Two Traditional Greek and Chinese Systems: a Response to the General System Theory?

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Abstract. My previous research has shown that it is possible *to match* the *five elements* of the Chinese tradition with the five *Platonic solids* of the Greek tradition. This *rapprochement* reveals similar structures and has made it possible to reconsider the work of T. Wester on *structural dualism* and those of B. Fuller on the *vector equilibrium*.

The issue of this topic is to know if this *rapprochement* - of Traditional Chinese Medicine which connects humans and their environment with regular polyhedra - meets the ambitions of L. von Bertalanffy's *General System Theory*. Can we consider *wuxing* as a *general system* and Plato's model as an answer to one of the fundamental problems of modelling?

Beyond the fact that this research provides architects the possibility of integration in a wider relational and meaning context, to meet the need for *general systemology*, this study proposes to undertake research on what is can also call *vernacular systems*. Indeed, there are many systems in the different cultural traditions and by their study; this approach wishes to open a new avenue of research. In architecture as in music, popular cultures have long been recognized as cultural heritage, both for preserving and transmitting, and for providing responses to contemporary creativity and scientific investigation.

Introduction to previous research

In this first part, we will first summarize our previous research. For that, in a second part, we will re-question the different matching operations - *put in vis-à-vis* or *rapprochement*, according to the authors. What do they consist of, what are their philosophical foundations? Our research objects being closer to the notion of *system*, we will consider how similar operations were conceived, argued and named in this context of the *systemic*. In a third part, we will therefore examine the disciplinary fields which have contributed to the emergence of *general systemology*. So this article will make an epistemological return of the different stages of our research, to update a new referential framework allowing new results in the fourth part.

A first rapprochement between two cosmologies that appeared at about the same time, the five Chinese elements (*wuxing*, in *Classic of documents*) and the five Greek *Platonic solids* (*Timaeus*) made it possible to verify that these two models present a similar structure and functioning [1]. The methodology used is based on F. Jullien: taking a detour through China - outside Western thought - to better reveal the *unthought* of our own culture. A work of transposition of *wuxing* to Greek geometry makes it possible to read Plato's account with the lighting of the Chinese model [2].
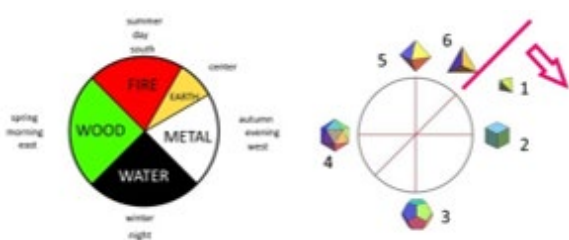

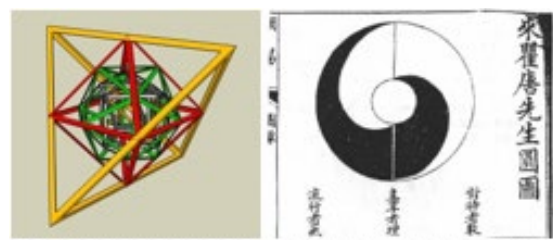**Fig. 1**. Matching: *Wuxing* and 5 polyhedra

Fig. 2. Minimal polyhedra nesting and *Taijitu de Lai*

The spatial organization of regular polyhedra, following the deployment of *wuxing*, can also be read as the different stages of the living transformations. It leads to organize the polyhedra according to a minimal nesting, which we called *organon* in reference to M. Serres' metaphor. The matching of this geometric *organon* with the Chinese *Taijitu of Lai* makes it possible to renew the reading of the Platonic model [3].

Then, the representation of this minimal nesting allows the hypothesis of an intermediate sphere as the locus of the "dual" transformation between the 2 series of *yin* and *yang* polyhedra. The central position of this sphere raises the question of its role in the generation of polyhedra. The way to fill the space with 12 tangent spheres to a central one leads to consider the role of the cuboctahedron - called *vector equilibrium* by B. Fuller. Thanks to its deformation capacities, the cuboctahedron turns out to be a polyhedron articulating spherical and polyhedral shapes. Thus, we can hypothesize that the sphere contains the 5 Platonic polyhedra as a seed [4].
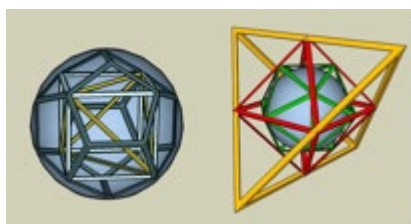

