

MOSAIC STRUCTURES IN LIVING BEINGS IN THE LIGHT OF SEVERAL MODERN STANCES

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Abstract. *Biocosmology implies that the laws of the microcosm (i.e. the laws governing living beings and their minds) mimic the laws of the macrocosm. These laws are based on a mosaic structure and triune organisation, with some roots that may be in the classical dialectical movement. A number of modern stances can be seen in relation to the Biocosmological perspective. The relationship to the mosaic structure may be direct, as with the experimental work of Michod, or indirect, as in theoretical approaches (e.g. Yamawaki) and practical approaches (e.g. Feldenkrais). In contrast, the works of Lupasco and Cherlonneix provide different arguments for a triune basis, while Modell's analysis can include both mosaic structures and a triune philosophical paradigm.*

Keywords: *Biocosmology, Macrocosm, Microcosm, Mosaic structure, Triune process*

1. Introduction

Over a number of years, Konstantin Khroutski and his colleagues have been developing a neo-Aristotelian Biocosmological philosophical stance, focusing on the idea that the laws of the microcosm mimic the laws of the macrocosm. This leads to the suggestion that the laws of complexity which rule the complex systems found on our planet (i.e. living beings) could also be considered as general laws for complexity elsewhere in the universe providing an argument for what is referred to as Biocosmology. Khroutski has presented and discussed his theses in several papers (i.e. Khroutski, 2008) and, as a medical doctor, has analysed their relevance in the context of a philosophical approach to medicine (Khroutski, 2010).

Khroutski's views have been extended to other fields. Ugolev and Ivashkin (Ugolev and Ivashkin, 1992) developed a theory of elementary functional blocks where "complex functions could be reached due to the recombination and transposition of a large though limited set of molecular machines realizing elementary biological operations." This offers the possibility of extending Khroutski's theses to information processing. Khroutski's Biocosmology has been applied to informational anthropology by Guja (Guja, 2008): "a human being as the system/interface may be considered a fundamental component of her/his human society and the nature/cosmos system as well, just like a hydrogen atom is the elementary constituent of matter under the material form" (p. 5). A dialectical relationship between the whole and its parts is clearly seen in Guja's model which is set in the unitary Biocosmological system described by Khroutski. In the field of

sociology, Sorokin (Sorokin, 1965) calls for a “new sociology” able to reconcile mutually exclusive or contradictory theories. Sorokin argues that their “sound parts can be unified and incorporated into a more multidimensional and more adequate integral theory... (an) integral sociology to come.” Once again the emphasis is on the possible dialectical relationship between the parts and the whole.

In previous papers, I have developed a theoretical model of complexity in living beings – the model of complexity in mosaics (Chapouthier, 2001; 2009) – as a general (or universal) model of complexity, thus compatible with a Biocosmological point of view. My mosaic model, based on the functioning of living beings, has been applied to the complexity of language (Robert and Chapouthier, 2006) and to complexity in robots (Kaplan, 2011). I shall summarize here the main properties of this mosaic model, showing how it fits Khroutski’s Biocosmological stance and may be related to Khroutski’s triunity laws, presenting evidence showing that theories developed by certain modern thinkers could, to a certain extent, be integrated into the present scope, leading on, ultimately, to consequences on knowledge.

2. Living beings as mosaic structures

As mentioned above, the most complex structures easily observed and studied on the planet earth are living beings. When adopting a Biocosmological stance, principles governing complexity in living beings can be considered as general principles of complexity.

In previous papers (Chapouthier, 2008a; 2009), I argued that two basic principles – juxtaposition and integration – lead biological structures to complexity. Juxtaposition is the addition of identical entities; it may be compared to beads on a necklace. Integration is the modification or specialisation of these entities, leading to entities on a higher level which use the previous entities as units or parts (e.g. a necklace of beads modified and shaped for use as a container or tool), i.e. a more complicated structure.

Concrete examples of these processes have been given in papers published (Chapouthier, 2008a; 2009). At the level of genetic expression, there is silent duplication and integration of introns which can then produce complex organs. As an anatomical expression, the application of the two principles can be seen in unicellular organisms that develop into “juxtaposed” organisms, e.g. *Gonium*, and then into “integrated” organisms, e.g. *Volvox*. In more complex didermic species, juxtaposition produces colonies of polyps and the integration of the polyps then produces integrated siphonophores. In tridermic organisms, the juxtaposition of metamers produces the earthworm, whereas integration can lead to the bee, octopus or chimpanzee (or a human being). At further levels, juxtaposition and integration become social phenomena, with the grouping of individuals of the same kind (e.g. crowds) or the specialisation, or integration, of their roles (e.g. as colonies of bees or communities of primates).

The metaphor of the mosaic can be used to describe such structures when integration occurs at one level yet leaves lower level units in a state of relative autonomy. In complex living beings, as in an art mosaic made with individual tiles

(*tesserae*), the properties of a given level taken as a whole leave the autonomy of the component parts intact.

