

**A Socratic Dialogue¹ around Georges Chapouthier's
The Mosaic Theory of Natural Complexity:
A Scientific and Philosophical Approach; Preface by Peter McCormick,**
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Opening remarks (by Ana Bazac)

First of all, let me sketch some thoughts generated by your work.

1) From a methodological standpoint, the description – the deployment of the understanding – of reality or of the objects that represent the selective intention of our consciousness in front of reality is not a simple copy of them but an interpretation (a laying/an establishment/a structure) according to different criteria (involving concepts and theories): a way of looking at reality. Therefore, it is always necessary – especially in a scientific/rational reasoning – *to precise the perspective in/through which an analysis is developed*. And you did just that: you circumscribed your theory; actually, you showed its limits, and this sounds paradoxical since it refers to all the reality, by outlining the *criteria used to select the peculiarities* constituting their same shape everywhere.

In order to not be too abstract: you described the *complex* living systems – including the cultural-social ones – from the standpoint of their “appearance”, i.e. their forms *in the frame* of their relationships. In other words, the traditional meaning of morphology – as study of the *forms* of things (being material and living, as the (Aristotle’s) parts of animals, and immaterial, as the words and other cultural features) and even as a study of the relationships between the structures of living units/components, somehow as if these structures would be autonomous to each other – was here not only developed, but rather transformed into/ as a structural morphology: of *configurations* explained “from within”, from the inner functions of their components, realized only through their assembling/assemblage in collective structures

¹ Participants in the Socratic Dialogue : Professors Ana Bazac (initiator of the discussion) and Georges Chapoutier, author of the *Mosaic concept*. Their affiliations are: **Ana Bazac** – Romanian Committee for the History and Philosophy of Science and Technology, Romanian Academy, Bucharest Romania; and **Georges Chapouthier** – Emeritus Research Director (CNRS), “Controle Interoception Attention”, Institut du cerveau et de la moelle épinière, and Institut d’histoire et de philosophie des sciences et des techniques, Paris, France.

of similar components (*juxtaposition* and *integration*), and then through *combination* of these collective structures in a *mosaic* shape.

But this representation – and reality – is certainly a selective manner to see the world. This selective manner generates the *models*. The models are unilateral, irrespective of their generality. The models are the synonyms of theories, or their clear structure. When speaking about their own theories/manners to see the world, some people are so enthusiastic about them that either they consider them The (Only) Truth or they are willing to unconditionally submit to those opinions that dissolve their theories. A theory that speaks of everything from the viewpoint of the constitution of mosaic shapes everywhere could not be considered unilateral? No, not at all: if it is assumed only as a model. And *you have prevented the consideration of your theory as unilateral specifying that it is only a model*. What kind of model? We'll see later. Here we should note that the limits of a theory are given by the objectives of the model(s) it is able to develop.

By the way, the traditional “Socratic” dialogue was designed in order to understand not only the truth of things, i.e. the necessity of reasoning, of disciplined logical construction of theories about things, but also – and in fact this was the intermediary goal toward the truth – that many opinions (actually, every opinion is a “theory”) are unilateral and thus do not “catch” the truth. The dialogue was/is a manner to overcome this unilateral view not only by revealing the contradictions arisen from unilateral theories (that they could not account the exterior aspects ignored by these theories) but also by signalling that they can be surpassed in dialectical theories having “Janus faces” lighting *both* the aspects clarified by the theories and the exterior aspect. But dialectic is not a magic. Later on, Aristotle, very familiar with the idea of dialectics – he professed it – has made order in Plato’s suggestions: each theory is a *model*, and as such it accounts only for the aspect it reveals. Accordingly, two theories about the same thing are truthful – if they are logical – because they light different aspects. Well, once again the book of Georges Chapouthier cannot be accused of unilateral thinking just fit for a “Socratic” disclosure of unilateral conclusions: the book’ starting point is just the precautionary “philosophical” introduction of the epistemological characteristic of his theory: it is a model.