Fig. 3. Central position of the sphere in the *organon*   **Fig. 4.** Cube: three modalities of stability and assemblages

From this *wuxing*/polyhedra correspondence, the last publication made it possible to apply the notion of *structural dualism* of T. Wester and to consider the Platonic solids not only as geometric objects, with *structural* properties but also with "*structurelle*" ones. The structure of the *yin*/*yang*/*center* cycle of Chinese thought allows a coherent re-reading of the stability and assemblages of the polyhedral forms according to three modalities. Structural morphology then finds a clearer theoretical basis and the *organon* becomes its synthesis [5].

These different stages of research - the *organon*, the spherical *central frame of reference*, and the morphologico-structural properties of Plato's model - have provided additional arguments for the correspondence of the Greek and Chinese models, with different disciplinary points of view: architecture, philosophy, morphology, structures, history of science, etc ... Following this same logic, the *organon* could be the subject of new investigations, to find a mathematical expression to these geometric transformations. But the undertaken translations always operate in the same direction: from *wuxing* to the *Platonic solids*. Also, we now propose the reverse approach: transcribe from Plato to the *wuxing*. But first, it will be useful to go back to our itinerary to better situate the approach, its purpose and specify in which scientific context it finds its coherence. By revisiting the previous stages of research from an epistemological point of view, we, therefore, hope to bring to light new unthought.

The two theoretical supports of the methodology of this research

Thus, it is a question of re-contextualizing this correspondence of the two Greek and Chinese models, in the various theoretical frameworks which served as a basis for its argumentation. We will discuss three main angles of attack that have helped to build our approach.

The methodological tool of the first part of this research is, as already seen, first of all a strategy of *translating* the cosmology of the *wuxing* towards that of the Platonic solids - and not by a *comparison* operation which supposes an overhanging view. Indeed, *to put in vis-à-vis* allows a *genetic translation* [6] by avoiding the traps of *assimilation*, which would reduce to the known, what we can learn from the unknown. F. Jullien sums it up as follows: *learn Chinese to better read Plato* [7]. But this strategy relates more to the *operations* than to the manipulated *objects*, and the two Greek and Chinese models are rather to be considered as *systems* - not on the register of words and concepts as with F. Jullien.

On the other hand, our approach is also completed by the notion of *rapprochement* of M. Serres who specifies in *Eclaircissement* that philosopher's thought passes from a whole which makes sense,

to another, like Hermès - hence his *hermeneutical approach*. Thus, he connects distant models by removing disciplinary, temporal, or cultural boundaries. For example, by bringing together the mathematics of Archimedes and the physics of Lucretia, M. Serres concludes as follows:

"Two systems look at each other and describe the same world: one, that of Archimedes, with mathematical theorems, the other with descriptions in everyday language, although extremely precise and exact. But both have the same object: turbulences, fluid vortices, their spiral form, and their liquid nature, in short, their formation and, from their construction, the formation of the world. (...) It consists of a system-to-system correspondence and not of measurement and quantification procedures" [8] (our translation).

M. Serres uses the metaphor of *bridges* [9] to express the intelligence that links *what is remote*, territories as well as knowledge:

"Rather, it is a question (...) of decompartmentalizing the disciplines, by showing that the discourses, the theoretical practices, and the ideas reach their highest point of invention respectively only by confronting what Foucault calls "heterotopias", that is to say, heterogeneous spaces, far from the codified and standardized spaces of sedentary thought. It is there, in this confrontation with the unknown that a thought can "branch off" (...), go where it did not expect. The bridge as a methodological figure of a philosophy grasped in its relation to land and territories, (...) reminds us that it is only by making the effort to confront something else, by transgressing its own territorial limits, that a thought can enter into a development which transforms it and allows it to generate new possibilities of thought instead of perpetually rehashing the same truths" [10] (our translation).

But we cannot quote M. Serres and the intelligence which links without making reference to the notion of *metaphor* (together with that of *analogy* that we will not have time to develop here). To B. Latour's question: "If we come back to this problem of displacement, (...) that of metaphor ...", M. Serres replies:

"Metaphor means, precisely: transport. This is indeed there Hermès' method: he exports and imports, therefore crosses; he invents and can be wrong, because of the analogy; dangerous and even, at a pinch, forbidden, yet we do not know of any other way of invention than it" [11] (our translation).

