



Faculty of Design

2022

## Every Schoolboy Should Know that Patterns are Connecting Patterns and Threads are connecting Threads

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### Suggested citation:

Rasoloniaina, Fanjasoa Louissette (2022) Every Schoolboy Should Know that Patterns are Connecting Patterns and Threads are connecting Threads. In: Proceedings of Relating Systems Thinking and Design, RSD11, 3-16 Oct 2022, Brighton, United Kingdom. Available at <https://openresearch.ocadu.ca/id/eprint/4305/>

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Relating Systems Thinking and Design  
2022 Symposium  
University of Brighton, Brighton, UK,  
October 13-16, 2022

## **Every Schoolboy Should Know that Patterns are Connecting Patterns and Threads are connecting Threads**

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This article traces the influence of Gregory Bateson's thought on the construction of a new epistemological, didactic and praxeological framework based on the systemic analysis of the Swahili territory and community, the observation of the use of the Environmental Genetic Code (EGC) systemic matrix by Master students of the architectural project studio "Conjuring Social and Natural Catastrophes in the Post-Covid Area" at ENSAPVS, and the questioning of the EGC during the RSD10 workshop "Weaving a Collective Intelligence Systemic Design Tool."

This set of studies allowed the consolidation of the EGC matrix by reinforcing the realisation of the relationships and communications between *creatura* and *pleroma*, thwarting the very principle of a border, of a hierarchy between reigns and even more fundamentally requesting its notion, opening a perspective towards epigenetics and biosemiotics thresholding disciplinary boundaries and fully embracing the inter-trans-poly-disciplinarity or post-disciplinarity that suits the paradigm of Post-Normal Science that allows us to grasp uncertainty and formulate effective and reasoned conceptions that support the connection and reliance between systemic research, design, policy-making and activism.

Systemic thinking is one step, but ecosystemic thinking, designing, and acting is the ultimate phase to achieve, establishing a symbiosis between humans, their

productions and environmental conditions embodying the ARMSADA principle, moving out of predation, domination framework and embracing a collaborative mode of operation and existence. The change in mind thought demands the integration of complexity and tentacular thinking; in this maze, the Ariane's thread is the work of Gregory Bateson, who has paved the way and laid the groundwork for pragmatic ecological intelligence.

KEYWORDS: systemic design, ecosystem thinking, morphological mapping, string figures, epigenetics, tentacular thinking

RSD TOPIC(S): Cases & Practice, Learning & Education, Methods & Methodology

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## **String figure: an ontological and holonic representation**

### **Being there**

Drawing the line of a simple thread, it enunciates a *dasein*, the first active verb in the world of form: to be (Thom, 1972, p. 307). A chain from a beginning to an end (Figure 1), from birth, *telos* to death (Thom, 1989, p. 146), through which co-evolution with the associated milieu, hands and techniques close the string loop, creating a matrix within which ontologies are formed and characterised by the knots' complexity, representing each time only one individuation among an infinite number of others (Simondon, 1989), all linked by a phylogenetic kinship establishing equal valence through the biodiversity and/or objects diversity (Figure 2). In its core structural definition, a string is a whole made of parts; fibres and filaments, illustrating the holarchy and holons' nesting hierarchy, stating the multilevel of holonic *dasein* whereby whole and all parts are all holons, any part is a whole on itself, and the whole is part of a higher level of the holarchy (Figure 3)—making all *dasein* connected and imbricated as a solid fabric in a multi-dimensional complex reality.

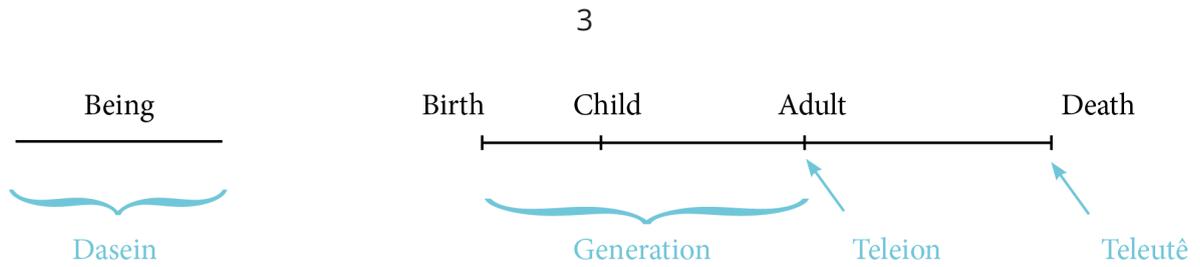


Figure 1. A line semiophysics. Source: Adapted from René Thom, 1972 - Author: F. L. Rasoloniaina, 2022.



Figure 2. String figures. Source: Adapted from E. Vandendriessche (2015), Author: F. L. Rasoloniaina, 2022. (Ozanne-Rivierre, Henri, & Vandendriessche, 2020).

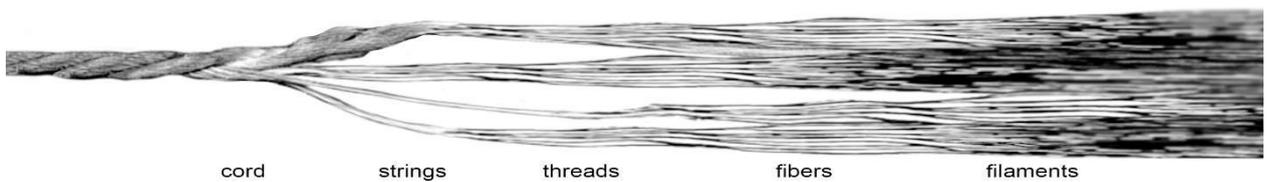


Figure 3. Cord: an aggregation and organised system. Source: Inspired by James Grier Miler, 1987, p 240. Author: F. L. Rasoloniaina, 2022.

## **A biased and silo knowledge context resulting in interpretation errors**

The scientific method of compartmentalising objects through chronology and discipline deceives the data by shadowing many facts, among them the notion of evolutivity, which is necessary to the assimilation of structures as evolutive and perishable organisations. The research specialisation implies siloed work inducing a lack of porosity between disciplines causing knowledge inconsistencies, and generating discrepancies.

The Swahili case study illustrates the impact of this observation and how the accumulation of contradictory data led to looking for a new investigation method. Prior to the analysis of the Swahili territory and community on the ECG systemic matrix, the data were based solely on archaeological interpretations of tangible evidence, like the Swahili coral stone forts, dated circa 800, that portray an East-African mixed Arab and Bantu society, based on the Swahili language, the Sunni and Shia religious denomination. What may seem credible has been the official history since the 16th-century Western hegemony over all oceans. When Westerns reached the Indian Ocean basin, they discovered a vibrant and dynamic globalised world system linking Africa to Far East Asia by land and maritime routes. But those routes were already mentioned in *Periplus of the Erythraean Sea*, circa first century AD (Crowther et al.), as well as the singularity of that Eastern coastal Azania that hosted a cosmopolitan community sharing one common language and constituting the last marketplaces, stretch as a long ribbon before the Terra Incognita. The glottologic analysis of the Bantu language phylogenesis displays the rise of Sabaki Swahili—proto-Swahili—in 800 AD, posing the dilemma of how to explain the official emergence of the Swahili people in the 9th century while their proto-language appeared 16 centuries earlier.

Avoiding going astray and facing complexity of reality, Bateson proposed a cybernetic epistemology that has the potential for a new strategy to sustain science and sanity (Wazik, 2016), with a method that consists of crossing results from different perspectives multiple times to ensure that the result is the same, and only then can one hope to have a relatively "true" perception of reality. He set the method called "the double description" that implies abductive reasoning logic to find potentially informative

similar patterns; therefore, it drives a specific type of research and is results-oriented—towards establishing link(s) between disparate data. Keeping in mind that the sense of disparateness is only the indication of not perceiving the relations between parts and the whole yet.

A long series of contradicting data has forced us to look for new investigation methods, which has led to the need for a heuristic methodology that first accommodates all data, especially those that seem to conflict, and secondly links and weaves together cause and effect in an intelligible manner. The Environmental Genetic Code (EGC) is a systemic matrix taught in architectural and urban design; it matches the requirements. Its current usage in profiling artefact and, for this case, its usage was switched to reverse-architecting.