2) Now: what kind of model? First, a model is superior to a concept, even if it operates with concepts. And we know that many concepts are theories. But a model is a deployment of a theory connecting concepts in order to *explain* them and their connection(s) considered by the model. Chapouthier’s model explains the ways in which the systems are organized spatially and structurally.

Then, the Chapouthier model is *general*, but, by starting from the living systems, it is more *concrete* than the concept of *holism*, for example, even though the model is

holistic. It explains the general characteristics of systems from the standpoint of formal constitution resulting from inner processes of systems. The model is better than the concepts of *chaos* and *order*, although it supposes order as both premise and consequence of the formative processes of systems.

Finally, the book advances a *philosophical* model. But it is not speculative – even though the author uses this word –. Anyway, it is *not metaphysical* (meaning searching for primary/original principles and “finally finding” them). Here philosophy means a model where the principles are ordered by scientific knowledge and the disclosure of reality from many standpoints.

Traditionally, philosophy was before science, supplying suppositions subsequently verified by science; the traditional speculation deduced Truth from suppositions based on intuitions, and ideas resulted from observation. The present valid philosophy – and here the Chapouthier model – is ulterior to science, is based on science and thus the “speculation” of the book is simply philosophy. In this respect, it is a premise for not only scientific, but also philosophical development.

3) Apparently, the model is only of forms /configurations. Actually, it is founded on *processes* leading to these forms, namely on the morphing of these configurations. In this respect, it is consonant with Aristotle’s founding theory of biological functionalism within the animal systems (in the frame of the comprising milieu), certainly with the modern system theory and inherently to these, with dialectics. But, once more it is based on the last research in biological sciences, psychology and cultural studies.

Since it is about configurations, we can relate the Chapouthier model to Adrian Bejan’s model of flows². The first is based on the living, thus on biological sciences, the second, on physics. But both are *holistic* and both give to their models (and demonstrate their) ability to predict the new configurations/entities. Is this – and now we return to the Chapouthier model, but the question is suitable to the Bejan model as well – a detour to impose the intelligent design against evolution? Certainly, not: the model of configurations and processes of configuring, suggesting the possibility to predict the future configurations and processes or those from different spaces/structures, is not the expression of the design of an extramundane omnipotent being, but reflects absolutely *natural* – material, physical, chemical, biological – phenomena. But Chapouthier has posed a very important

² Adrian Bejan, Sylvie Lorente, (2004). “The constructal law and the thermodynamics of flow systems with configuration.” *International Journal of Heat and Mass Transfer*. 47 (14–16): 3203–3214. [doi:10.1016/j.ijheatmasstransfer.2004.02.007](https://doi.org/10.1016/j.ijheatmasstransfer.2004.02.007). ISSN 0017-9310; Adrian Bejan, Sylvie Lorente, (2006). “Constructal theory of generation of configuration in nature and engineering.” *Journal of Applied Physics*. 100 (4): 041301. [Bibcode:2006JAP...100d1301B](https://doi.org/10.1063/1.2221896). [doi:10.1063/1.2221896](https://doi.org/10.1063/1.2221896). ISSN 0021-8979

epistemological/methodological problem: no theory, however founding and revolutionary it is, accounts for all the aspects of the analysed domain. Accordingly, Darwin too is a model and thus, the two models *coexist*, configure a more complete explanation.

In this respect, Chapouthier has dialogued with Darwin; his conclusive look on the organisation patterns of living – but also of inanimate and social realms – allows /is a formalised, synthetic manner of expressing the evolution. It is a late creation, based on n years of research: as Marx has said, a later theory allows a better understanding of the previous ones (or a more complex structure allows the better understanding of a simpler one).

Briefly and finally, both juxtaposition and combination or integration are caused by the relational character of reality. Things cannot exist and especially cannot evolve only as singular. Valid existence and development are always collective, realised through mutual hooking / mutually attaching in order to exist, to develop, to function. Therefore, the units are not absolutely autonomous structures, even though they have, as every structure everywhere, a relative autonomy. Actually, just this description is highlighted by the Chapouthier model, consonant with the great founding theories (of dialectics, of theoretical biology, of systems). And it should be noted that the book is the first supply of the Chapouthier's in toto model of complexity in mosaic, even though its elements were emphasised before in his articles and books.

