A typology of systems and processes.
A possible approach to the problem of complexity and emergence.

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Abstract:

Depending on viewpoint, our reality consists of
1. solid bodies ("solida") and "movements",
2. self ordering "equilibrium systems" and "movement projects",
3. self regulating "flow equilibrium systems" and "flow processes",
4. self organizing "non-equilibrium systems" and "conversion processes",
5. structurally self creating "hierarchy systems" and "hierarchical processes",
6. a materially self creating "universal system" and "universal process".
The autonomy of the systems increases with growing complexity.
The "emergence processes" show the way from the simple to the complex. They always follow (geometrically) the same pattern, i.e. in accordance with a certain code, the flows are 1st bundled (bundling), 2nd positioned in the next higher level (alignment), 3rd interlaced with each other (interlacement), and 4th folded (folding). About the emergence processes cf. Appendix.

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Introduction

There have been many attempts to describe and explain complexity (Lissack 1999). But what exactly happens when complexity begins to emerge is still not understood. Perhaps the phenomenon may become clearer when we approach it via the structure of systems. This will be attempted in the following article.

The term "system" is derived from the Greek "συστημα" which originates in turn from the verb "συνιστημι" and therefore means something which is "an unified whole which is assembled from several parts". The term "complexity" has its roots in the greek "πλεκω", which means "to weave or tie together", and in the latin "complico", which means "to fold or wind together", i.e. more or less linear shaped objects are connected with and arranged around one another in such a way that they yield something coherent which we can study in detail and as a whole.

Thus, both terms "system" and "complexity" refer to one another. Assembling, uniting, weaving, folding are processes which are controlled by information. Research into systems and complexity is therefore closely connected with research into information. Information positions matter and flows of energy, assigns them to one another, links them to one another, arranges them in sequences to form processes, creates patterns, thereby allowing controlled distribution.

We will attempt now to define the various possibilities of coexistence between the components of systems according to the various degrees of complexity. In doing this, we will establish the archetypes of the systems in order to arrive at an intrinsically consistent and complete typology. Any place in the Universe belongs to all types of systems simultaneously.

Our considerations are founded on the development of a theory of emergence which complexity and process sequence (from the point of view of the social sciences) link with one another. Each system type is raised to the next more complex type by a process of emergence. It carries out the process, i.e. the development of new structural characteristics of a system which cannot be explained by the elements alone. All system types are altered in basically the same way when they move up one level in the scale of complexity (cf. Appendix). The following four operations are required [explained using the example of a blacksmith's forge, which emerges from a group of farms]:

1. Bundling: A group of systems of a lower degreee of complexity come together in order to form a system of greater complexity. This accumulation of systems similar in structure and content is termed "bundling".
[E.g. farms are animated to supply the market with more products, i.e. to increase their performance. This causes an overload in work and prompts them to remove the labor-intensive smithy work from the range of their activities. In the bundling stage, these individual activities are treated as a single whole.]

2. Alignment: These activities are arranged into a new whole, i.e. "aligned". This overriding process ("main process") is made up of 4 phases ("adoption" of the demand, "production" of the supply, "reception" of the necessity to adapt the system itself, and "reproduction", i.e. the corresponding change to the system). This can be depicted by a comprehensive system of coordinates (1st rank) which symbolizes the basic structure of the operations. In addition (the

sum of the) systems with their own processes must be considered. All of them are subordinate to the new whole and involved in its processes. This can be represented by 2nd rank coordinate systems which are inserted in each quadrant of the overriding (1st ranking) system.
[Here the division of labor for the various types of blacksmith's work begins, the decision to participate in a common production process. The main process includes the satisfaction of the demand for forged products and self-maintenance. In addition, the two segments planning and execution.]

3. Interlacement: The individual processes now have to be incorporated in the main process. To this end, the existing process sequences are woven into the higher level of complexity. These processes take place perpendicularly to the previous ones, because this no longer concerns the many individual process sequences, but their organization into a whole. It takes place in a process resembling weaving, as described above. Mathematically, this involves a reversal of the coordinate system.
[Cooperation is intensified, the blacksmith's work is more strongly coordinated because not only the individual main stages are arranged in order, but the individual activities are brought together or woven into the main stages of the system. The workers involved therefore coordinate their actions with one another in great detail.]

4. Folding: The system must appear as a unit to the outside world or to its environment. The market demanding the products appears as the ("superordinate" or) "superior environment" and the market supplying the resources the ("subordinate" or "inferior environment". The beginning and the end of the main process are joined to one another by means of "folding". In this way, the process sequences can be terminated and backward coupling becomes possible. The system is consolidated, the structure strengthened and adapted to the necessities.
[For our blacksmith's forge this means that the market oriented processes and the processes which preserve or alter the system control one another mutually, i.e. that the new system forge adjusts its production to its capacity or, vice versa, the investments in the new forge correspond to the necessities of the markets. The forge participates in the market, with regard both to material procurement and to turnover. This necessitates compactness and causes it to take a form which permits these contacts.]

The example of the forge is located between the third and the forth level of complexity (cf. chapters 3 and 4). But these four phases of the emergence process can also be established as a fixed principle for the other transitions from one type of system to the next. This formal procedure makes it possible to follow and verify the processes of emergence (cf. Appendix).

Levels of complexity

Let us begin our considerations in the world of our experience, the Mesocosmos (Vollmer 1985, p. 57 f.), and proceed from the simple, i.e. the non-complex, to increasingly higher stages of "the complex". The process is at the center.

1. Solid body ("solidum") and movement (cf. Appendix, fig. 1)

The simplest process is the movement of an object, a "solidum". E.g. if a stone receives an impulse, it moves in a certain direction; it is then braked by an opposing force until it comes to rest again. The impulse comes from outside, from the "superior environment". The opposing force also comes from outside, but this time from the "inferior environment". Here, we are assuming that the impulse to the solid object is not without consequence, but that the inferior environment reacts in the same way as with an elastic impulse. The following example is taken from our everyday experience.

An object (solidum) is moved, e.g. a motion of the hand is executed. The following stages can be observed, first of all starting from the superior environment:
1. In the course of a superior planning or reaction of an individual (as the superior environment) a hand is stimulated to execute a movement;
2. the stimulus is transferred to the body of the individual (inferior environment), to obtain energy for the movement;
3. the stimulus is received by the body of the individual;
4. the stimulus is stopped.
Thus, the process of stimulation from the superior environment comes to an end and the reaction of the inferior environment follows:
1. the energy is released;
2. the energy is transferred to the hand;
3. the hand receives the energy;
4. the hand executes the movement, the flow of energy ends in the superior environment.
This process demonstrated here by a motion of the hand, can be used as an example of a fundamental process, observed universally in reality. It forms the basis of all movements of solid bodies (solida) - because each beginning of a movement is accompanied by an end, and affects the environment more or less, regardless of whether the solida are hands, stones or cars.