### **The ECG systemic matrix**

The Ceccarinian information and heuristic matrix called the Environmental Genetic Code (EGC) is structured as in abscissa axis (x), the column of phenomena, and (y) in the ordinate axis (y), the morphological development timeline, the overall constituting a morphogenetic informational and heuristic system. Since all the data are made into maps/cards, the morphogenetic process is modelled through their placement and their links manifested by intelligible threads. Along the development phases, this deployed growth narrows and highlights significant emergences and recurrences that are the characteristics of the analysed entity.

In Figure 4, the matrix is detailed as (a) in abscissa axis, the column of phenomena is brooked down into two major sections: (a1) the physical field, subdivided into meteorology/atmospheric sciences, earth sciences and biotope sciences data; (a2), and the anthropological field, subdivided into historical, contemporary, and programmatic data; (b) in ordinate axis, the timeline is divided into 4-column development phase: findings, diagnostics, strategies, and artefact (profiled). All data/maps/cards are orderly placed on the matrix: (b1) the referential cartographies inform the findings phase and scales; (b2) the analytic cartographies are positioned between finding and diagnostics phases (crossed generated maps based on SWOT analysis); (b3) the synthetic

cartographies are feeding the strategies and programmatic strategies phase (crossed maps) and finally (b4) the profiled artefact (Ceccarini, 2017).

Finally, EGC deconstructs and/or analyses architectural, urban, and inhabited territory figures. The weaving obtained is a visual trace that constitutes intelligibility, a thread of thought. Its robustness allows its usage as a profiling and retro-profiling morphogenetic process. It is a cartographic data visualisation, drawing up the complexity of a contextual environment, reinscribing the built environment in its milieu in coherency and lineage with the living-ecosystemic system (Ceccarini & Rasoloniaina, 2021).

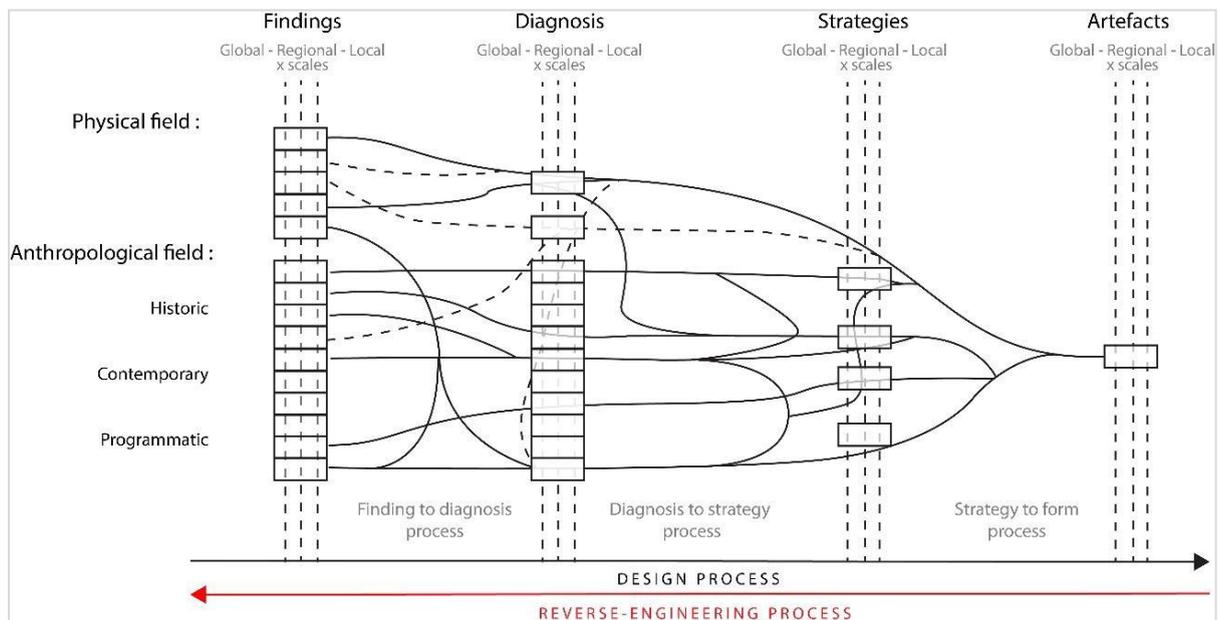


Figure 4. The EGC matrix—Two-way analysis: profiling and retro-profiling Source: Patrice Ceccarini, 2012. Author: F.L. Rasoloniaina, 2014.

## **The Swahili territory and community revealed on the ECG systemic matrix**

The Swahili territory exemplifies a territorial figure whose morphogenesis started in the Bronze age and developed into a long-reticulated rhizome, just like a string of beads of cities-states, villages, islands, and archipelagos along the East African coast, a 3 000 km-long strip from South Somalia to North Mozambique. The early Swahili group is a melting pot of Bantus and Austronesian immigrants—from West Africa and Southeast Asia—settled altogether on the Shungwaya delta (de Vere Allen, 1993), showed by a long-lasting climate change that has dried up the planet. They formed a syncretic culture based on the systemic integration of immigrant masses and diaspora coming from all around the Indian Ocean basin (Somalia, Yemen, Oman, Iran, India, Indonesia, China, etc.). Like multiple fibres constituting one rope, each thread is regarded as a characterised sub-group still fully part of a concrete social fabric. Based on the facts that this reticulated territorial figure combines more than 400 city-states, is involved in global trade and with cosmopolitan inhabitants—equivalent to modern global cities—and is shaped by natural geographical entities can be qualified, in contemporary discourse regime, as a megaregion.

This assertion is an anachronism for a mind formatted by the current scientific framework dividing epochs and their “attached” notions as singular and enclosed within their time frame, restricting their knowability (Agamben, 2002). To Korzybsky's famous statement, “the map is not the territory”, Gregory Bateson added, “and the name is not the thing named” (Bateson, 1980; Korzybski, 2000/1933). He fought against the “thingification of nouns”; for him, the epistemological error is that what we take to be “things” should be taken to be “relations” (Borden, 2017; Nachmanovitch, 2007). He objects to the map-like boundaries used to divide and separate things and invites us to distinguish “the name and the process that is named.” The map cannot contain the territory; the process of representation filters the territorial data into a “mental territory”, that is, maps of maps showing differences, for information is “difference that make a difference” in the living processes of perception (Harries-Jones, 2021).

Keeping this precept in mind, we could relate to Patrick Geddes<sup>1</sup> standpoint on urban figures regarded as living organisms. He coined the notion of conurbation in 1915, which prefigures the megalopolis figure (Gottmann, 1961), itself re coined as a megaregion by Armando Carbonell (Yaro & Carbonell, 2007). In Geddes' vista, urban and territorial figures are objectified states of evolution; sustaining the idea of a genealogical growth process; extending biological studies to the physical structures and artefacts built by humans and non-humans, that requestions the division and relation between *pleroma* and *creatura*, another Bateson's topics.

The diversity of origins of the Swahili is not differencing their habit—as clothing—their habitus, their habitation or their environmental habitat. The Swahili language, dress code, socio-cultural behaviour, dwelling and settlement location near the mangrove and coral reef are very standard across the megaregion.

The Swahili exemplify Carl Gottfried Semper's theory of architecture, which states that the woven cloth enclosing a space is the archetype of human habitat and that "dressing" is the first principle of architecture before building (2004). This archetypal structure—which can be traced here through language, making connections between things that are initially perceived as disparate objects but point to the ideational process (objectification of terms and concepts through symbolic thought)—is consistent with Bateson's epistemology, which states that the cognitive process is based on the mind's ability to distinguish, treat, and organise differences at various successive levels, which the mind interprets as information to structure knowledge about the world (Mela, 2020). The human mind produces continuous thought across tangible and intangible representations that have a nested multiscale structure: mental, physical, and environmental at the individual and collective levels.

This highly standardised society and its lack of evolution indicate a primitive social structure in a state of metastability until the 19th century as a prominent maritime and commercial wealthy society weaving a sophisticated relationship network at the local and global scales, acting as a geographical hub between Black Africa, in the hinterland, and the Afro-Eurasian world-system axed on the Indian Ocean, extended to the Chinese

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<sup>1</sup> Biologist by training, urban planner by practice and tutored by the geographer Elisée Reclus.

Sea. Fully embedded in a large systemic mechanism, the Swahili economic and ecologic performance —close to the defiance of gravity— is a 3-millennia model of sustainability rooted in the Swahili enaction.