Dialogue questions (by Ana Bazac : question №1 – Q1)

Q1: Complexity should not scare. It must be described as simply as possible. But the description is not/should not be simplistic. **Was that the need that stimulated the construction of your model?**

Georges Chapouthier (GC): Science, by creating theories and models, is, as you have said, a selective way of seeing the world, and to a certain extent, it is the transformation of an unknown complex entity into a simple known entity. My model of complexity in mosaic formation was directly based on my work as a researcher in biology over five decades. Observations of different stages of complexity in the form of living beings³ led me to break it down into two major principles, *juxtaposition* and *integration*. The simple, but not simplistic, concept was

³ Chapouthier G., Maurel M.C. (editors), 2020, *The Explosion of Life Forms, Living Beings and Morphology*, Iste, London.

the spontaneous outcome of scientific observations of complex entities. Yes, as you said, principles are determined by scientific knowledge.

Q2: Is the form of complexity not the result of the intertwining of evolution and function? Is the spirit of reaching a single cause/principle⁴ – a metaphysical spirit – not refuted by reality? And it has not been continued today (some people emphasize genetics and ignore epigenetics)? Functionality involves a certain *configuration*, i.e. permanence/continuity/preservation that lasts or constancy; but it also involves *changes* (positive, negative, from many causes, including from the informational level), and *discontinuity*. Therefore, is your morphology not much more than an exterior description of shapes, but also a conclusion of the internal “logic” of structures, thus an evolutionary morphology (“from within”)? And is this internal logic not related to the complex environments of a Russian doll model of internal “logic” of structures? And does that “from within” not involve both the ontogenetic and phylogenetic levels?

GC: Indeed, the complexity model originally arose from morphological considerations, and also reflects internal functions and their evolution, “processes leading to these forms” or “internal logic”. While these ideas were not explicitly highlighted in my text, they can be found in the epistemological analysis of the role of asexual reproduction in both phylogenetic evolution and ontogenesis. A relevant example of this is the link between the mosaic-form complexity of the brain and of thought. Obviously my mosaic model needs to be developed and applied to other organic functions, to what you have called the “internal logic” of structures.

Q3: Can you give a brief explanation of mosaic evolution?

GC: Post-Darwinian theses take natural selection as the basis of evolution, and for some it is the one and only explanation.

⁴ See the 1830 Cuvier – Saint-Hilaire debate, but even those positions were open and are open to us, today. For example, as for Cuvier, the function does not presuppose evolution, but its fulfilment; but for this reason he considered only the differences between species, and ignored the similarities. While for Geoffroy de Saint-Hilaire, the evolution generating the organism’s unity of composition, explained through analogy, was evolution through adaptation of functions.

I am with those who recognise the role of natural selection and also believe there is scope for other evolutionary processes. While Darwinian natural selection is mainly based on sexual reproduction, my model restores the role of asexual reproduction which then leads to processes of juxtaposition, not separation, of living organisms, with these elements being ultimately integrated as components of complex systems, forming mosaics of living organisms.

Q4: Since you described the formation of the structures of complexity, **does your model (juxtaposition and integration) not select the plural, the multiple face of reality? Can a single cell be described through your model?**

GC: Yes, for while the model focuses on the “multiple face of reality” and specifically the hierarchical order from cell to animal population, the same model can be used to describe a single cell which is seen as a collection of cell organelles, first juxtaposed and then integrated.