F. Jullien also shows a great interest in metaphor as a strategy for *uncoincide* with habits, which close the door to the discovery of the *other*, to the *true encounter*, to inventiveness:

"The metaphor, by its transport into the other or, said in reverse, by the intrusion of the other into oneself, causing the same to disengage from its coherence with itself... (...). The metaphor is therefore much more than a matter of language and expression (...) so much does it illuminate, by its functioning, what is our chance of finally encountering the "real". (...) Because the metaphor, by freeing from the Same, from the in-itself as to itself (...) daringly reopens possibilities" [12] (our translation).

Thus, the operations of *"correspondence, bridge, rapprochement, metaphor..."* - to name but a few - are different modalities of *matching* and *translation/transcription* that we implement. For what follows, it is, therefore, necessary to question the disciplinary fields that have contributed to the emergence of the *systemic*, because it is also particularly appropriate to our approach.

The General Theory of Systems, the DNA of this research? Results

When and how does the system notion appear in the context of contemporary science? Some locate the origin of the *systemic* from precursor works that mobilize the word system: E. Bonnot de Condillac (1749), NL Sadi Carnot (1824), Rudolf Clausius (1850) or even with the Macy conferences (1942), etc ... Others retain precursor thought movements, such as *structuralism*, *cybernetics*, or the *theory of communication* ... But D. Durand recalls in his synthesis on the *systemic*, the even older origins:

"The development of Western thought and science for three centuries stems directly from an old rationalist tradition that can be traced back to Greco-Latin Antiquity and more precisely to Aristotle,

and of which in France, Descartes is the most prominent representative. We generally tend to think that this civilization should be considered as the best possible, that it can serve as a universal reference, since it has given the West an undeniable superiority in the fields of technical and economic progress. In recent decades, however, this dogma of Western superiority has been called into question more and more often; we first discovered that the rationalist tradition is far from having always and everywhere occupied the central position that we believed. Indeed: - before Aristotle, the Pythagoreans and Heraclitus had a different conception of the world, which one can qualify as globalist compared to the Aristotelian analytical vision; - other civilizations, as old and complex as ours, the Chinese for example, are based on conceptions which are the opposite of our rationalism; - two fundamental discoveries of the beginning of this century, the theories of quantum and relativity, call into question the very foundations of this form of rationality" [13] (our translation).

This introduction clearly situates the context of the emergence of the systems field and how it imposed itself as a new scientific paradigm from the beginning of the 20th century. The appearance of the notion of *general systems theory* (GST) in 1947 will make its author Ludwig von Bertalanffy the reference - even if others - E. Laszlo, R. Rosen, Rapoport or G. Klir… collaborate in this research [14].

In 1968, his summary book *General System Theory: Foundations, Development, Applications* resumed his research from the 1920s and shows the genesis of *systemic*, its definitions, pitfalls, the existing theories on which it is based, the potential fields of application, and new modes of research, of knowledge that this allows. L. von Bertalanffy thus opens a new epistemological dimension: his ambition - to define a truly *general theory* - opened up many avenues of research in the world and obviously generated dissident currents. There is therefore no unified approach to the systemic.

In France, we will remember in particular three authors who argue for a different approach. In 1975, J. de Rosnay published *Le macroscope* which explores the consequences of the *systemic approach* on ways of thinking about the contemporary world [15]. In 1977, in Volume I of *The Method*, E. Morin developed the notion of *complexity* which characterizes the interweaving and interactions of *systems* and *subsystems* [16]. Six months later, J.-L. le Moigne defined a *modeling theory* - which the pun of the title *The Theory of the General System* underlines that only the notion of system can be general [17]. Overall, the speeches of each differ from that of Bertalanffy.

But let's first come back to the initial momentum inaugurated by Bertallanfy's research. D. Douvreau's thesis "*A history of "general systemology" by Ludwig von Bertalanffy - Genealogy, genesis, actualization and posterity of a hermeneutical project*" (our translation) will allow us to better situate our research in the genesis of the systemic with its language. In the chapter "*The ontology of general systems*", he identifies the notions of *general system*:

"*It is of course impossible to undertake this examination without first considering the way in which the main contributors to "fundamental theoretical systemology" - namely Bertalanffy, Rapoport, Rosen, Mesarovi, Klir, and Le Moigne - clarified their conception of nature itself of its objects, that is to say of those beings that they qualified as "general systems". <u>These clarifications concerned the roles and limits of analogies as well as the concepts of isomorphism and equivalence class between models</u>. They resulted in several precise and complementary definitions of a "general system"*" [18] (our translation, underlined by us).