2. Equilibrium system and movement projects (cf. Appendix, figs. 2 ... 5)

Let us assume that the motion of the hand is part of an ensemble of movements of solida forming (an action project or a movement project, e.g. the ploughing of a field or the writing of a book). Then many solida are moved in order to achieve the aim. We would then distinguish between a whole, i.e. a system, and its parts, i.e. the individual elements. On an average each solid body and each movement, each arm and each motion of the hand contributes to the movement of the whole system, but, on the other hand, is also subjected to that movement.

The movement projects with their ensembles of solida are - ideally - a simple system, an equilibrium system. The elements contribute to the movement of the whole and are in a stable state of equilibrium. From an energetic point of view, the whole corresponds to the sum of the parts, if the movement is smooth, i.e. without vortexing. The elements adapt to the inferior environment as source of energy. These systems are linear.

Each undifferentiated substance of this kind consisting of moveable parts, is an equilibrium system. This type of system also includes liquids, for instance standing or smoothly flowing water where no energy (for instance much heat) is applied from outside. The molecules are the elements. Their space requirement depends on the energy content. They perform unaligned, haphazard movements (Brownian moleculare motion), the structure of the system itself, however, is not affected. Other examples are characteristic groups e.g. persons belonging to one profession as elements in an area, animals of one species in an area or piles of sand with grains as elements.

3. Flow equilibrium system and flow processes (cf. Appendix, figs. 6 ... 9)

The equilibrium system is not yet a complex structure. Complexity requires that at least 2 substances or equilibrium systems with different energy contents interact with one another. A group of equilibrium systems resp. movement projects is stimulated by another group of equilibrium systems and movement projects. The two groups do not have to mingle, but nevertheless it must be possible to transport energy from one of these systems to the other. For this purpose a transport medium is required, either the transport of (and trade with) goods in industry, or a liquid which transfers heat or chemical energy, or radiation, electric power, etc. So these systems become compartments of a new type of system. The energy flows from one compartment (the producer), to the other (the consumer). We call this flow process. Both compartiments together create a kind of internal market. A balance is sought. The producers supply energy, the consumers demand energy. The demand is information, so that there is a flow of information from the consumer to the producer (demand), and a flow of energy from the producer to the consumer (supply). We call this a flow equilibrium system.

Systems of this type distribute and control the flow of information and energy. Energy is lost in the process (dissipation; Nicolis and Prigogine 1987). However, no conversion of energy takes place (as in the non-equilibrium systems, cf. chapter 4).

In a closed flow equilibrium system, which receives no energy from outside, the energy flow dwindles to a stop. The result is an energetic equilibrium (cf. chapter 2). In an open system, however, which receives new energy, a flow equilibrium in which the system is able to retain its structure develops separately from the energetic equilibrium.

The separating of information and energy into their own process branches allows the system to regulate itself through feedback. This is possible, because each demand stimulates a flow process. If demand and supply do not correspond at the end of the process, the demand re-enters the system. Now there are numerous systems in society and nature which do not at any time manage to adapt the energy demand to the energy supply, because the energy supply is linked with the transport or even with the conversion (cf. chapter 4) of the energy demanded. This causes a delayed reaction to the demand by the producer (and perhaps an over-reaction by the process, i.e. a temporary excess in supply). This causes oscillations and therefore the intermittent transfer of energy; due to feedback, this in turn causes continuous readaptation by the system to the demand. Consumer and producer stimulate one another continuously and so stabilize their own existence. In these systems (in contrast to the equilibrium systems) the whole is more than the sum of its parts, i.e. they are nonlinear systems and can be termed complex.

Flow equilibrium systems are ubiquitous. One example is the above mentioned market, where certain goods are transferred from one side (i.e. the producer) to the other (the comsumer). Many energy flows of this kind form the basis for the economy of a region, where substances serve as raw materials for different levels of production. Demand and supply oppose one another and strive to achieve a balance. Similarly, the ecosystems contain many "markets" of this kind. The plants extract nutritive substances from the soil, and they themselves serve as food for animals. Here too, one may speak of producers (plants, suppliers) and consumers (animals, demanders; Ellenberg 1973). In both cases the aim is an (flow) equilibrium between demand and supply. The economy or the ecosystem of a region is frequently studied in the same way as flow equilibrium systems (for instance Forrester 1969). However, it should be remembered that the economic and ecosystems also include the production itself, so they possess a higher degree of complexity (cf. chapters 4 and 6).

Flow equilibrium systems are also characteristic of inorganic nature. Thus, the socalled chemical clocks belong to this field (e.g. Nicolis and Prigogine 1987, pp. 29 f.; Hess and Markus 1986). Several substances interact in these systems, exchanging energy. In technology, a desired value is frequently put into the system for the orientation of the process. Well known examples of this are the speed controllers in steam engines or temperature controllers in heating systems.

4. Non-equilibrium system and conversion process (cf. Appendix, figs. 10 ... 13)

If the flow equilibrium system is overloaded for a long period of time (e.g. if more energy is demanded than can be delivered), a state of chaos may arise. Before this happens, however, "at the edge of the chaos", the system reacts with "emergence", i.e. pattern formation in which certain signs of self organization can be detected.

These processes are the subject of extensive research activity (socalled complexity research; Langton [ed.] 1989; Epstein and Axtell 1996). However, the step from the level of flow equilibrium systems to the level of permanent non-equilibrium systems cannot be attempted in this way. Such permanent non-equilibrium systems may be, for example, biotic populations, organisms etc. ("artificial life") or social populations (companies, communities, states etc.; "artificial society"). They are part of a higher level of complexity.

Non-equilibrium systems have the ability to convert one kind of energy to another, for instance from chemical to kinetic energy, or from electrical to thermal energy, etc. In other words, non-equilibrium systems produce. Several flow equilibrium systems may unite to a non-equilibrium system to serve a certain purpose. As part of the division of labor, they assume tasks for a new whole. Energy - as matter - is shaped into products, i.e. it is furnished with information so that it exactly suits to the needs of the demanding consumer, who asks for it in the market and who is able to utilize exactly this energy form.

A further condition for the conversion of energy are processes which perform different tasks in succession in accordance with certain rules. There are two part processes: induction and reaction process. In the induction process 4 information converting process stages appear first, followed by 4 energy converting process stages. The stages have certain tasks:
1. "Perception": The non-equilibrium system receives the information as a stimulus from the superior demanding environment;
2. "Determination": The non-equilibrium system decides for (or against) the acceptance of the information;
3. "Regulation": The control between the system as a whole and the elements is regulated;
4. "Organization" a: The system arranges the information flow to the inferior environment spatially;
5. "Organization" b: The system arranges the energy flow from the inferior environment spatially;
6. "Dynamization": The energy is distributed to the elements;
7. "Kinetization": The conversion of energy takes place by combining of the different individual energies or material according to the information received;
8. "Stabilization": The finished product is offered to the superior environment. In the product

information and energy are stored and can be transmitted.

The organization stages (4 and 5) at the transition from the information converting to the energy converting parts of the process overlap in time, so instead of 8, only 7 stages result.