Q5: Since a model is a selective reading of reality, and as reality is always richer than models, can you describe the *nature/culture* line not only as continuity (of the latter towards the former) from both physical and informational standpoints, but also as discontinuity? **Does the juxtaposition-integration model of complexity also fit this discontinuity?**

GC: The model basically applies to continuity, and is designed to reduce the difference between nature and culture (or nature and nurture), showing that the underlying complexity processes involved are the same. Obviously the model starts with a description of nature and of the forms of living organisms, but in my book, as well as in an article published in the review *Noema*⁵, I have provided many examples, and specifically on the structure of language⁶, showing that the same principles of juxtaposition and integration can also apply to culture. However while common processes can of course be seen existing

⁵ Chapouthier G, La mosaïque des traits culturels, *Noema* (Romania), 2018, XVII, pp 61-68

⁶ Robert S, Chapouthier G, The Mosaic of Language, from *Marges linguistiques* (online review), (Béatrice Fracchiolla, éditeur) *Les origines du langage et des langues*, Editions de l’Harmattan, Paris, 2013, Volume 1, pp 211-223

in both nature and culture, the two spheres are still separate and there is clearly also discontinuity.

Q6: Concerning the concepts of quantity and quality, how do they relate to juxtaposition? Can units resist without accumulating in (more complex) structures?

GC: The model involves both quantity and quality, firstly as a mosaic, with the original units resisting or persisting when “accumulating in (more complex) structures” as they retain some of their original features. Cells maintain certain functions within the larger organism; animals maintain their own individual behaviour patterns when part of a group or community. Qualitative characteristics are therefore maintained despite quantitative accumulation. On the other hand, the shift through integration to higher levels of organisation also sees new features emerge. The higher organism has properties not found in cells. A group or community of animals has characteristics not found in each individual animal. The integration of quantitative elements thus sees the emergence of new qualitative features.

Q7: You said: “At the level of organisms, juxtaposition is more likely to be social than anatomical. Social contact provides a context for complex three-layer (I add, multi-layer) organisms”; is this development of the social from the biological not the sign of continuity (nature – culture), and **is the unity of juxtaposition and integration not the dry model of both continuity and discontinuity?**

GC: As stated earlier, the model focuses on the continuity and similarity of processes in nature and culture, but it is true that the integration of elements into increasingly complex stages is also a form of discontinuity. An organism stands as discontinuity in relation to the cellular stage; an animal community stands as discontinuity in relation to the stage of the individuals comprising the community. Yes, it could be described as a “dry model” of both continuity and discontinuity.

Q8: You clearly showed that your “philosophical”, i.e. general, model/theory is the result of scientific research, and not a clever intuition, by raising the problem of *transition from juxtaposition to integration as both a structural and evolving phenomenon*. Darwin’s theory of evolution and the theory of “complexity in mosaic formation” do not oppose each other, but they complete each other. You said: “complexity arising with new properties and from originally simpler structures is indeed a phenomenon of emergence. In other words, the mosaic model is an original way to interpret emergence within biological systems.” Thus, **is your theory not “a part” of the understanding of evolution?**

GC: Yes, it is. Together with the principles of Darwinian selection, which I consider to be irrefutable, my theory offers an interpretation of the evolution of the species that is complementary to those principles, and leads to a certain “purpose through construction” to quote the term I used in a previous publication⁷, where a degree of internal determinism leads to greater complexity. This “understanding of evolution” is therefore not in conflict with a Neo-Darwinian approach, but complements and completes it.

Q9: The following question diverts from the course of the book. Nevertheless, your observation that “when in situations requiring a choice to be made between two options, the tendency to choose the less familiar one” was very interesting to me; **is this “spontaneity”/creativity/freedom not the sign of the singularity of the human being?** You have insisted on the continuity in pre-human and human life. **But does the above aspect not show rather discontinuity?**

GC: Indeed, “when in situations requiring a choice to be made between two options, the tendency is to choose the less familiar one.” While this clearly applies to creative activities and to the unique features of the human species, it is in no way specific to humans. The same phenomenon has been observed in birds which, for certain learning activities, display a preference for a slightly different option rather than choosing the same option. Throughout the animal kingdom, there is a general tendency to alternate⁸: animals confronted with an

⁷ Chapouthier G, L'évolution vers la complexité: finalité par construction. *Arch. Int. Physiol. Biochem.*, 1986, 94(4), 95–100.