Similar processes can be described in the most complex structure known to date which is the human brain (or mind). The brain-mind distinction, i.e. the precise relationship between the functioning of the brain as an organ and the mental functioning of the mind, will not be discussed here.

Several parts of the human brain are clearly mosaic constructions. The entire brain is built from five encephalic vesicles initially juxtaposed at the embryonic stage and then integrated until the complex brain of the adult is produced. Certain areas of the neocortex provide fine examples of mosaic structures with specific areas dedicated to a given function such as sensory perception (touch, sight, hearing, taste and smell), motor control and the expression and/or understanding of oral and/or written language. While these areas have a functional specificity and a degree of autonomy, they still act harmoniously, playing a role as part of the greater neocortex. The two hemispheres of the brain provide another example, but this time of a two-part mosaic. With the two hemispheres, each has different functions: in the classical situation of the right-handed subject, analytical and discrete functions are governed by the left hemisphere, while general and combined functions are governed by the right hemisphere. With the exception of pathological cases with disruption of connections between the two hemispheres (split-brain patients), each hemisphere has functional specificity and a degree of autonomy, while also acting in harmony with the other hemisphere as part of the whole brain. In all these cases, the functioning of the whole does not cancel the autonomy of the component parts.

3. Mosaic structures in mind and language

Similar observations can be made for vital mental functions such as consciousness, language and memory (Chapouthier, 2001) which will be reviewed briefly. Specialists on the subject of consciousness state that human consciousness, though perceived as a whole, is actually a mosaic of several states of consciousness (Delacour, 2001). Examples can be found with split-brain subjects with two distinct states of consciousness (two decision-making centres) existing and sometimes competing, or with the distorted consciousness of the dream state in normal subjects. In language expression (Robert and Chapouthier, 2006), the successive semantic units in the sentence (the parts) combine to render the final meaning (the whole), but only once the sentence is complete.

Human memory is often considered to be a single whole, yet is actually a mosaic of several different memories (habituation, conditioning, spatial memory, cognitive memory etc.) that were gradually acquired by our animal ancestors and which have retained a certain degree of autonomy within the whole. Three basic psychological functions – consciousness, language and memory – may therefore be described as mosaics where the properties of the whole do not preclude the autonomy of the properties of the component parts.

In short, genetic and anatomical arguments, plus observations of the brain and thought suggest that complex living beings are built as mosaic structures, as entities

where, at each and every level, the properties of the whole allow a large degree of autonomy to the component parts. In the course of the evolution of species, this situation appears to have been achieved through repeated applications of the two general principles leading to complexity – juxtaposition and integration.

4. Triunity in living beings

It has been argued that an elementary process of the functioning of organisms may be triunity. Khroutski (Khroutski, 2010) cites a number of biological examples of triunity in living beings, e.g. sympathetic systems or sub-systems, the sleep-wake cycle, systole/diastole and the “(one) vegetative (super) system: the parasympathetic, sympathetic and metasymphathetic (sub)systems” (p 70). It may be noted that western medicine is largely based on simple dichotomies, emphasising the opposition between sympathetic and parasympathetic systems, and has therefore tended to overlook the autonomous action of the “free” ganglia in the metasymphathetic system, which, for example, are responsible for the rhythmic activity of the heart occurring spontaneously, a continuous activity not requiring any action from the sympathetic or parasympathetic systems and which, to a certain extent, integrates occasional, opposite actions from the sympathetic and/or parasympathetic systems. Similarly, between sleep and wakefulness, there is a state of waking with the possibility of the concomitant existence of both “poles”, even though they may appear alternately. This can be seen as an expression of the “law of polarization” as defined for sociocultural processes by Pitirim Sorokin (Sorokin, 1937-41) who argued that the alternation of the two poles induced macro-evolutionary spirals.

I maintain that for biology, such triunity may be much broader in scope, provided that it is linked to changes in metabolism occurring with time and ultimately leading to the ontogenetic development of living beings. Here again the modern scientific approach would first emphasize the dichotomy between two opposing entities, e.g. opposite reactions in a biochemical equilibrium, the opposition between production and inhibition in the regulation of hormones, or the effects of the two hemispheres of the brain on the behaviour of higher animals. Simplicity prevails and binary division is more commonly found in living beings. Similarly, the physical movement of animals involves a right and left side in an approximately symmetrical arrangement, leading, in some cases to two brain hemispheres.

However, the focus on two opposing actions overlooks the later stage in time when such actions achieve balance, and in the subsequent stage of ontogeny when the two opposing actions produce a more stable state, “overruling each other by turns” (Khroutski, p. 72), reaching a state of “oneness of the two autonomous poles (bipolar unity)” (p. 73) – a temporary, conclusive and unitary stage of the opposition, creating a triadic unity which, once again, may become the point for further triadic developments.