The reaction process follows. It is performed in the same manner like the induction process, but leads into the system, changes it, adapts it to the new conditions by giving it a new structure or size (or both). The performance of the process requires a spatial coherence of the systems, i.e. distinct limits, otherwise energy is wasted. So non-equilibrium systems organize themselves, i.e. their internal energy flows in such a way that as little energy as possible dissipates. The internal organization is accompanied by a specific shape, into which the systems can develop (for organisms: "equifinality"; v. Bertalanffy 1950, p. 25). So non-equilibrium systems are definable and can be typified. They strive continuously to secure or enlarge their sphere of influence, i.e. their energy resources.

Because the last stage of the induction process (stabilization) overlaps with the first stage of the reaction process (perception), the whole process consists not of 14 but only of 13 stages.

It is obvious that the process is irreversible. Energy is continuously required, not only to transform the structure or the size of the non-equilibrium system ("changing processes"), but also to maintain it ("conserving processes"). In the conserving processes, only as much energy is demanded as the system needs for its own maintenance. Here the processes carrying out different tasks run simultaneously, like the organs in an organism, or the departments in a company which have different tasks and interact continuously with one another. The organs or departments may be considered as subsystems of the organism or the company, i.e. subordinate non-equilibrium systems.

All the tasks have to be performed. However, not all stages are always clearly recognizable as such. Many processes are incomplete, are broken off, and frequently two partial processes are performed in one single stage.

The non-equilibrium systems are the actual centres of activity in our universe. Typical examples are the organisms and organs, populations and industrial companies, molecules and atoms, stars and galaxies.

5. Hierarchy system and hierarchy process (cf. Appendix, figs. 14 ... 17)

The non-equilibrium systems deliver the demanded products to the superior markets, i.e. flow equilibrium systems, which distribute them. On the other hand the non-equilibrium systems receive the energy which they need for the conversion into products through subordinate flow equilibrium systems. This energy, again, is made available by subordinate non-equilibrium systems, subsystems or elements. In this way a hierarchy becomes recognizable with different levels which themselves consist of a number of non-equilibrium systems. So the vertical information and energy flow is hierarchically ordered. These hierarchies enable a control of the production in the non-equilibrium systems over several levels. In this way, the inferior environment is used to a great extent as a differentiated source of energy in order to use the materials better in accordance with the differentiated requirements.

The induction process performs the control. Each non-equilibrium system is reached. It has its own specific task in the energy flow along with the other non-equilibrium systems of the same hierarchical level. It obeys the orders, because its existence depends on its integration in the flow of information and energy. So the information and energy (products) can be transmitted between the demanding consumers and the supplying producers in exactly the form required. Selection and evolution become possible, because each non-equilibrium system is adjacent to other non-equilibrium systems of the same kind which are in the same (i.e. competing) situation. The reaction process stabilizes and arranges the whole hierarchy system. In doing so, new non-equilibrium systems are structurally (not materially; cf. chapter 6) created.

Empirical investigations (Fliedner 1981, 1997) permit the conclusion that the ubiquitously distributed human populations (i.e. the human society) arrange themselves into a hierarchy as non-equilibrium systems (level):
Mankind as a population (1), cultural populations (2), peoples and states (3), city-umland-populations (4), communities (5), families and companies (plants or small business holdings) (6), and individuals as elements (7). The hierarchical levels are held together by a vertical process, each level is characterized by its task and the "basic institutions" performing that task.

The tasks of the non-equilibrium systems at the individual levels (8, is actually 7, due to overlapping; cf. chapter 4) of the hierarchy systems correspond to those which the non-equilibrium systems have to perform in their induction process. Thus, the sequence perception ... stabilization is also recognizable in the vertical process. The duration of the processes decreases from above to below. In each subordinate non-equilibrium system, the induction processes have to be performed at least 7 times faster than in the superordinate systems, because the subordinate systems "work for" the superordinate systems. So the number of the subordinate non-equilibrium systems increases positive exponentially down the hierarchy, whereas the duration of the process stages decreases negative exponentially down the hierarchy.

For example, the cultural populations (like Europe or the Orient) are responsible for the task of determination (long term values; basic institutions magic, religion), the states and the peoples are responsible for the task of the regulation (basic institution: rule in the wide sense, including administration). Possibly the living world can be hierarchically differentiated in a similar way: Living world as whole (1), empires (2), species (3), organisms (4), organs (5), cells (6), and organic molecules as elements (7).

Most of the hierarchies, however, are structured incompletely, they consist of less than 7 levels. At the individual levels different tasks may be performed. Nevertheless, each non-equilibrium system is securely bound into a hierarchy and possesses a defined task for this hierarchy. In the hierarchical systems, non-equilibrium systems are created structurally.

6. Universal system and the universal process (cf. Appendix, figs. 18 ... 21)

At the next higher level of complexity on the other hand, the non-equilibrium systems are also created materially. In a certain sense, the (physically defined) matter can be regarded as consisting of non-equlibrium systems. Matter which is located outside the system serves as a source of energy and is consumed as a substance. The systems, i.e. forms, are created from these. The form of the system on the other hand makes possible the reception of substance. Thus, the non-equilibrium systems are at the center as compact formations and intervene in the space outside themselves to obtain other matter as energy.

Demand and supply transfers, information and energy flows must be orientated in complex systems and precisely connected with another. On the other hand, they must be screened from each other, so that they do not disturb each other and lose their distinctiveness by noise resp. dissipation. This is attained on the one hand by making the energy usable and transportable, i.e. by creation of matter as substance, and on the other hand by bringing distances into and around the system, i.e. by creating space which is free from the substances of which the elements resp. the systems consist. The substances can be created only then, when their substantial ingredients are extracted from the space. So substance and space are antagonists which are related to one another within the frame of systemic structures.

The global ecosystem (from a functional point of view) or the biosphere (from a spatial point of view) we are familiar with may be taken as an example. It is the visible expression of the spatial coexistence of living matter in the most varied forms. The information (demand) and energy (supply) flows demonstrate on the one hand the connection and on the other hand the isolation from each other, and this in a nearly perfect manner.

Each living creature seeks only very specific, exactly suited nutrition sources, and this creature itself is also required as a nutrition source by only a few other creatures. Here the organisms, i.e. non-equilibrium systems, are themselves involved in the flow of energy, are snatched up and destroyed, serve as substance for building up new life, new organisms. Every individual tries to bring the procurement of energy from outside into harmony with the transformation of energy in the interior. Thus, it controls its energy demand and supply itself, and utilizes the received energy as effectively as possible.

The outer form and the internal spatial structure are of decisive importance. The living beings create their own forms. We are dealing with forms and spaces which are organized from inside. Maturana and Varela (1984, pp. 50 f.) described living beings as "autopoietic", self creating systems. As we know from research into evolution, the form of living organisms is the long term result of adaptation to environmental conditions.

The spheres neighboring on the biosphere are affected in the process. We now leave the orders of magnitude of the Mesocosmos. From the biosphere we arrive at the Macro- and Microcosmos.