⁸ Chapouthier G, *Biologie de la mémoire*, Editions Odile Jacob, Paris, 2006.

alternative choice between two possible options will, after making the same choice a number of times, tend to choose the other less familiar option. Such phenomena can be seen as evidence of continuity rather than discontinuity. The remarkable skills of the human species, with specific qualitative features, are in fact continuity of more basic skills found across the animal kingdom.

Q10: You said that there is scientific information about animal communication related only to the present environment/events. But I read that an elephant remembered a man who had hurt him a long time ago. **Is this the same thing, since he remembered when he saw the man?**

GC: The fact that, with only a few rare exceptions, animal communication is set in the present time does not preclude certain animals from having strong memory skills. There are elephants, of course, and also lions, dolphins, parrots, and even fish such as rays or salmon, and many others. Many animals can recall events from the past, but they are unable to convey messages on such past events to their fellow animals.

Q11: I loved this conclusion of yours: “While within non-equilibrium situations, negentropic paths tend to oppose the general (entropic) path of the universe, and while biology may appear as a rebellion against the second law of thermodynamics, then culture does the same at an intellectual or cognitive level.” It is interesting. Before Prigogine – but certainly recent scientists know more than the previous ones – it was Hyacinthe Guilleminot who, in *La Matière et la Vie* [Ernest Flammarion, 1919], spoke about the law of option/choice, near the two laws of thermodynamics, that govern life and thus channels evolution.

GC: This highlights relationships between natural processes and cultural processes, both for the theoretical bases in thermodynamics and their opposition (rebellion) to those bases. It is, as you say, “the sign of the unity between the continuity of structures and the unity of the forms of reality, and, on the other hand, their discontinuity.”

Q12: The complexification – through juxtaposition and integration, in the mosaic model – is a correlate of reality’s management of energy, governed by the laws of thermodynamics. **Is this not the basis of the neo-Aristotelian position about the correspondence/unity of the micro- and macro-cosmos?**

GC: That is the case. The common thermodynamic bases are only the starting point triggering common organic processes that form the basis of Aristotle’s “organicistic” thought. Such a position then leads to correspondences and unity of microscopic and macroscopic processes. My entire argumentation on complexity in mosaic formation is clearly set in this Neo-Aristotelian perspective and in the philosophical movement of Konstantin Khroutski.

Q13: I loved both the explanation of triunity and its interdependence with dialectics – actually, the first is a concretisation of the second or, more correctly, they are theories of different orders: dialectics is philosophical, triunity belongs to science. Stéphane Lupasco’s theory of the included middle belongs to logic. (All are related to Aristotle, aren’t they?) But do all of these illustrate only the cosmological principle? Can we confound some enthusiastic theories – but every theory is historical, as we all know, so not the Unique Truth and even not pretending that it is the Truth, but only that it is the truth at that moment or, as enthusiastic theories, that they are (plausible) hypotheses – speculating about (human) consciousness as the “reason to be” of the development of matter, with the simple, descriptive theory about the uniqueness brought about by the development of human consciousness? For me, fully assuming the holistic, cosmological dialectical view, human consciousness is unique through *meanings, ideas, values* – something absolutely new, this is the discontinuity – towards any dialectical management of the world’s energy. **Do you not consider that your theory about the formation of complexity is suitable also for the unique results of human consciousness?**

GC: Human consciousness is unique through meanings, ideas and values, but it is also built according to the principles of complexity in mosaic formation. Human “split-brain” cases, i.e. human subjects who, through an accident have ruptured fibres needed to communicate between the two hemispheres of the brain, have two centres of decision-making and consciousness, one in each half of the brain. Warped consciousness, experienced for

example when dreaming, suggests that consciousness involves intervention by different cerebral modules, juxtaposed and, normally and fortunately, integrated. Even at such a high degree of complexity as human consciousness, there also appears to be a system governed by construction in mosaic formation.