Enaction is an emergent cognition process involved in the mind-body-environment interaction in the exercise of intelligence in situated and embodied action. This link, this cognitive process, is concomitant, inseparable and established between the "situated being" and the "situated environment", also referred to as the organism/environment sensorimotor coupling. It is triggered and structured by the perception and action of recurrent but not predefined sensorimotor patterns, which will generate endogenous and dynamic patterns of brain activity, which in turn inform the sensorimotor coupling (Thompson, 2007). The circularity of the overall process is the development of sense-making and learning (Fuchs, 2020); these are crucial in establishing ecological intelligence: it is a collective ability to perceive/understand the human impacts on ecosystems and to act to improve them. Daniel Goleman summarised this as “our ability to adapt to our ecological niche [...] these days the entire planet” (2009). Most Premier People have kept a vivid ecological intelligence that is passively built on the perceived relationship between the natural and built environment(s). It is consistent with the Ethics of Care that is not limited to health but truly relates to all living things of the pleroma and creatura as a planetary community.

### **The local scale**

At the local scale, their high level of stability is erected on a symbiotic territory expressed through their settlements and architectural configurations that are in relation to the surrounding ecosystems —the mangrove and, more particularly, the coral. While studying those ecosystems, a certain number of principles appeared on different scales: zonation, arc, symbiosis, etc. These words gathered made possible the connection with the cultural geography and Joël Bonnemaïson, a specialist of the Austronesians; based on his work, it easy to figure out the Swahili system and size their installation and settlement pattern.



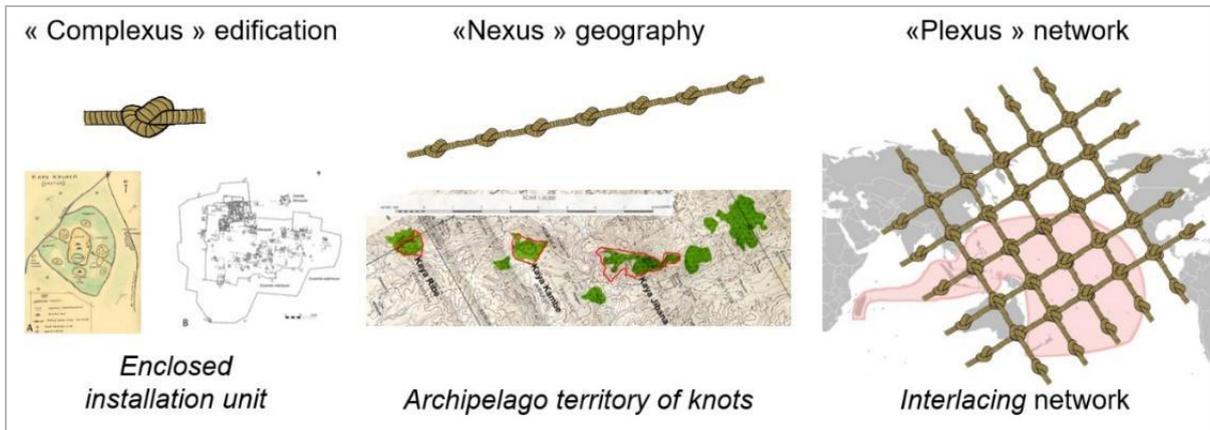


Figure 7. From a knot, a string of knots (settlements) to the interlace (network) - Author: author, 2014.

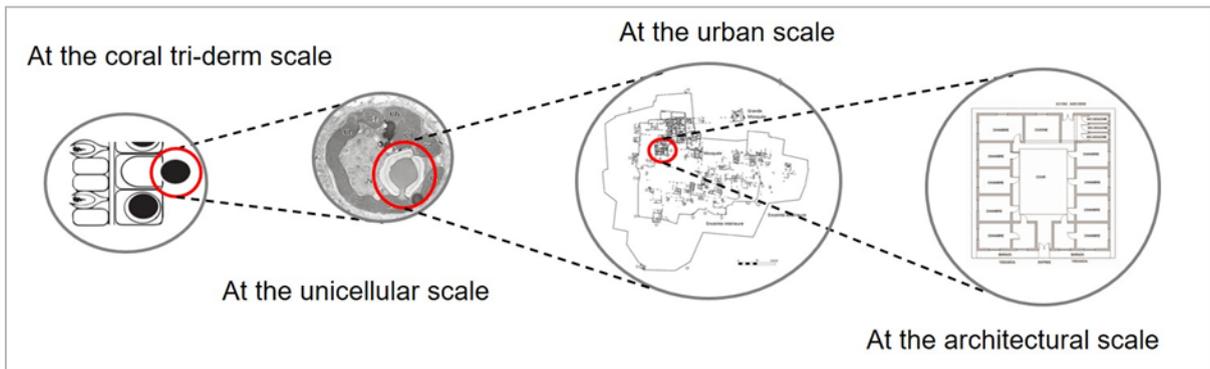


Figure 8. The hologrammatic “unicellular pattern” found in the “Swahili-Coral-Mangrove holobionte.” Author: F. L. Rasoloniaina, 2014.

Swahili means “people of the seashore” in Arabic, but it is an Austronesian way of naming people by their geographical location or means of transport. It has a pendant, “people of the forest or mountain”, which made us realise the relationship between the Swahili and the Mijikenda. The zonation attests that they belong to the same society based on the Austronesian binary zonation of the territory; an East-West transect, from the shore to the humid tropical forest; from urban to rural areas; from the navigators and traders to the farmers and breeders.

Not only the local ecosystems are providing their building materials, but their structural patterns are manifested in a fractal transcalar dimension (Eglash, 1999) in the Swahili territory, social zonation, the urban fortress, and the architectural layouts (Figures 6 & 8). This phenomenon illustrates the hologrammatic principle, one of the system indicators (Morin, 1997). The Swahili territory is specified by the systematic presence of coral reef and mangrove ecosystems; these two ecosystems originate from the region of origin of the Austronesians (Figure 5) as well as to the primitive Swahili habitat that has the same layout as the *Limasan*, a rectangle Javanese habitat.

### **The global scale**

At the global scale: their commercial predominance overseas was based on their knowledge of the monsoon mechanism—a phenomenon known by Westerns from the 16th century as the “Trade winds”—that helped them to weave a wide network through the successive tying of mercantile and kin relationships, a social and “colony” pattern inherited from the Austronesians, whose territory is the largest throughout human geography and history (Bonnemaison, 1985) (Figure 7).

This series of patterns were noticeable on the matrix; since the data are made into graphical cards/maps, the visual repetition of patterns makes the recurrences obvious through the parts, the whole, and the local and global scales. In his last book, *Mind and Nature: A necessary unity*, Gregory Bateson laid out a set of epistemological principles that form a new conceptual framework commonly referred to as “patterns that connect patterns” (Bateson, 1980). His research focused on the patterns that connect the realms of the living and the interconnectedness of all things. For Bateson, the greatest problems result from the difference between how people think and how nature works.

In 1978, James Grier Miller, another cybernetician, published *Living Systems*, set the Living Systems Theory with its 20-sub-system process, which fully links the patterns from the cell to the supranational system level, and has inspired, in turn, J. T. Velikosky's continuous multiverse through to subatomic particles (2016) derived from Ervin Laszlo's *Characteristics of the terrestrial microhierarchy*, 1972 (Figure 9).

By examining the case of the Swahili community, we did zoom in and out of a multi-layered complexity, which made clear that the hologrammatic principle was present in all scales, weaving a multidimensional holarchy: a structure of holons hierarchy (Figure 9).

The concept of holarchy best summarises this organisation of systemic patterns across scales. Holon and holarchy are relevant to the topic of ecological architecture because they are systemic patterns that occur in nature, in both physical and non-physical phenomena, and especially in living organisms and their byproducts. There is no threshold between the man-made, biological, geographical, and astronomical levels of an organisation, only different levels in a multidimensional perspective (Figure 9).