On the one hand, the biosphere is embedded in the three large non biotic compartments on the earth, the rock formations, the water and the atmosphere, which we will call the "sphere of the chemical systems". On the other hand, the material composition leads to the development and the decay of living beings right down to the "sphere of molecules". These two inorganic spheres are connected to one another, because the molecules compose the chemical systems. However, they are autonomous spheres with their own processes and systems. The non-equilibrium systems of the sphere of molecules are the molecules. Those of the chemical sphere however are not permanent formations, e.g. cyclones, eddies etc.

Like in the biosphere, the anorganic non-equilibrium systems consume other non-equilibrium systems, to use the energy which is stored in their matter. They convert it and create new non-equilibrium systems. These in turn fall apart and give energy for new processes of formation. Thus, the systems at this complexity level are created not only structurally (cf. chapter 5) but also materially and spatially.

This also applies for the other spheres in the universe. Depending on the process sequence, there are probably 16 of these in all (by overlapping 13; cf. chapter 4). As seen spatially they are arranged hierarchically around one another like the skins of an onion. The spheres form the energetic interaction spaces with their own laws. Matter is formed by specific substances with quite different characteristics. This ensures that the processes perform their tasks for the universe within their own orders of magnitude. In this way the processes within the molecules are distinguished, for instance, from those within the ions or atoms. The levels to which these systems belong, are clearly distinguished from another, so that information and energy flows are screened from another. Only in this way can the processes take place in a controlled manner.

The other forms, e.g. the quarks, the planetary systems or the galaxies may also be assigned to certain spheres on the scale. This final chapter should actually be written by physicists, but when the literature accessible to non physicists is considered (e.g. Weinberg 1977; Hawking 1988; Landy 1999), one has the impression that these theoreticians occupied with the phenomenon in the macrocosmos (e.g. theory of relativity) or the microcosmos (e.g. quantum theory) are mainly concerned with causality, but neglect finality, without which no research into complexity is possible. What physicist enquires what functions the quarks, planetary systems or galaxies have in the code of systems and processes for the universe as a whole? Perhaps physics, which for decades has had such an important influence on the social sciences, will now be able to learn from the social sciences in their research into our complex reality.

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Appendix: About the emergence processes

The stages between the levels of complexity are bridged by the emergence processes. This is described briefly below in order to assist in understanding the typology of the systems and processes. As characteristics also emerge with every new stage of complexity, the processes are described as emergence processes, although in the literature this term is only used for the transition between flow and non-equilibrium systems (cf. appendix, chapters 3 and 4).

1. Solidum and movement

The following individual stages of movement can be identified (cf. fig. 1a):
From the (superordinate or) superior environment:
1. Impulse from the superior environment;
2. the solidum is accelerated;
3. immersion in the (subordinated or) inferior environment;
4. receipt of the stimulus by the inferior environment.
From the inferior environment:
1. Inferior environment detects and forms itself;
2. inferior environment gives solidum impulse;
3. counter-force is absorbed in the solidum;
4. solidum passes impulse on, accelerates into the superior environment.
The inferior environment reacts according to ist consistency. Physically, this is equivalent to the elasticity of a base onto which a ball falls (elastic impulse).

Here the solidum is the main concern. It is directly affected by the process in stages 1 and 2 in the sequence proceeding from the superior environment and in stages 3 and 4 in the sequence proceeding from the inferior environment. On the other hand, stages 1 and 2 of the sequence originating in the inferior environment and stages 3 and 4 of the sequence originating in the superior environment concern the inferior environment. In our process they are folded behind the upper part. They belong to the moved solid but are not subject to the control of the solidum.
We can formalize the movement of a solidum using a system of coordinates (cf. fig. 1 b):
The stimulus is entered in the (+x,+y)-quadrant.
The transfer of the stimulus to the inferior environment leads vertically downwards into the (+x,-y)-quadrant.
The energy intake from the inferior environment takes place below the abscissa in the (-x,-y)-quadrant.
The actual work performed by the movement then takes place in the (-x,+y)-quadrant.
Thus, 2 polarizations are produced:
- vertically, along the ordinate, the demand and the supply (of energy),
- horizontally, along the abscissa, between the stimulus and the action, i.e. the sequence in time.

Within the system of coordinates, we can depict how the stimulus and the energy are received and how they are answered by the body. However, as we are concerned with the concept of complexity, we are not interested in the performance of the movement in detail - i.e. for instance in the velocity which could be represented by a function - but only in the relationship between these events. It is therefore sufficient to consider the coordinate systems themselves and their quadrants.

2. Equilibrium system and movement project:

In order to rise to the equilibrium system and the movement projects, 4 different operations are necessary to characterize the emergence process correctly and completely (cf. figs. 2 .. 5):

1. Each single element (solidum and movement) can be represented by a system of coordinates. All the elements execute their movements as parts of a whole. The first operation can be represented by an accumulation of coordinate systems (cf. fig. 2): "bundling".

2. The elements are assembled to form the new whole of the movement project ("alignment"; cf. fig. 3). Thus, it is necessary to distinguish two levels, the whole and the elements. The whole must complete the movement, just as each part i.e. element. In the system as a whole, reception of the stimulus from outside (1), the transfer of the stimulus to the entire project (2), the absorption of the energy (3), and the execution (4) have to be taken into account. This can be depicted by a comprehensive system of coordinates (1st rank) which symbolizes the basic structure of the operations. The quadrants contain the partial processes:

(1) quadrant +x,+y,
(2) quadrant +x,-y,
(3) quadrant -x,-y, and
(4) quadrant -x,+y.

In addition the elements with their own movements must be considered. As all of them are subordinate to the system and involved in its movements, the movements are integrated in the whole. This can be represented by 2nd rank coordinate systems. In average, the individual elements participate in the four movements of the main system (i.e. the movement or action project) symbolized in the quadrants of the overriding coordinate system. This can be represented in such a way that the subordinate coordinate systems (2nd ranking systems) of the average single movements are inserted in each quadrant of the overriding (1st ranking) system. Depending on their position in this coordinate system the subordinate process stages 1-2-3-4 are reflected at the abscissa and the ordinate.

3. Now we are not only dealing with just a transfer of energy as in a motion of the hand i.e. a simple movement. Instead, the temporal sequence has gained in importance. The elements in their own movements are connected with the system to form a process ("interlacement"). In our treatment of the solid body (cf. appendix, chapter 1), the movement was represented in the coordinate system in a mathematically positive direction. If we wish to comprehend the whole system and the elements in their temporal sequence, we must align them horizontally. Thus the coordinate systems have to be inverted.

This has to take place in two operations, as depicted in fig. 4 (interlacement).
a) Firstly the numbers representing the individual stages of the movements in each of the four (2nd rank) coordinate systems of the elements have to change their places, i.e. on the diagonal y=x. Then
b) these values are again converted according to their position in one of the 4 quadrants of the superior (1st rank) coordinate system.

4. The last stage is the "folding" stage (cf. fig. 5) the coordinate systems are resolved. The

horizontal process of the system (1st rank process) appears as a sequence of 4 stages 1-2-3-4. As the uppermost line shows, it takes place from right to left. The (2nd rank) element processes, however, are vertically ordered. The stabilization of the process is represented by the actual process of folding. The former y-negative quadrants (in fig. 5a these are shown offset slightly downwards) are "folded" behind the former y-positive quadrants (cf. fig. 5c).