The author stresses that mathematics is the perfect tool to give a force of explanation and to allow the analogical matching of *isomorphic systems*.

"*(...) Mathematics would then constitute the perfect tool to make this "stimulation" fruitful, to "control" analogies by transmuting them in order to give them a real force of explanation, in order to successfully complete its theoretical and "systemological" target: the transition from a "focus on the content of events", towards a focus on their structure, behavior, and evolution* [19] - *that is to say (...) towards relationalism consisting to "<u>chase away the material to keep only the underlying organization</u>"* [20]" [21] (underlined and translated by us).

Thus, we can make here the link with the correspondence of the Greek geometric model of the five regular polyhedra of the *Timaeus* which can also be considered as a mathematical model of

transformation. The comparison with the Chinese model of the five elements (Wuxing) focuses well on the *organization* of the two systems.

Further on, D. Douvreau specifies that it was A. Rapoport, then R. Rosen who gave a rigorous and formalized definition of the *analogy* between two *dynamic systems*:

"The isomorphism of mathematical models (the modern "mathematical analogy") being the ideal form, both the most subtle and the most powerful that an analogy can take" [22].

With regard to the two Greek and Chinese models, despite the fact that certain aspects still remain to be verified - in particular the question of the *relation of domination* of the *wuxing* [23] - we can make the assumption that they are *isomorphic systems*.

But Rosen's definition of a *general system* emphasizes the need to find a *canonical* system:

"Modeling can be studied in the context of an arbitrary equivalence relation imposed on a class (or category) of systems; such an equivalence relation says precisely that any two systems in the same equivalence class are indistinguishable with regard to a certain property P which defines equivalence. (...) One of the fundamental problems of modeling is to extract from this class of equivalence a certain canonical representative, characterized by an additional property of simplicity and minimality" [24] (translated and underlined by us).

This last R. Rosen's remark sheds new light on our research. While J-L le Moigne constructs an *artificial object of reference, the General System*; Rosen seeks a *canonical representative* of the *equivalence class* of the systems studied. If we maintain our hypothesis that the two Greek and Chinese systems belong to the same class, our approach responds to this problem. We have a *natural system* (*wuxing*) on one side and a geometric/mathematical model on the other: - taking *wuxing* into account is consistent with Bertalanffy's principle of *not excluding from the theoretico-systemological field, the similarities between models not yet having any mathematical form, strictly speaking* [25]; - and on the other hand, Plato's geometric model is well characterized by an *additional property of simplicity and minimality*.

As far as we are concerned, it is indeed the highlighting of two *general systems* - like Plato's statement as well as the discourse on *wuxing* in Asia suggest - and of two *isomorphic systems*. We can conclude that this *rapprochement* between: - on the one hand, the organization and the biological functioning of the internal organs of humans in relation with the environment (5 Chinese elements/*wuxing*); - on the other hand, the fundamental geometric properties of the shapes of the 3D space we inhabit; find a real echo in the ambitions of the GST (L. von Bertalanffy & R. Rosen were both biologists).

One point goes away from it in spite of everything. To answer the contemporary challenges of a true *general systemology*, this study is not addressed only to contemporary scientific models like Bertalanffy did. What characterizes our work is to be based on traditional knowledge, to undertake research on what we can call the *vernacular systems*, in particular those which concern human-environment interaction. In architecture, as in music (B. Bartok or Komitas…), popular cultures have since long been collected in order to recognize them and label them as *cultural heritage* - both with the intention of knowing what and how to conserve/transmit and that of providing relevant responses to be mobilized in innovative approaches or contemporary scientific investigations - with the concern for sustainable development for our societies (see Versus for example [26]). There are indeed many systemic groups reported by different cultural traditions: the *wuxing* are a remarkable example.

Conclusions: Plato's system, a general canonical system?