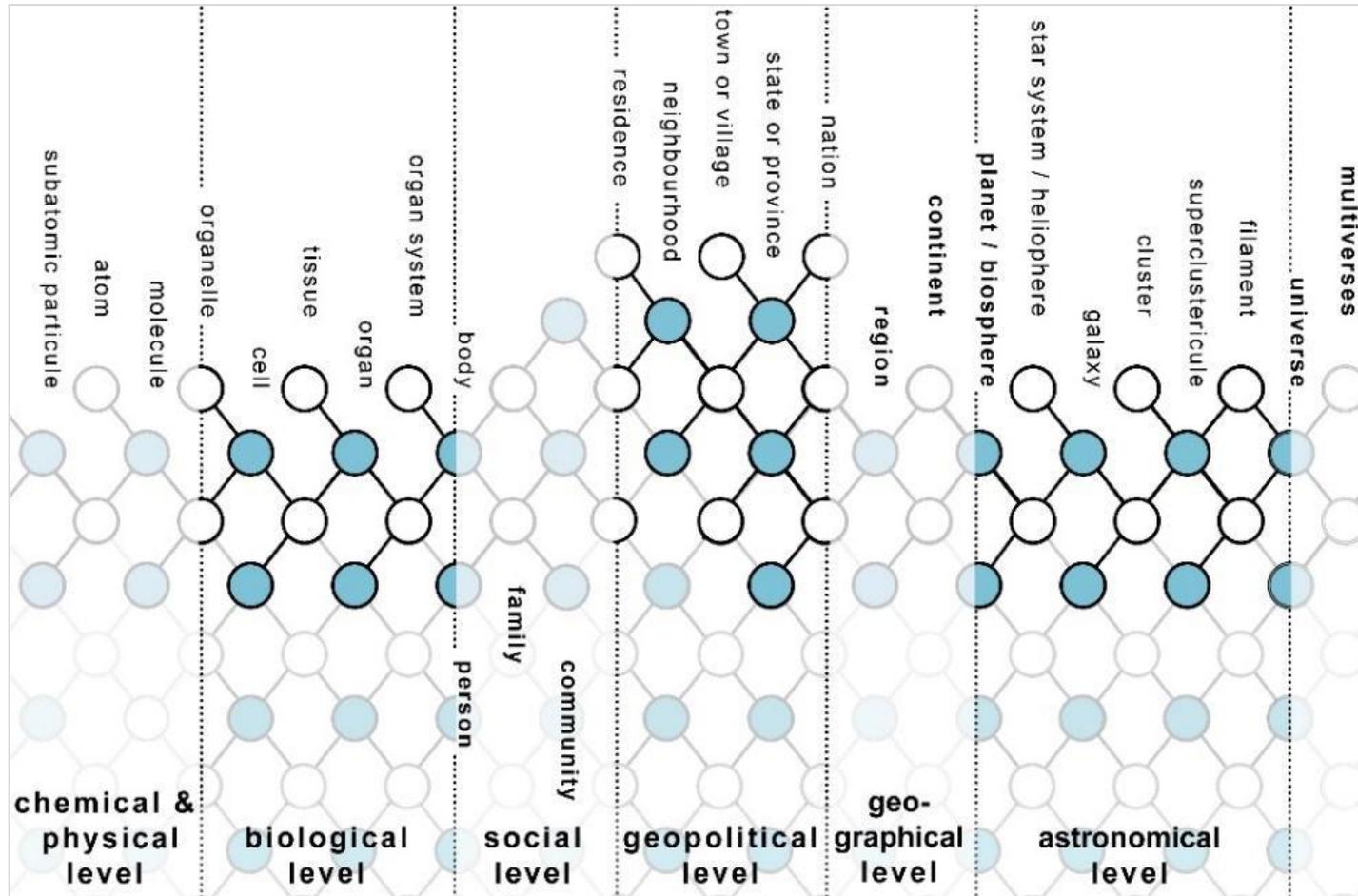


Figure 9. The multiscale and multi-structure holarchy fabric. Source: Adapted from J. T. Velikosky, 2016, p. 211. Author: F. L. Rasoloniaina, 2022. (2016).

### **Societal inclusiveness and vegetative expansion**

The Swahili community is a societal structure composed of individuals from heterogeneous and immigrant backgrounds, and this integration goes through a *Swahilization* process (de Vere Allen, 1993, p. 246). Those who want to change their condition must accept detribalisation by adopting the practice of the Swahili language and way of life to become a Swahili (ibid, p15) without losing their original identity, which is instrumentalised as a vector of interfacing in mercantile exchanges, what John Middleton describes as a *mercantile ecology* (1992).

The adhesion act allows any Swahili to integrate a societal system at any point of location across the long territory. The Swahili society implies a collective intelligence moved by a vegetative system with neither centralised control nor governance but a multiplicity of simultaneous responses to contextual stimuli, which conforms itself to a reference scheme based on a simple and self-regulated behavioural register (Bronckart & Schurmans, 1999).

These features characterise animal swarm intelligence, “the emergent collective intelligence of groups of simple agents” (Bonabeau, Dorigo, & Theraulaz, 1999) that allow the assertion of human swarm phenomenon—like fish school or bird flock. It is a pragmatic model to review the contemporary dilemma: (a) how, as a collective group, can we act as one, and (b) having a global influence while having a low carbon impact on the local scale and living as symbiote with the environment.

Most human swarms do not generate collective intelligence for constructive and mutual benefit but rather destructive behaviours characterised by irrationality, fear, and violence. Austronesians form a coherent and long-lived human swarm on a very large scale (Peterson, 2009), and it appears that the Swahili, originally composed of Bantu and Austronesian migrants, have inherited or nurtured this ability (Figure 7).

This principle of component autonomy within an integrated whole is found in the Austronesians. The Swahili “colony” pattern is similar to the coral, as it is a symbiosis manifested by the association of two species: an invertebrate (cnidocyte) and an alga (zooxanthella) lodged into a collagen matrix (polyp) and an exoskeleton matrix (mineral limestone), at the junction of what Westerns calls *pleroma* and *creatura*, where animists

do not make any boundary. It is still the same string of being—a manifestation of the living. This ideation is not an analogy or a metaphorical figure but the reality of living creatures on Earth (Rasoloniaina, 2021). The Swahili human productions have the same patterns as the Swahili natural ecosystems (Figure 11). It is a mirroring principle coined Echo-systemy (Rasoloniaina, 2021) that characterises the specific symbiosis they form with their natural environment.

There is no life and evolution without symbiosis (Margulis, 1999). Symbiosis is a long-term relationship based on "unity through diversity" for the sharing of gains and losses that have allowed species to survive for billions of years. This term is more precisely redefined as an Association for the Reciprocal and Mutual Sharing of Advantages and DisAdvantages (ARMSADA) (Bricage, 2014); it forms a living system constituted by the embedding of living systems; construction that requires a hosting capacity, ecoexotope,<sup>2</sup> and the capacity to be hosted, endophysiotope.<sup>3</sup>

To leave the logic of predation brings a reciprocal win-lose equilibrium between symbiotes—all the species taking part in the symbiosis—which lets them both survive through the constitution of a new individuation that belongs to a new species: an exaptation.<sup>4</sup>

With their logic of integration of the immigrant masses by making use of their diversity of origin, the Swahili have built a metastable community that spreads like a colony and weaves their territory. Catastrophes impose changes and transformations as adaptive responses; thus, the great standardisation observed among the Swahili is an indicator of its long-lasting state of metastability from the local to glocal scale.

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<sup>2</sup> Ecoexotope is the external space allowing the "hosting capacity", eco=inhabitation, exo= external, tope= space-time, space, umwelt, milieu.

<sup>3</sup> Endophysiotope is the inner space allowing the "capacity to be hosted", eno= internal, physio=functioning, tope== space-time, space, umwelt, milieu.

<sup>4</sup> Exaptation: evolutionary adaptation with new function (Gould, S. J., & Vrba, E. S., 1982).

### **When past helps to question, (re)read present and potentially open the future**

In 1992, Gunder and Gill demonstrated that 5000 years ago, due to a prolonged climate change that dried up the planet, the scarcity of fertile land turned agriculture into a commercial activity that required storage facilities, which led to the establishment of physical centres: cities. This economic activity implied the establishment of an exchange rate system for values/weights/measures, division of labour, surplus production, and double-entry bookkeeping— all principles commonly attributed to today's capitalism but already observed in the Bronze Age. Philippe Beaujard has uncovered not one but a whole constellation of world systems that he has dated to the Iron Age (2020) (Figure 12). Fuller and Boivin (2009) made clear that the translocation of plants and ruminants testifies to very ancient maritime and terrestrial exchanges on a very large scale across the Indian Ocean.