Taken together, the stages described above - bundling, alignment, interlacement, folding - form the emergence process. By structuring the coordinate systems at the system and element levels, symmetry (the structure) and asymmetry (the process) are brought into an order.

3. Flow equilibrium system and flow process:

The next step leads from the equilibrium system (movement project) to the flow equilibrium system (flow process). The emergence process shows us formally the way (cf. figs. 6 .. 9). It takes place according to the same pattern as with the equilibrium system.

The four stages of bundling, alignment, interlacement and folding are shown here for a better understanding of the procedure used. The process sequence of the y-positive (front) part of the folded equilibrium system (cf. appendix, chapter 2) forms the start and appears (according to the bundling stage (cf. fig. 6) in the alignment stage in the +x,+y quadrant of the system. In the other quadrants, this sequence is reflected as with the equilibrium system (cf. fig. 7). In the subsequent interlacement stage (cf. fig. 8), the procedure is also the same as that shown in the discussion of the equilibrium system, i.e.
a) Reversal of the smallest process units, each of which includes 4 figures;
b) Rearrangement of the figures in these process units according to the position in the 1st ranking coordinate system;
c) Reversal of the smallest process units consisting of 4 figures as a whole into the vertical position, thus creating 2 new process units, each including 16 figures;
d) Rearrangement of the figures in these new units according to the position in the halves of the 1st ranking coordinate system.

Through folding at a horizontal hinge (cf. fig. 9) these processes are connected to one another to produce circular processes. Geometrically this produces a pipe shaped structure. As a result of this transformation process 4 superimposed levels appear (bonding levels). In each of theses levels 2nd rank process stages are present.

The 1st rank process running through the whole system, is vertically aligned. The information (demand) from the superior environment is directed downwards, whereas the energy (supply) from the inferior environment is directed upwards. So the same structures, i.e. the four bonding levels are gone through one after another in the opposite direction. The sequences of the part processes 1-2-3-4 are connected with one another back to back (1-2-3-4/4-3-2-1).
The 2nd rank processes (movement projects) run in a horizontal direction. The structure of this type of process can be seen in the diagram.

4. Non-equilibrium system and conversion process:

As already underlined, the flow equilibrium systems must be distinguished from the non-equilibrium systems. The transition ist again described by the emergence process.

The three first stages of the emergence process are bundling, alignment, and interlacement (cf. figs. 10 .. 12). They can easily be visualized using the rules given in (appendix) chapters 2 and 3. In the folding process (fig. 13) 8 links of the induction process appear horizontally from right to left, along with 8 links of the reaction process in the same direction. In each stage of this 1st rank process, the 4 bonding levels (cf. appendix, chapter 3) have to be vertically opened up by 2nd rank processes. These 2nd rank processes (the flow processes) run in a vertical direction. (The structure of this type of process can be seen in the diagram).

In the horizontal process, the individual vertical processes which correspond to the processes in the flow equilibrium systems, are put together to form a new whole. The induction and reaction processes have to be coupled to one another at their ends and beginnings, thus forming a circular process. So geometrically they form a torus shaped structure. It symbolizes a 1st rank horizontal circular process, to which 2nd rank circular processes contribute.

The induction process is oriented towards the demanding superior environment. The information is conducted down the bonding levels (perception ... organization) and the energy up the bonding levels (organization ... stabilization). Thus, the same bonding levels are gone through from two sides. The formulae described for the part processes thus appear twice, in reverse order to one another, back to back, so to speak (1-2-3-4/4-3-2-1).

5. Hierarchical system and hierarchical process:

In accordance with the above-mentioned pattern (cf. appendix, chapters 2 and 3), the complexion process (cf. fig. 14 .. 17) leads to the next complexity level. As the result of the folding (cf. fig. 17) 8 levels can be seen at which the (horizontal) processes in the non-equilibrium systems are taken place and are joined to form circular processes (cf. appendix, chapter 4). These 2nd rank processes in the non-equilibrium systems of the several hierarchical levels are bracketed by a 1st rank vertical process. The induction process runs in a downward direction, i.e. from the whole via the subsystems to the elements, and the reaction process from the elements up to the whole of the hierarchy as the uppermost level. So induction and reaction processes are connected with another back to back (1-2-3-4-4-3-2-1/1-2-3-4-4-3-2-1).

Die 2nd rank processes (conversion processes) run in a horizontal direction. (The structure of this type of process can be seen in the diagram.)

6. Universal system and universal process:

With the assistance of the emergence process we can progress to the next complexity level. The pattern explained above (cf. appendix, chapter 2) with its 4 stages (bundling, alignment, interlacement, and folding; cf. figs. 18 .. 21) is also the basis of this process. As the result of folding, a horizontal sequence of 16 tasks of the 1st rank induction process is recognizable. They must be solved, so that the whole remains conserved or can be changed. The induction process runs from right to left, followed by the reaction process which has to be coupled to the induction process. The single tasks are performed by subordinate (2nd rank) vertical processes, each of which consists of 8 links. These 2nd rank processes (hierarchical processes) run in a vertical direction. (The structure of this type of process can be seen in the diagram.)

By folding (cf. fig. 21) the reaction process is turned behind the induction process. So appropriate 2nd rank processes are connected in circular processes with 16 links each.

Figures:

a)

$$\begin{matrix} 4 & 1 \\ 3 & 2 \\ & \\ 2 & 3 \\ 1 & 4 \end{matrix}$$

b) Superior Environment

$$\begin{matrix} 4 & 1 \\ & \\ 3 & 2 \end{matrix}$$

Inferior Environment

Fig. 1: Scheme of the course of a movement.

a) The vertical arrangement of the stages between solidum and inferior environment;

b) The stages of movement assigned to the solidum. The stages concerning the inferior environment are folded behind. The stages of movement assigned to the solidum can be depicted in the quadrants of a coordinate system. The numbers symbolize the sequence (in clockwise direction). (The axes of the coordinate system are not shown.)

$$\sum_{i=1}^{i=n} \begin{matrix} 4 & 1 \\ 3 & 2 \end{matrix}$$

Fig. 2: Scheme of the movement project in the bundling stage. Compare with fig. 1. The movement project incorporates n movements. The 4 individual stages of a movement are shown, the numbers represent the process sequence.

$$\begin{matrix} 1\,4 & 4\,1 \\ 2\,3 & 3\,2 \\ & \\ 2\,3 & 3\,2 \\ 1\,4 & 4\,1 \end{matrix}$$

Fig. 3: Scheme of the movement project in the alignment stage. Compare with fig. 2. The bundled movements are divided into 4 groups for the new process. A new (1st rank) coordinate system is set up. In each quadrant, 2nd rank individual coordinate systems appear for the bundled movements. (The axes of the coordinate systems are not shown.)