5. The Dialectical Roots of Triunity

Triunity may be considered, to a certain extent, as a development arising from the philosophical concept of Hegelian dialectics, but applied to material movements

and when looking beyond the limited scope of natural dialectics and the oversimplistic examples presented by Engels in the “Dialectics of Nature” (Engels, 1979). With limited biological knowledge at the time, Engels chose physical phenomena, measuring, for example, movement, tides, heat and electricity, producing arguments for the dialectics of nature which are relatively unconvincing. Biological examples such as the complex ontogeny of living beings or the evolution of species could provide clearer and stronger arguments for the triadic development of the biological and terrestrial phenomena in the universe. Triadic development is better suited as a prerequisite for dialectics, as argued by Hegel, but is applied by Engels to the physical side of nature instead of thought. This is a critical point as it makes it possible to link modern neo-Aristotelian stances with Hegelian dialectics.

A Biocosmological stance leads to the conclusion that such triadic movement is obviously not specific to living beings, but can apply to the complexity of the cosmos; or, stated differently, evidence for the triadic development of living beings can be used to predict triadic development in other entities of the cosmos.

6. Biocosmology and certain modern philosophical stances

In the following paragraphs, I wish to show how several modern thinkers have developed stances that may then be related to a Biocosmological viewpoint, although such stances do not necessarily cover *all the laws* involved in the neo-Aristotelian perspective, but simply express concepts which may easily be related to either mosaic structures or triunity, even in philosophical arguments such as Lupasco’s theses which claim to be non-Aristotelian.

Richard E. Michod. Richard E. Michod is primarily a biologist and professor of the Department of Ecology and Evolutionary Biology at the University of Arizona (USA). Michod has developed theses on the complexity of living beings, independently of my own philosophical work on mosaic structures, and has reached similar conclusions. Michod has noted how much biological evolution is linked to integration (a term he uses himself) of (simple) individuals into individuals at a higher level of complexity. He argues that the main reasons that have led to the diversification of living beings and their hierarchical organization are those mutations of individuality, moving from genes to animal societies, going through all the levels of complexity observed in biology, including cells, groups of cells, organs, organisms and societies. Michod’s main interest is anatomical complexity; he has not focused, as I have, on thought and language. One of his great achievements is to have experimentally analysed some of the processes involved. While my position remains speculative, Michod has conducted experiments to find the underlying molecular processes behind the switches to different levels of complexity (Michod, 1999; 2009), and in particular for the aggregation of cells in the algae *Volvox* mentioned above. The work of Richard E. Michod thus stands as an extremely interesting approach in modern biology investigating what is one of the most puzzling questions of biological evolution – complexity.

Stephen M. Modell. Modell (Modell, 2006) first investigated healthcare, suggesting that general Biocosmological principles could also be applied to

healthcare which was seen as a general and complex structure, before extending his scope of study to the entire living kingdom. Not only is there classical Darwinian selection at the genetic level, but Modell (Modell, 2011) also sees space for “additional laws” to explaining the complexity of biological forms, arguing that in evolution “surely there must be more than simple randomness at work.” For energy, Modell suggests that there should be involvement of “islands of energetic stability, which, supplemented by selective adaptation, could account for new levels of evolutionary complexity,” a position very similar to modern biophysical stances as developed by Prigogine (Prigogine and Kondepudi, 1998) and Tonnelat (Tonnelat, 1995). All of this could ultimately lead to morphological changes in organisms. Modell quotes my hypothesis of duplication (juxtaposition) followed by integration leading to mosaic structures, recognising that such “combined processes may be responsible for the emergence of complexity” in the human brain, while also seeing it as a possibility at the different morphological levels of living beings. Modell suggests that as a paradigm these juxtaposition–integration processes demonstrate the thesis–antithesis–synthesis triune common to philosophy and Biocosmology, again focusing on the potential for common ground between modern Biocosmological stances and classical dialectics.

Naoshi Yamawaki. The Japanese philosopher Naoshi Yamawaki has endeavoured to establish trans-national public ethics (Yamawaki, 2009), which, initially, appears to be substantially different from the present author’s biological approach. Yamawaki argues that his ethics cannot be determined by either local or global considerations and has coined the term “glocal” to describe the “correlation between the global character of the problems and the culturally and historically defined locality where each human being lives” (p. 198), noting that “global and local perspectives are interdependent” (p 198). The dialectics of the whole and its parts, when seen in the context of human civilisation, can stand as an excellent example of integration between different levels of complexity, as proposed here for living beings. At the same time, it supports the idea that laws of the (biological) microcosm could also play a useful role in the (moderately) macroscopic social field.