Despite these findings, the current doxa still points to global cities, megaregions, globalisation, and the world system as products of 1970s capitalism, supposedly the source of all the major problems of our time. The Swahili study has demonstrated that the city-state is the early world-system urban figure that, over time, has evolved into a global city, now turning into a megacity. Their territory is a megaregional occurrence. These urban and territorial figures are systemic and autopoietic phenomena shaped by world systems; they are by-products of human exchange flux.

For Eugene Peasant Odum, the city is an ecosystem that should be studied like any "natural" ecosystem. The artificial productions are by-products to be evaluated as biological material (1975). Contrary to Darwin's theory of natural selection, hypertelia -an abnormal, degenerative, and/or handicapped trait due to maladaptation - exists in nature. The deer's wooden outgrowth, showing its apparent inability to perform normal activities, should act as a repulsive vector for the doe but instead becomes an attractive vector, even taking the risk that the potential offspring will bear this disability. The same danger exists with human productions that have reached hyperthelic levels, e.g., the megacity, an excessive form of metropolization that leads to deadly pollution, excessive waste production, etc. All these unhealthy actions mean our own suicidal extinction and embarking of other species (Tort, 2019).

The human species has lost the ecological "mind and nature" patterns (Bateson, 1980) by letting financial powers determine our lives, relationships, and achievements. This new parameter of nature is changing the algorithm of life and transforming our existences and achievements into a dangerous, destructive mode. The credo of money/profit has exacerbated the predatory relationship, away from the symbiotic logic and leading to the disrespect of ecological ecosystems and to other catastrophes.

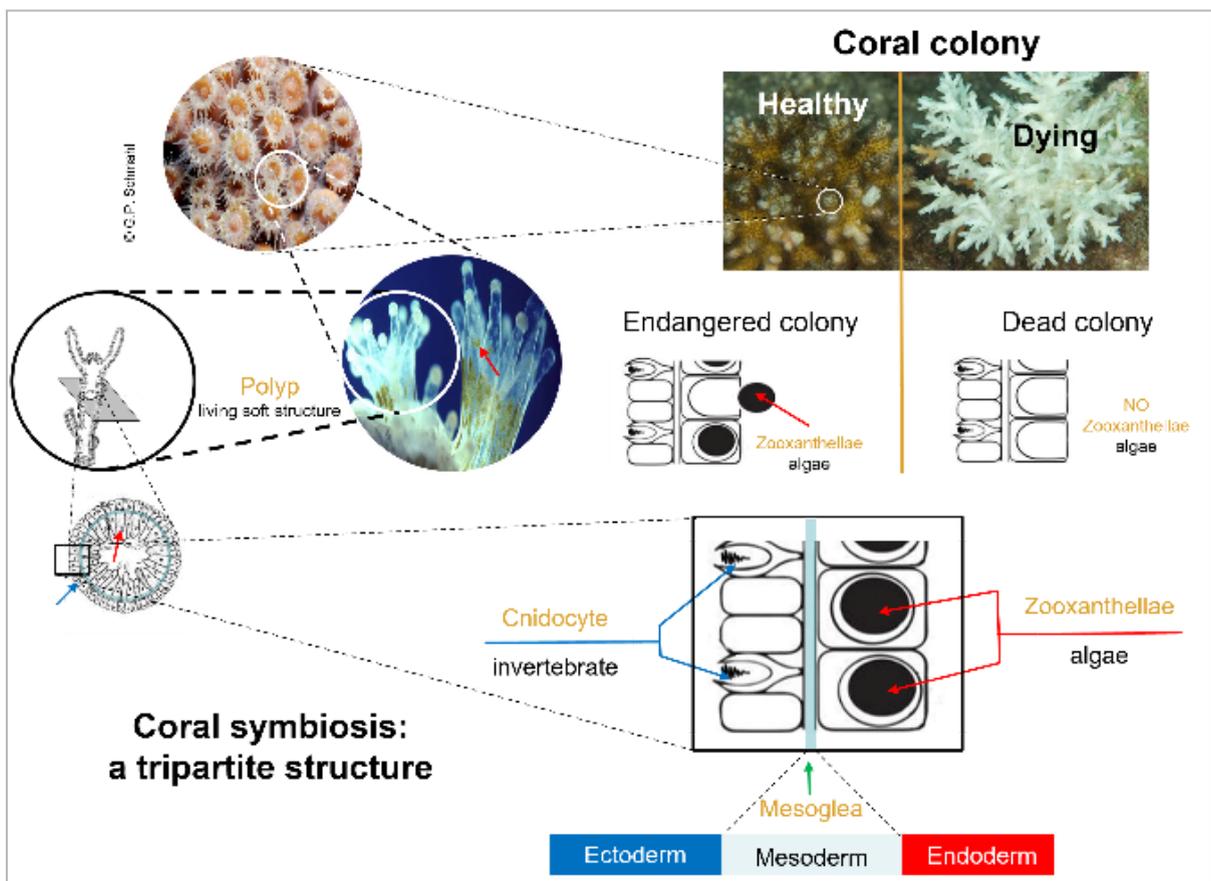


Figure 10. Coral symbiosis: a tri-laminar pattern. Author: F. L. Rasoloniaina, 2014.

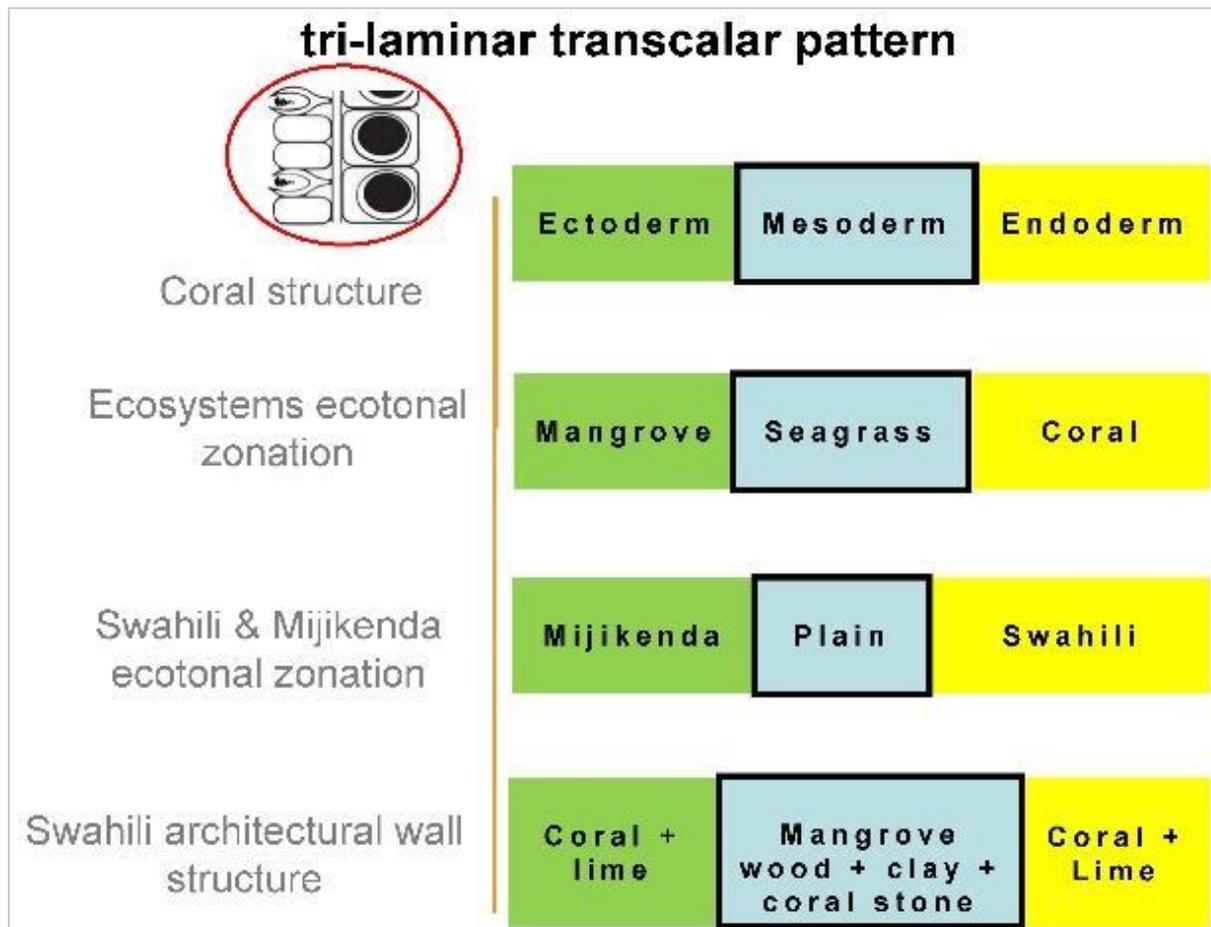


Figure 11. The tri-laminar pattern is found throughout the territory at different scales. Author: F. L. Rasoloniaina, 2014.