a)		b)	
3 4	2 1	4 3	2 1
2 1	3 4	1 2	3 4
4 3	1 2	2 1	4 3
1 2	4 3	3 4	1 2

Fig. 4: Scheme of the movement projects in the interlacement phase. Compare with fig. 3. The vertically aligned sequence is arranged horizontally. The reversion operations are shown. (The axes of the coordinate systems are not shown.)
a) Reversion of the smallest quadratic process units, each containing 4 numbers;
b) Rearrangement of the numbers in these process units according to the position in the 1st rank coordinate system.

a)
←
4 3 2 1
1 2 3 4

2 1 4 3
3 4 1 2

b)

←	←	←	←
4 3 2 1	1 4 3 2	2 1 4 3	3 2 1 4
1 2 3 4	2 3 4 1	3 4 1 2	4 1 2 3
2 1 4 3	3 2 1 4	4 3 2 1	1 4 3 2
3 4 1 2	4 1 2 3	1 2 3 4	2 3 4 1
t 1	t 2	t 3	t 4

c)
←
4 3 2 1
1 2 3 4

Fig. 5: Scheme of the movement project in the folding phase. Compare with fig. 4.
a) The coordinate system is removed. A movement project scheme is created.
b) The diagram shows 4 stages (t1 ... t4) in the development of the equilibrium system resp. movement project. The 1st rank process proceeds from right to left. The 2nd rank processes are shifted in the corresponding pattern without changing their basic structure. They symbolize the sum of the solida or movements each with their 4 stages.
c) The folding process is now carried out. The lower part is placed on the left beside the upper part and then folded behind the induction process on an imaginary vertical hinge. The arrow shows the direction of the 1st rank process. Depiction of front section of process.

$$\sum_{i=1}^{i=n} \begin{matrix} 4\,3\,2\,1 \\ 1\,2\,3\,4 \end{matrix}$$

Fig. 6: Scheme of the flow process in the bundling stage. Compare with fig. 5. The flow process incorporates n movement projects. The individual stages of a movement project are shown, the numbers represent the process sequence.

1 2 3 4   4 3 2 1
4 3 2 1   1 2 3 4

4 3 2 1   1 2 3 4
1 2 3 4   4 3 2 1

Fig. 7: Scheme of the flow process in the alignment stage. Compare with fig. 6. The bundled movement projects are divided into 4 groups for the new process. A new (1st rank) coordinate system is set up. In each quadrant, 2nd rank individual coordinate systems appear for the bundled movement projects. (The axes of the coordinate systems are not shown.)

a) 3 2 1 4   2 3 4 1
4 1 2 3   1 4 3 2

2 3 4 1   3 2 1 4
1 4 3 2   4 1 2 3

b) 2 3 4 1   2 3 4 1
1 4 3 2   1 4 3 2

4 1 2 3   4 1 2 3
3 2 1 4   3 2 1 4

c) 2 3   4 1
1 4   3 2
4 1   2 3
3 2   1 4

2 3   4 1
1 4   3 2
4 1   2 3
3 2   1 4

d) 2 3   4 1
1 4   3 2
4 1   2 3
3 2   1 4

3 2   1 4
4 1   2 3
1 4   3 2
2 3   4 1

Fig. 8: Scheme of the flow process in the interlacement phase. Compare with fig. 7. The horizontally aligned sequence is arranged vertically. The reversion operations are shown. (The axes of the coordinate systems are not shown.)
a) Reversion of the smallest quadratic process units, each containing 4 numbers;
b) Rearrangement of the numbers in these process units according to the position in the 1st rank coordinate system;
c) Reversion of the smallest process units (each containing 4 numbers) as wholes into the vertical position. This shows the vertical process (flow of information above and flow of energy below the abscisse);
d) 2 new quadratic units each with 16 numbers have been created. The lower, in the y-negative zone must be turned around on an imaginary horizontal axis.

a)

2 3 4 1 1. Bonding level
1 4 3 2 2. Bonding level ↓ Information
4 1 2 3 3. Bonding level flow
3 2 1 4 4. Bonding level

3 2 1 4 4. Bonding level
4 1 2 3 3. Bonding level ↓ Energy
1 4 3 2 2. Bonding level flow
2 3 4 1 1. Bonding level

b)

2 3 4 1 1. Bonding level
1 4 3 2 2. Bonding level ↓ Information
4 1 2 3 3. Bonding level flow
3 2 1 4 4. Bonding level

Fig. 9: Scheme of the flow process in the folding phase. Compare with fig. 8.
a) The coordinate system is removed. A flow process scheme is created. The bonding levels appear.
b) The folding process is now carried out. The (above shown) information flow is folded behind the (below shown) energy flow on an imaginary horizontal hinge. The arrows indicate the direction of the 1st rank process (downwards for the information flow, upwards for the energy flow). Depiction of front section of process (information flow).

$$\sum_{i=1}^{i=n} \begin{matrix} 2\ 3\ 4\ 1 \\ 1\ 4\ 3\ 2 \\ 4\ 1\ 2\ 3 \\ 3\ 2\ 1\ 4 \end{matrix}$$

Fig. 10: Scheme of the conversion process in the bundling stage. Compare with fig. 9. The conversion process incorporates n flow processes. The individual stages of a flow process are shown, the numbers represent the process sequence.

1 4 3 2	2 3 4 1
2 3 4 1	1 4 3 2
3 2 1 4	4 1 2 3
4 1 2 3	3 2 1 4
4 1 2 3	3 2 1 4
3 2 1 4	4 1 2 3
2 3 4 1	1 4 3 2
1 4 3 2	2 3 4 1

Fig. 11: Scheme of the conversion process in the alignment stage. Compare with fig. 10. The bundled flow processes are divided into 4 groups for the new process. A new (1st rank) coordinate system is set up. In each quadrant, 2nd rank individual coordinate systems appear for the bundled flow processes. The arrows indicate the direction of the 1st rank process (clockwise direction). (The axes of the coordinate systems are not shown.)

a)		b)	
1 4 3 2	2 3 4 1	1 2 3 4	4 3 2 1
2 3 4 1	1 4 3 2	4 3 2 1	1 2 3 4
3 2 1 4	4 1 2 3	3 4 1 2	2 1 4 3
4 1 2 3	3 2 1 4	2 1 4 3	3 4 1 2
4 1 2 3	3 2 1 4	2 1 4 3	3 4 1 2
3 2 1 4	4 1 2 3	3 4 1 2	2 1 4 3
2 3 4 1	1 4 3 2	4 3 2 1	1 2 3 4
1 4 3 2	2 3 4 1	1 2 3 4	4 3 2 1

Fig. 12: Scheme of the conversion process in the interlacement stage. Compare fig. 11. The vertically aligned sequence is arranged horizontally. The reversion operation incorporating the entire table of numbers in the coordinate system is shown. (The axes of the coordinate systems are not shown.)

a)

Sta	Kin	Dyn	Org	Org	Reg	Det	Per	
1	2	3	4	4	3	2	1	
4	3	2	1	1	2	3	4	Induction-
3	4	1	2	2	1	4	3	process
2	1	4	3	3	4	1	2	
2	1	4	3	3	4	1	2	
3	4	1	2	2	1	4	3	Reaction-
4	3	2	1	1	2	3	4	process
1	2	3	4	4	3	2	1	
Sta	Kin	Dyn	Org	Org	Reg	Det	Per	

b)