Stephane Lupasco. It may seem paradoxical to quote the Romanian philosopher Stephane Lupasco (1900–1988), known for his defence of non-Aristotelian logic, but I maintain that his reasoning is neo-Aristotelian. In his book *The Principle of Antagonism and the Logic of Energy* (Lupasco, 1951), Lupasco questioned the *tertium non datur* principle of classical logic which does not leave any logical scope beyond the duality of being and non-being. Lupasco maintained that one phenomenon could simultaneously include both an action and its opposite, but Lupasco introduced a “third state” between the two opposing entities, going beyond the classical principle of duality, and defining something similar to Konstantin Khroutski’s triunity. Today Lupasco’s work is little known, but I would call for a neo-Aristotelian reading of his work. Indeed Lupasco’s opposition to *tertium non datur*, with no scope beyond the duality of being and non-being, could be readily interpreted in a biological context as the equilibrium between two opposite actions producing a balance when in the third stage of this triunity, thus seeing Lupasco as an

Aristotelian view. A biological understanding of complexity, such as the Aristotelian approach, would have Lupasco's apparent opposition to classical logic reduced to a mere difference in expression.

Laurent Cherlonneix. Cherlonneix is a promising young French philosopher interested in the processes underlying biological phenomena and in particular the philosophical consequences of apoptosis, i.e. programmed cell death, which has been shown by Ameisen (Ameisen, 1999) to be a necessary stage in the evolution and development of organisms. Cherlonneix conducted an in-depth analysis (Cherlonneix, 2008) of the opposing actions of apoptosis and its inhibition referred to as "a-death", i.e. non-death. But constant movements in the metabolism, such systematic and opposite actions of death versus non-death occurring at the cellular level, must reach a stable third stage, even if only a transient stage, for living beings to develop their structures (as is the case with the mosaic structures according to my arguments). In other words, Cherlonneix's views could be a description of the basic processes of the dialectics of life, in which mosaic structures would be the third – transient and stable – stage which could be cited as further evidence for triunity as a model.

Moshe Feldenkrais. Feldenkrais (1904–1984) is not a philosopher but was an engineer, physicist and physiotherapist. His well known method (Beringer, 2010; Feldenkrais, 1994) teaches a technique involving kinaesthetic feelings: a person practising the method must learn to feel distinct parts of the body, e.g. bones, separately; the analysis of the juxtaposed feelings then leads to better integration, i.e. functional integration of movements.

In different ways, the thinkers cited above present arguments for the mosaic model of living beings. It may be done directly, as with the experimental work of Michod, or indirectly, as with Yamawaki, or through a practical approach, as for Feldenkrais, but all can be seen as juxtaposition/integration of simple structures to form more complex ones. The works of Lupasco and Cherlonneix can be seen as presenting a triune basis for the emergence of such mosaic structures, thus bringing an Aristotelian approach to the dialectics of life. Modell's view can even include both arguments, having a clear relationship involving the integration of simple structures to form more complicated ones, plus the possibility of a triune philosophical basis.

7. Conclusion – Why knowledge is possible

All these considerations on complexity in living beings have another important epistemological consequence that can be presented as a conclusion. If the (mosaic) structures of life, as well as their basic triune processes, are considered as models for the structures and triune processes of the entire cosmos, there is then a clear explanation of why the laws of the universe can be understood by humans, of why human (scientific) knowledge is possible. As has been seen, the most complicated organ, the human brain and the mind processes which it controls (e.g. consciousness, language and memory), fits the theory of the mosaic and triune process of life and is thus able to simulate or mimic the laws of the surrounding environment, which are, in the Biocosmological hypothesis, the same laws.

More specifically, as the nervous system of living beings has emerged as part of the universe, the system is able to understand the functioning of other parts of the universe which operate along similar lines. The simulation of the external world by the brain (Chapouthier, 2008b) which is already present in evolved animals such as vertebrates and cephalopod molluscs, reaches its highest point in the human ability to develop scientific knowledge of the world where humans live. In more philosophical terms, as living beings, humans are determined by the four Aristotelian causes (material, formal, efficient and final), so it is only logical that humans should understand other systems in the universe which are determined by the same causes. Furthermore, complex species tend to “cephalization”, i.e. concentration towards the front of the body, in the direction of movement, with the brain, a highly sophisticated organ, gathering sensory information and processing it in complex ways, including reasoning and memory (Chapouthier, 2008b). Through this general process (found not only in vertebrates, but also in insects and molluscs), the simulation of the laws of the universe by animals and humans becomes increasingly sophisticated.

In short, as both the cosmos and biological systems are built in the same way through the same Aristotelian causes, they tend to achieve the same patterns of complexity, with parts of the cosmos (human brains) able to simulate and understand other parts of the cosmos. As “human consciousness is exactly a means – a tool function” (Khroutski, p. 72) for cosmic evolution, there is then an explanation for human consciousness being able to understand the laws of cosmic evolution.

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