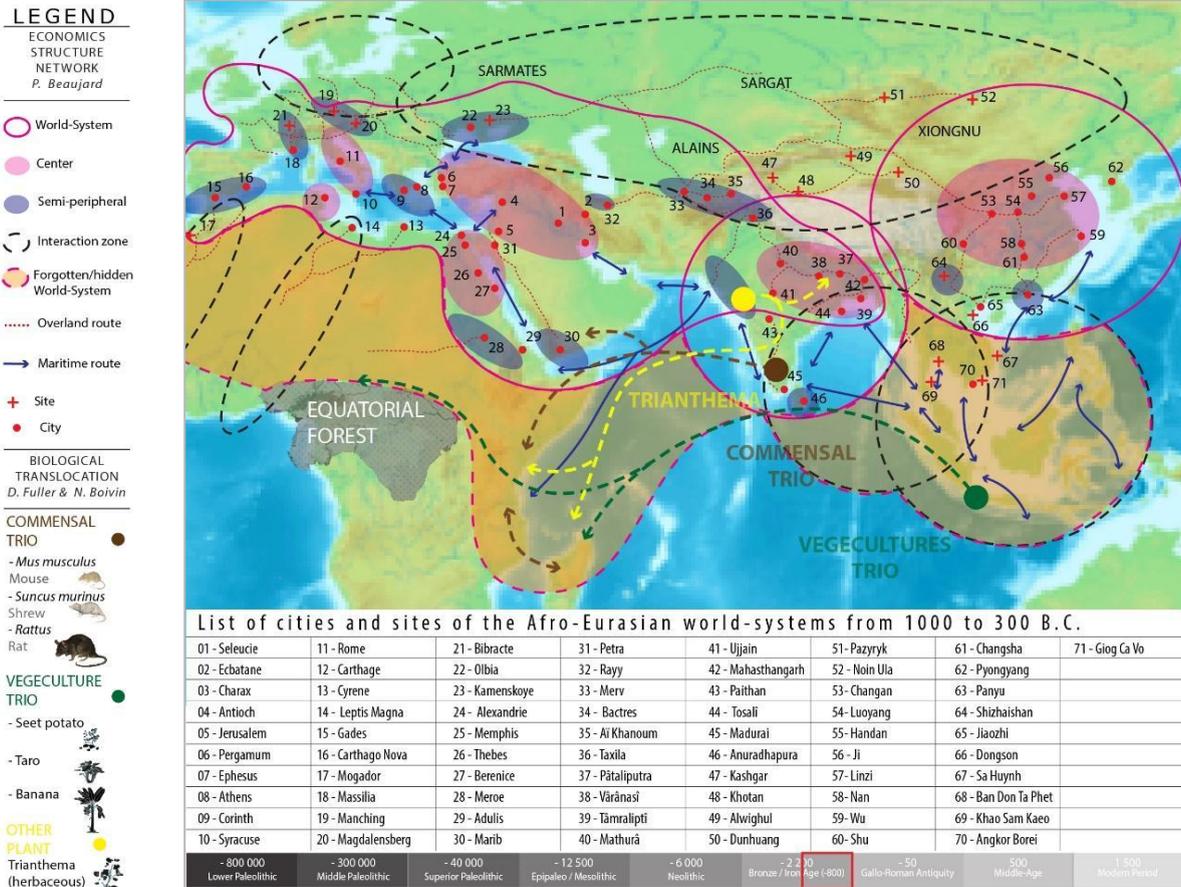


Figure 12. Afro-Eurasian World-Systems and biological translocations Source: Philippe Beaujard, 2020. Author: F. L. Rasoloniaina, 2020.

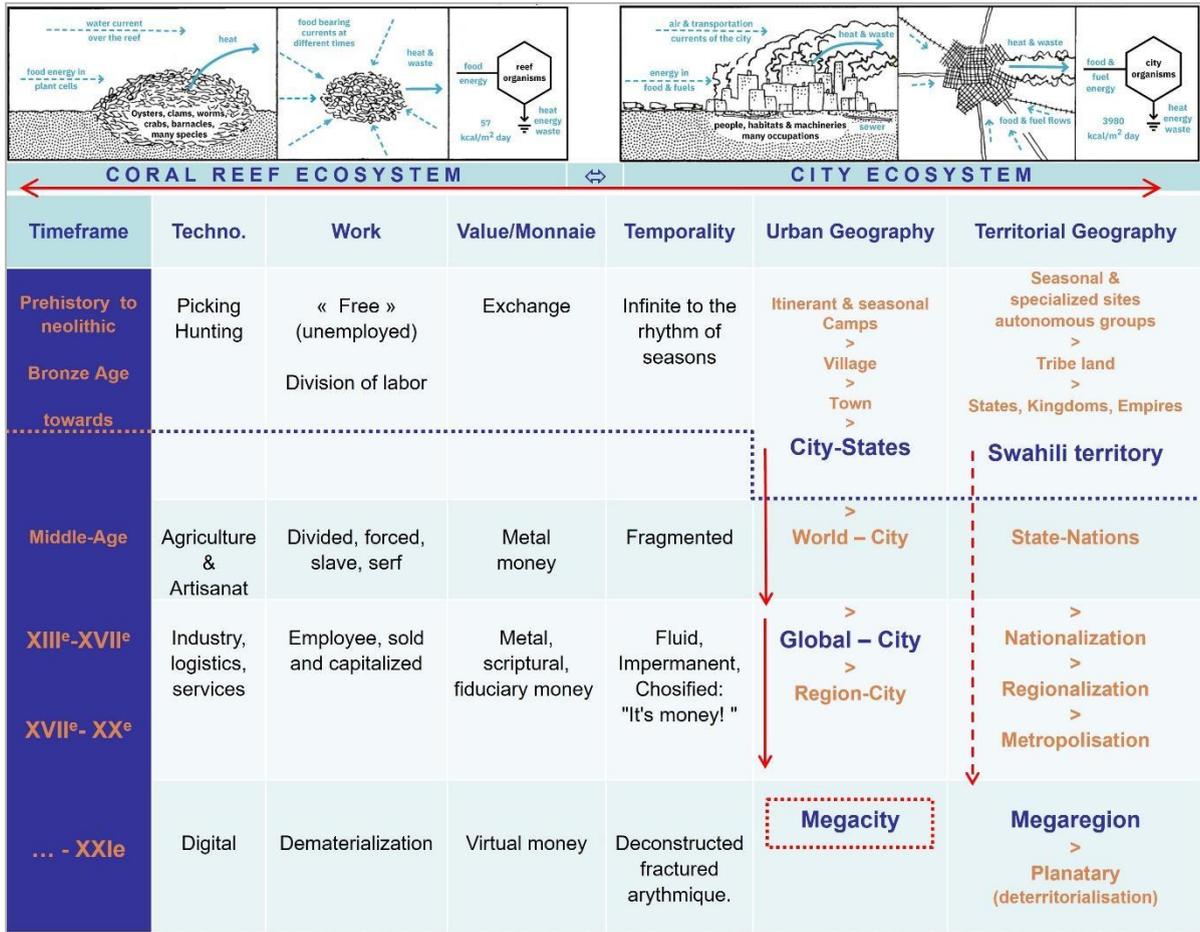


Figure 13. Societal, economic, urban, and territorial figures' evolution and Natural/Artificial equivalency. Sources: Adapted from Odum, E. P., 1975–Levy, J-C. Author: F. L. Rasoloniaina, 2020–2022.

## Investigating EGC efficiency

The efficiency of the matrix to reveal patterns have stayed for a while a puzzle; even thus, it was known to be conceived based on embryo morphogenesis; still, it was surprising to realise that it proceeds on the same typologies of pattern as the Swahili architectural and urban patterns. Therefore, a deeper investigation on the EGC matrix capacity to unveil transcalar, trans-species and trans-reigns hologrammatic patterns and relations was to be conducted.