Sta	Kin	Dyn	Org	Org	Reg	Det	Per	
1	2	3	4	4	3	2	1	
4	3	2	1	1	2	3	4	Induction
3	4	1	2	2	1	4	3	process
2	1	4	3	3	4	1	2	

Fig. 13: Scheme of the conversion process in the folding phase. Compare with fig. 12.
a) The coordinate system is removed. A conversion process scheme is created. The process sequence and the tasks appear.
b) The folding process is now carried out. The reaction process is placed on the left beside the induction process and then folded behind the induction process on an imaginary vertical hinge. The arrows show the direction of the 1st rank process (in the induction process to left, in the reaction process to the right). Depiction of front section of process (induction process).
Abbreviations:
Per = Perception, Det = Determination, Reg = Regulation, Org = Organization, Dyn = Dynamization, Kin = Kinetization, Sta = Stabilization.

$$\sum_{i=1}^{i=n} \begin{matrix} 1&2&3&4&4&3&2&1\\ 4&3&2&1&1&2&3&4\\ 3&4&1&2&2&1&4&3\\ 2&1&4&3&3&4&1&2 \end{matrix}$$

Fig. 14: Scheme of the hierarchical process in the bundling stage. Compare with fig. 13. The hierarchical process incorporates n conversion processes. The individual stages of a conversion process are shown, the numbers represent the process sequence.

1 2 3 4 4 3 2 1	1 2 3 4 4 3 2 1
4 3 2 1 1 2 3 4	4 3 2 1 1 2 3 4
3 4 1 2 2 1 4 3	3 4 1 2 2 1 4 3
2 1 4 3 3 4 1 2	2 1 4 3 3 4 1 2
2 1 4 3 3 4 1 2	2 1 4 3 3 4 1 2
3 4 1 2 2 1 4 3	3 4 1 2 2 1 4 3
4 3 2 1 1 2 3 4	4 3 2 1 1 2 3 4
1 2 3 4 4 3 2 1	1 2 3 4 4 3 2 1

Fig. 15: Scheme of the hierarchic process in the alignment stage. Compare with fig. 14. The bundled conversion processes are divided into 4 groups for the new process. A new (1st rank) coordinate system is set up. In each quadrant, 2nd rank individual coordinate systems appear for the bundled conversion processes. The arrows indicate the direction of the 1st rank process (anticlockwise direction). (The axes of the coordinate systems are not shown.)

a)

3 2 1 4 2 3 4 1	3 2 1 4 2 3 4 1
4 1 2 3 1 4 3 2	4 1 2 3 1 4 3 2
1 4 3 2 4 1 2 3	1 4 3 2 4 1 2 3
2 3 4 1 3 2 1 4	2 3 4 1 3 2 1 4
4 1 2 3 1 4 3 2	4 1 2 3 1 4 3 2
3 2 1 4 2 3 4 1	3 2 1 4 2 3 4 1
2 3 4 1 3 2 1 4	2 3 4 1 3 2 1 4
1 4 3 2 4 1 2 3	1 4 3 2 4 1 2 3

b)

1 4 3 2	2 3 4 1
2 3 4 1	1 4 3 2
3 2 1 4	4 1 2 3
4 1 2 3	3 2 1 4
4 1 2 3	3 2 1 4
3 2 1 4	4 1 2 3
2 3 4 1	1 4 3 2
1 4 3 2	2 3 4 1
1 4 3 2	2 3 4 1
2 3 4 1	1 4 3 2
3 2 1 4	4 1 2 3
4 1 2 3	3 2 1 4
4 1 2 3	3 2 1 4
3 2 1 4	4 1 2 3
2 3 4 1	1 4 3 2
1 4 3 2	2 3 4 1

Fig. 16: Scheme of the hierarchical process in the interlacement phase. Compare with fig. 15. The horizontally aligned sequence is arranged vertically. The reversion operations are shown. (The axes of the coordinate systems are not shown.)
a) Reversion of the quadratic process units, each containing 16 numbers;
b) Reversion of the process units (each containing 16 numbers) as wholes from the horizontal into the vertical position;
(c) 2 new quadratic units each with 64 numbers have been created. The lower, in the y-negative zone must be turned around on an imaginary horizontal axis. This is not apparent because of the symmetrical arrangement in this block.

a)
1 4 3 2 2 3 4 1 Per
2 3 4 1 1 4 3 2 Det
3 2 1 4 4 1 2 3 Reg
4 1 2 3 3 2 1 4 Org Induction-
4 1 2 3 3 2 1 4 Org process
3 2 1 4 4 1 2 3 Dyn
2 3 4 1 1 4 3 2 Kin
1 4 3 2 2 3 4 1 Sta

1 4 3 2 2 3 4 1 Per
2 3 4 1 1 4 3 2 Det
3 2 1 4 4 1 2 3 Reg
4 1 2 3 3 2 1 4 Org Reaction-
4 1 2 3 3 2 1 4 Org process
3 2 1 4 4 1 2 3 Dyn
2 3 4 1 1 4 3 2 Kin
1 4 3 2 2 3 4 1 Sta

b)
1 4 3 2 2 3 4 1 Per
2 3 4 1 4 1 2 3 Det
3 2 1 4 4 1 2 3 Reg
4 1 2 3 3 2 1 4 Org Induction-
4 1 2 3 3 2 1 4 Org process
3 2 1 4 4 1 2 3 Dyn
2 3 4 1 1 4 3 2 Kin
1 4 3 2 2 3 4 1 Sta

Fig. 17: Scheme of the hierarchic process in the folding phase. Compare with fig. 16.
a) The coordinate system is removed. A hierarchic process scheme is created. The hierarchic levels (and tasks) appear.
b) The folding process is now carried out. The reaction process is folded behind the induction process on an imaginary horizontal hinge. The arrows indicate the direction of the 1st rank process (downwards for the induction process, upwards for the reaction process). Depiction of front section of process (induction process).
Abbreviations:
Per = Perception, Det = Determination, Reg = Regulation, Org = Organization, Dyn = Dynamization, Kin = Kinetization, Sta = Stabilization.

$$\sum_{i=1}^{i=n}\ \begin{matrix}1&4&3&2&2&3&4&1\\2&3&4&1&1&4&3&2\\3&2&1&4&4&1&2&3\\4&1&2&3&3&2&1&4\\4&1&2&3&3&2&1&4\\3&2&1&4&4&1&2&3\\2&3&4&1&1&4&3&2\\1&4&3&2&2&3&4&1\end{matrix}$$

Fig. 18: Scheme of the universal process in the bundling stage. Compare with fig. 17. The universal process incorporates n hierarchic processes. The individual stages of a hierarchic process are shown, the numbers represent the process sequence.

