a principle and model, as an initiator for constituting the following region, such that a modification thereby extends progressively throughout this structuring operation. (Simondon 2020: 13).

Transduction is the transit from one domain to another or the conjunction of two of them to form a new one. We must however distinguish between the mere information transmission, where source and target remain unchanged and the important is to avoid any information loss (as in Shannon's information theory) and the process by which there is transformation, in-formation or a process of morphogenesis or transformation. We mentioned already Descartes' observations on pain and the need to explain the transformation of a mechanical encounter of the human body and a cutting object to the mental reality of sensation. We know today that the mechanical encounter involves some information, which is apprehended by the skin, and then turned into electrical information in the nerves, to finally arrive to the brain where information is captured by chemical neurotransmitters. There is a set of encounters: thing-skin, skin-nerves, nerves-brain, but also a simultaneous transmission of information, both losing and adding new bits of it. The "upwards" way goes from physical encounter to sensation and finally to the interpreted pain; but for this to occur there is a "downwards" path going from memory and thought to sensation in order to interpret it. This is also what we can see in Kant. The path going from object to subject (O → S) is called, first, affection, and then sensation. The complementary path goes from the subject to the object by the synthesis of apprehension (S → O) and is called thought. But, as we have seen, both paths are complex, made of sets of *directed arrows or relationships*.

We must concede that the relationship Kant-Simondon remains problematic. One seems to offer a theory of subjectivity, based on critical premises. The other, seems closer to a philosopher of nature, using concepts for which no deduction is

provided, following rather a dogmatic exposition. But, as we have seen, Kant is both a transcendental idealist and an empirical realist. We have tried to show that intuitions are in Kant the *partial* print of the real in us. Simondon also claimed that his philosophy of individuation of the physical and living worlds cannot be accomplished with an individuation of thought and its concepts. Kant shows us a static world, where forms are always already given, and matter is only found. But in the section on schematism he shows a process where the initial heterogeneity of concepts and intuitions is overcome in a new and concrete object of knowledge. Such a processual approach is clear in Simondon. He does not admit neither the eternity of forms, nor the eternal amorphous character of matter. And yet, he confronts the same problem of Kant, that of hylomorphism. By two different paths they encounter an analogous set of problems offering similar observations. We showed how both must attribute form to matter and matter to form. They must be conceived as complex structures and not as points or trial terms of a relationship. We saw also how there is a multilayered relationship between both domains, involving both local a global, micro, and macro approaches. There is, finally, in both perspectives, the emergence of a third and new domain where an individual object is constituted. This is the concrete object for Simondon and the known object for Kant. Several nuances must be made in this new alliance between Kant and Simondon, but it certainly promises the possibility to pursue a natural-materialism compatible with Kant's indispensable criticism.

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