Patrice Ceccarini took his matrix morphogenesis journey from René Thom's works. It is through the observation of frog egg gastrulation that René Thom read a development singularity: a fold followed two others. This folding process generates the embryo's three derms: the ectoderm, the mesoderm, and the endoderm (Figure 14). This trilaminar is one of the Swahili architectural patterns, as well as the coral core structural constitution. Amazed by the discovering, a closer study of the René Thom approach was conducted, from which two more common patterns appeared: the unicellular unit—the zygote—and the binary zonation—Animal/Vegetal on the abscissa axis. The phylogenetic thread leads to the biologist Conrad H. Waddington with his “Epigenetic landscape”, which illustrates the cell characterisation through its evolution through the landscape topological constraints. This model helped Thom to elaborate his own morphogenetic model and to establish a new discipline: semiophysics.

In line with the *Gestalttheorie*, René Thom describes the form phenomenon related to the physical or theoretical background; his inter-trans-poly-disciplinary approach connects with the theory of affordances coined by James J. Gibson, using the analogy of a continuous surface made of regular points, from which emerges a frown—that is a discontinuity resulting into (a) an emerging protruding pleat called *salience* generated by a point/vector of attraction or (b) a negative fold called *pregnance* generated by a point/vector of repulsion. The overall framework is called the Catastrophe Theory.

The EGC matrix concentrates on the understanding of the edification phenomenon and its reception for a more accurate and adequate design practice called profiling by affordances. The closeness to the medical approach, using cartography as radiographic means to reveal physical and anthropological data, and crossing morphological

information instinctively led to a caring and therapeutic approach to the conception, which is no longer based on wish, volition, or concept but by a profiling, process thinking and acting with accuracy, parsimony, pertinence, integrity, and intelligence.

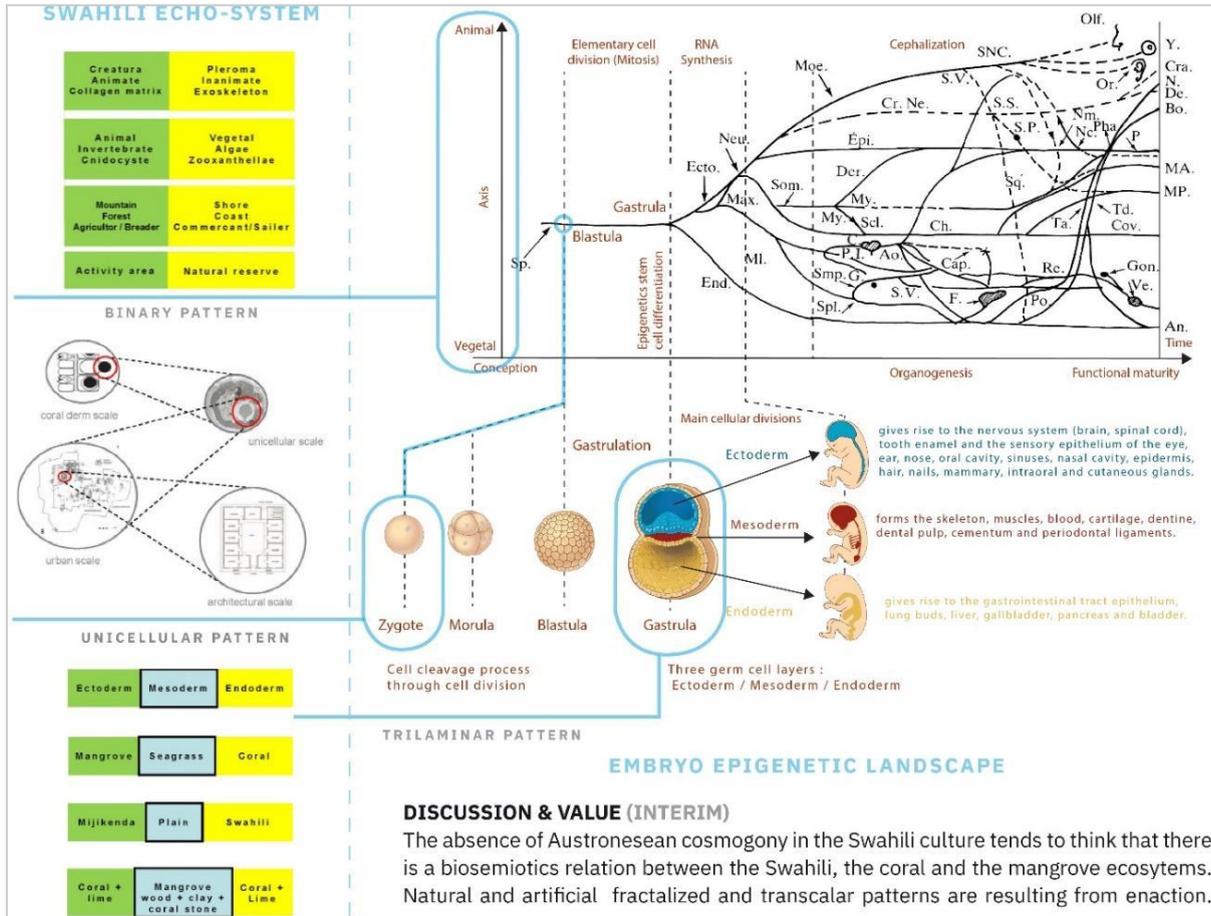


Figure 14. The Swahili and Thom's embryo epigenetic landscape pattern. Source: Adapted from René Thom (1989). Author: F. L. Rasoloniaina, 2021.

## Knitting and folding with pupils

Even though EGC has been applied at ENSAPVS for almost two decades, it is still regarded as a novelty, a pseudo-scientific methodology rather suspiciously seen as a fancy mechanic preventing students' creativity, etc. The weight of tradition conveyed by most of the teachers of the old guard—neither trained to didactics nor epistemology, comforted by an out-of-date practice—is a heavy pressure against change; their posture and discourse regime frozen in the Fine Arts tradition is also seductive to students approaching architecture as a path to stardom and the star system. As a result, the Master level architectural project studio used to attract a small number of students each year, but with the Covid-19 pandemic, the number of students willing to “care of” and “alleviate” the world, biodiversity, and life quadrupled from five to 20 students. Upon their arrival, they must relearn to think without prejudice or apprehension, accepting to let the past, present, and future data emerging from the place, the environment, and the living communities that live there define the characteristics that make this whole a concrete and unique individuation. It is only by listening to this complex ontological uniqueness that they will be able to treat and bring adequate therapy, whatever it is, from the aesthetic point of view—not as the artistic doxa. In the systemic paradigm, the aesthetic principle is considered under its etymological and Aristotelian meaning as *aísthêsis*, a sensory experience that ignites the sensibility—the *faculty to perceive*—the perception —*the exercise of sensibility*—that through the organs of sense operate affection and pathemes—*sensation, states of feeling, state of mind, mood, or passion*—produced by the sense-perception objects (Aristotle and Beare, 90 BC/trad. 1996; Greimas and Fontanilles, 1993; Fiers, 2002).

In the EGC process, we have three major folds or transformation phases: (1) the diagnostics turned into strategies, (2) the strategies turned into programmes, and (3) the programmes turned into profiled artefact(s) (Figure 17); just like the three cell germ layers, it is only when this process is over that the organism/organisation has reached its complete functional maturity. The strategy phase corresponds to the organogenesis, the diagnostics phase to the internal and external phenotyping of the cells, and the finding phase to the genetic components.