1 4 3 2 2 3 4 1	1 4 3 2 2 3 4 1
2 3 4 1 1 4 3 2	2 3 4 1 1 4 3 2
3 2 1 4 4 1 2 3	3 2 1 4 4 1 2 3
4 1 2 3 3 2 1 4	4 1 2 3 3 2 1 4
4 1 2 3 3 2 1 4	4 1 2 3 3 2 1 4
3 2 1 4 4 1 2 3	3 2 1 4 4 1 2 3
2 3 4 1 1 4 3 2	2 3 4 1 1 4 3 2
1 4 3 2 2 3 4 1	1 4 3 2 2 3 4 1
1 4 3 2 2 3 4 1	1 4 3 2 2 3 4 1
2 3 4 1 1 4 3 2	2 3 4 1 1 4 3 2
3 2 1 4 4 1 2 3	3 2 1 4 4 1 2 3
4 1 2 3 3 2 1 4	4 1 2 3 3 2 1 4
4 1 2 3 3 2 1 4	4 1 2 3 3 2 1 4
3 2 1 4 4 1 2 3	3 2 1 4 4 1 2 3
2 3 4 1 1 4 3 2	2 3 4 1 1 4 3 2
1 4 3 2 2 3 4 1	1 4 3 2 2 3 4 1

Fig. 19: Scheme of the universal process in the alignment stage. Compare with fig. 18. The bundled hierarchical processes are divided into 4 groups for the new process. A new (1st rank) coordinate system is set up. In each quadrant, 2nd rank individual coordinate systems appear for the bundled hierarchical processes. The arrows indicate the direction of the 1st rank process (clockwise direction). (The axes of the coordinate systems are not shown.)

a)		b)	
1 4 3 2 2 3 4 1	1 4 3 2 2 3 4 1	1 2 3 4 4 3 2 1	1 2 3 4 4 3 2 1
2 3 4 1 1 4 3 2	2 3 4 1 1 4 3 2	4 3 2 1 1 2 3 4	4 3 2 1 1 2 3 4
3 2 1 4 4 1 2 3	3 2 1 4 4 1 2 3	3 4 1 2 2 1 4 3	3 4 1 2 2 1 4 3
4 1 2 3 3 2 1 4	4 1 2 3 3 2 1 4	2 1 4 3 3 4 1 2	2 1 4 3 3 4 1 2
4 1 2 3 3 2 1 4	4 1 2 3 3 2 1 4	2 1 4 3 3 4 1 2	2 1 4 3 3 4 1 2
3 2 1 4 4 1 2 3	3 2 1 4 4 1 2 3	3 4 1 2 2 1 4 3	3 4 1 2 2 1 4 3
2 3 4 1 1 4 3 2	2 3 4 1 1 4 3 2	4 3 2 1 1 2 3 4	4 3 2 1 1 2 3 4
1 4 3 2 2 3 4 1	1 4 3 2 2 3 4 1	1 2 3 4 4 3 2 1	1 2 3 4 4 3 2 1
1 4 3 2 2 3 4 1	1 4 3 2 2 3 4 1	1 2 3 4 4 3 2 1	1 2 3 4 4 3 2 1
2 3 4 1 1 4 3 2	2 3 4 1 1 4 3 2	4 3 2 1 1 2 3 4	4 3 2 1 1 2 3 4
3 2 1 4 4 1 2 3	3 2 1 4 4 1 2 3	3 4 1 2 2 1 4 3	3 4 1 2 2 1 4 3
4 1 2 3 3 2 1 4	4 1 2 3 3 2 1 4	2 1 4 3 3 4 1 2	2 1 4 3 3 4 1 2
4 1 2 3 3 2 1 4	4 1 2 3 3 2 1 4	2 1 4 3 3 4 1 2	2 1 4 3 3 4 1 2
3 2 1 4 4 1 2 3	3 2 1 4 4 1 2 3	3 4 1 2 2 1 4 3	3 4 1 2 2 1 4 3
2 3 4 1 1 4 3 2	2 3 4 1 1 4 3 2	4 3 2 1 1 2 3 4	4 3 2 1 1 2 3 4
1 4 3 2 2 3 4 1	1 4 3 2 2 3 4 1	1 2 3 4 4 3 2 1	1 2 3 4 4 3 2 1

Fig. 20: Scheme of the universal process in the interlacement stage. Compare fig. 19. The vertically aligned sequence is arranged horizontally. The reversion operation incorporating the entire table of numbers in the coordinate system is shown. (The axes of the coordinate systems are not shown.)

a)

Microcosmos ←	Macrocosmos	
1 2 3 4 4 3 2 1	1 2 3 4 4 3 2 1	
4 3 2 1 1 2 3 4	4 3 2 1 1 2 3 4	
3 4 1 2 2 1 4 3	3 4 1 2 2 1 4 3	
2 1 4 3 3 4 1 2	2 1 4 3 3 4 1 2	Induction-
2 1 4 3 3 4 1 2	2 1 4 3 3 4 1 2	process
3 4 1 2 2 1 4 3	3 4 1 2 2 1 4 3	
4 3 2 1 1 2 3 4	4 3 2 1 1 2 3 4	
1 2 3 4 4 3 2 1	1 2 3 4 4 3 2 1	
1 2 3 4 4 3 2 1	1 2 3 4 4 3 2 1	
4 3 2 1 1 2 3 4	4 3 2 1 1 2 3 4	
3 4 1 2 2 1 4 3	3 4 1 2 2 1 4 3	
2 1 4 3 3 4 1 2	2 1 4 3 3 4 1 2	Reaction-
2 1 4 3 3 4 1 2	2 1 4 3 3 4 1 2	process
3 4 1 2 2 1 4 3	3 4 1 2 2 1 4 3	
4 3 2 1 1 2 3 4	4 3 2 1 1 2 3 4	
1 2 3 4 4 3 2 1	1 2 3 4 4 3 2 1	
Macrocosmos ←	Microcosmos	

b) Microcosmos ←—— Macrocosmos

1	2	3	4	4	3	2	1	1	2	3	4	4	3	2	1	
4	3	2	1	1	2	3	4	4	3	2	1	1	2	3	4	
3	4	1	2	2	1	4	3	3	4	1	2	2	1	4	3	
2	1	4	3	3	4	1	2	2	1	4	3	3	4	1	2	
2	1	4	3	3	4	1	2	2	1	4	3	3	4	1	2	
3	4	1	2	2	1	4	3	3	4	1	2	2	1	4	3	
4	3	2	1	1	2	3	4	4	3	2	1	1	2	3	4	
1	2	3	4	4	3	2	1	1	2	3	4	4	3	2	1	
Sta	Kin	Dyn	Org	Org	Reg	Det	Per	Sta	Kin	Dyn	Org	Org	Reg	Det	Per	Tasks
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Spheres

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Fig. 21: Scheme of the universal process in the folding phase. Compare with fig. 20.
a) The coordinate system is removed. A universal process scheme is created.
b) The folding process is now carried out. The reaction process is placed on the left beside the induction process and then folded behind the induction process on an imaginary vertical hinge. The arrows show the direction of the 1st rank process (in the induction process to left, in the reaction process to the right). Depiction of front section (induction process).
Abbreviations: Per = Perception, Det = Determination, Reg = Regulation, Org = Organization, Dyn = Dynamization, Kin = Kinetization, Sta = Stabilization.