Thus, let us assume that Plato's system is the *canonical representative* raised by R. Rosen. We could seek to mathematize the transformations of each polyhedron in the nesting. But that would amount to replacing by complex mathematical expressions what is at the origin rather simple, therefore to lose this *minimality*. What do Plato's polyhedra express? The answer is present in the simple expression of *Platonic solids* - on the condition of decoding it. Let's note that the properties which characterize *regular polyhedra* are their different number of faces, vertices, or edges. Face and vertex are in *duality relation* (while the number of edges of two dual polyhedra is identical): the 6

faces of the cube correspond to the 6 vertices of the octahedron (while 12 - number of edges - is not determining). So it is necessary to choose between face and vertex ... However, we noticed that the Greeks chose to name the solids starting from the concept of *face* (poly-*edra*). By taking into account this index, we make the assumption that it is the number of faces of each polyhedron that has significance within the framework of the Plato/*Wuxing* correspondence.

Thus, by orienting oneself on the following figure with the symbols of the *wuxing*: the *fire*/South would correspond to 8 (octahedron), *water*/North to 12 (dodecahedron), *metal*/West to 6 (cube), the *wood*/East to 20 (icosahedron) and earth/Center to 4 (tetrahedron) – the south is the upper part of the figure.
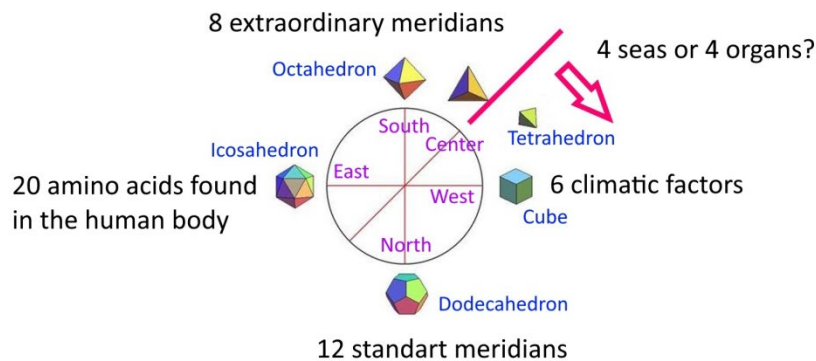

Fig. 5. Hypothesis of the subsystems of the MTC matched with the general system of the *wuxing*

Coming back to *wuxing* and taking into account Traditional Chinese Medicine which details the different levels of functioning of the organism, each polarity of the *five elements* can be associated with a subsystem. We will take as a reference the *Chinese Bio-energetics* of J-A Lavier because he initiated research on the identification and functioning of the different subsystems defined by TCM [27]. The 12, for example, would correspond to the subsystem of the 12 *standard meridians*: indeed, it is coherent to make the dodecahedron correspond to the 12 meridians, belonging to the register of *qi* - the vital energy - to the *water*/North, the end of the *celestial axis* [28] (Fig. 5). In the same register, there is another energy subsystem in TCM, the 8 *extraordinary meridians*, which would correspond on this same *celestial axis* to the octahedron, to the fire/South - according to our classification.

There remains the subsystem of the *6 energies* which would correspond to the cube with the *metal*/West. Then the subsystem of the 4 (*earth*/Center and tetrahedron) would correspond to the *4 seas* or the 4 *main organs*. Finally, there remains the number 20 of the icosahedron which does not correspond a priori to any subsystem in TCM. On the other hand, the wood/East is associated with the acidic flavor and if we accept to refer to Western biology, there are only 20 *amino acids* that characterize the human being.

This correspondence hypothesis obviously remains to be deepened, argued, and discussed from the Chinese texts. But it was important first to contextualize it in the systemic approach, to then *translate* in the Greece-China direction: therefore with the logic of the polyhedra towards that of the 5 Chinese elements. It is essential that this rapprochement operates in both directions so that we can truly speak of *reliance*. We can retrospectively notice that our research followed the logic of the *Macroscope*: starting from F. Jullien's *putting in vis-à-vis*, we opened our study with M. Serres' *rapprochement* to end with Bertalanffy's *General System Theory*.

Finally, it should be noted that this hypothesis opens up a line of research on the relationships between the functioning of each subsystem of the TCM with the functioning of the general system of the *wuxing* - *complexity* finding its full meaning here. If this Plato's system turns out to be *general* - as we propose it - the stake of this fundamental research is much broader, since it involves the whole systemic approach and the current notion of *transdisciplinarity*. Finally, also for architecture, this research offers the possibility of *integration into a holistic structure, ie. to a broader and encompassing relational context* [29].

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