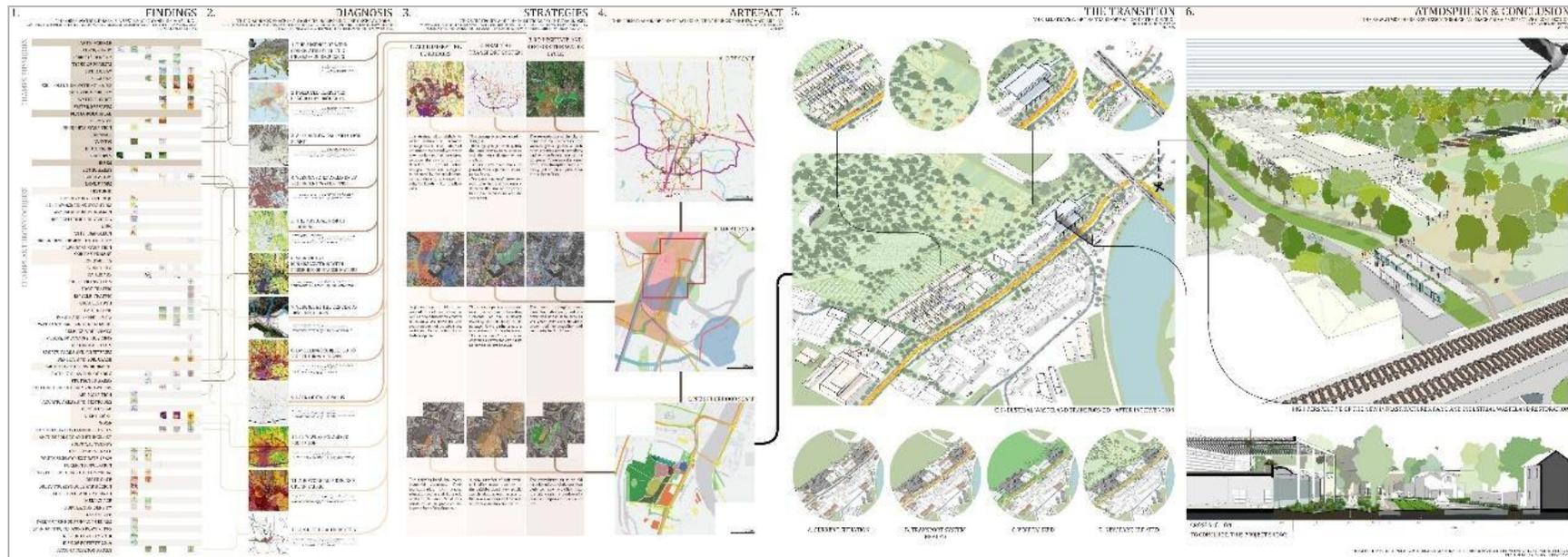


Figure 15. Revitalised, fluidised and bio/diversified Verona – Author: Charles Elias Boudlal, 2021.





Although the students have integrated that the matrix is the intelligible trace of their thinking throughout the project, they have difficulty putting into words their cognitive experience with the matrix. They have been for many years shaped to understand the word architecture in a definition that reduces to built edification, and it is difficult for them to think of the matrix as the architecture of thought to build knowledge, decisions, and actions. In their minds, there is a kind of constant battle between the "artwork architecture" and this new "care architecture", with conceptual approaches very far apart.

With this framework, we are far from preconceived ideas and seeking concepts. We are dealing with a structured method that results from a vision put into form, whose work is triggered by an archè—a vital principle—beyond the designer's artistic desiderata. It is a tekhnè that carries within it an asceticism that leads to what the Ancient Greeks called "the esthetics of existence"—tekhnè toubiou—a high degree of self-care not for oneself, but for the orientation of the mind and body; the ultimate requirement for serving others with genuine commitment, aware of the limits of one's actions, accepting and remaining concerned.

This positioning is critical to being able to: (1) act with parsimony and take only necessary acupuncture actions based on understandable, comprehensible, and reliable design prescriptions, (2) (re)build an ecological intelligence, and (3) inscribe the approach in the Ethics of Care.

## **Conclusion: a string figure relinking didactics, epistemology, and praxis**

### **Ecological Designers a lineage of carer rooted since Ancient Greeks**

If one (re)integrates the fact that *pleroma* and *creatura* are two necessary and different sides of the same coin and applies Bateson's method of "double description," one would consider the word "nature" as phenomenon and "artificial" as by-product. Every phenomenon has a cause(s) and effect(s), and the effect is a by-product that is itself a

phenomenon. Based on this circular phenomenology, the design approach is driven by the recognition that our tools dealing with living and systemic phenomena should reflect the same holographic principle that enables our edification to assume integration at all scales and levels of the holarchy. In this new design paradigm, designers no longer think of objects/artefacts but of parts, holons, and wholes that must (re)integrate the indole—the inherent nature of things (Neveu, 2005)— of systemic patterns to form a continuous string figure.

This (re)inscription in/with-in nature was the goal and approach of a long line of designers like Ian McHarg in the 1960s. As a theorist, teacher, and practitioner, he laid the foundations for transcalar Ecological Design from the regional to the local. His seminal book *Design with Nature* (1969) established a theoretical and methodological framework—heavily influenced by the ecosystem ecology of the brothers Eugene P. and Howard Thomas Odum—and based on a cartographic analysis of the ecological factors of the environment, land use, environmental health, and pathology. Ken Yeang pursued the ecological, symbiotic, and ecosystem logic of the architectural artefact. His book *Designing With Nature: The Ecological Basis for Architectural Design* (1995) models the interactions between the built environment and an ecosystem along the life cycle of the building. This visualisation represents the processes that integrate ecosystemic assessment and the architect's responsibilities. This lineage of ecological design has influenced international environmental policy, the development of GIS spatial analysis tools, and the practice of GeoDesign (Dangermond, 2009), which have shaped a North American approach to the interface of landscape, planning, and environmental ecology, such as in its most current form, *Projective Ecologies* by Reed and Lister (2014): both scientific and esthetic (sensitive), based on phenomenology, ambience, and systematics, it is the instrumentalisation of cartography as a radiographic tool for diagnoses and therapeutic action strategies: a goal enacted since McHarg and Steiner's *To Heal the Earth* (1998).

Systemic architects and urban planners are healers, therapists, and caregivers! This leads us back to the true meaning of the ancient Greek word *architekton*, on the basis on which Xavier Guchet states that the word architect is a qualifier not limited to the field of construction but to any profession that has the knowledge of what to do to

achieve a result, and this does not imply the exercise of the gesture that produces the projected result (1998). In this view, the architect is not, as in traditional architectural discourse, a builder in the sense of a highly skilled craftsman who leads the artisans who build, but the one who is able to project an existing state into an altered state-just like a doctor-and the essence of this action is care. The word care must be considered in its original meaning, *epimeleia*, as concern, responsibility, attention, and interest (2018). Therefore, it is not limited to the construction of healthcare facilities, which is a major limitation of the application of the Feminist Ethic of Care.

### **The EGC: A systemic tool that redefines the role of the systemic designer**

The matrix traces the phylogeny from genotype to phenotype, making each result unique. Some opponents of the methodology claim that it is a too mechanical method, while within the architecture project studio, an assignment leads to different solutions because the profiler is different, as logical as one leaf is different from another leaf, even if they belong to the same tree, they are not clones. In the matrix, this phenomenon is due to one factor: the observer effect. In any scientific experiment, the observer<sup>5</sup> changes the experiment by taking the decision to register the data to intervene in the process and the space within the system.

In the movie, *The Silence of the Lambs*, the profiler was able to profile in reflection of her psyche. Not that she projected her own self; her mind and soul reflected all the perceived threads based on her unconscious reception and evaluation of the veridicity and knowability dimensions of the clues; the observer had been someone else, the interpretations of the clues would have been different, even if the investigation had led to the same culprit; but the whole fine-tuning and portrayal of the culprit would have been of a different degree.

The resentment that the EGC matrix is a mechanistic method is based on the lack of perception that it is the subjective free will of the investigator that selects and crosses the threads among the objective data from the field that will weave a narrative with varying degrees of finesse and acute accuracy, depending on the degree of sensitivity

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<sup>5</sup> Be it a machine or a human.

and expertise of the observer before the context, the problems raised, the needs induced, and the strategies that emerge. With the EGC, architects are profilers who conduct investigations to accurately point out sound diagnoses and then prescribe appropriate prescriptions for remedies and/or actions as a caring dispositive. In this paradigm, the esthetical aspect is not to fulfil the architect's style desiderata but to strive to respond to the need for meaningful and emotional dispositives that serve the well-being of users.

### **Architectural and urban epistemology and didactics**

The analysis of the Swahili community, architecture, and territory has led us to embark on an inter-trans-poly-disciplinary approach that can be summarised in terms of Post-Normal Science. The deconstruction of Swahili history and artefacts has set us on this constructivist path, which would not have been possible without the influence of Gregory Bateson and the many threads he left behind, like the *white pebbles of Little Thumb*. We must question our method and knowledge, but first, redefine our view and perspective on architecture as a science and an object of science. We need to (re)connect the pebbles, (re)trace the paths, and (re)weave the links and fabrics to understand some of its complex dimensions. All imply, as well, educational reforms to reset ecological intelligence (Bowers et al., 2011).

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