HIERARCHICAL APPROACH

Introductory Remarks

We live in the world and encounter many different things; we observe different events, while participating in various public and private activities. All that is somehow organized and we feel it, even without too much care for explicit regularity. There are different ways to describe this universal ordering of things and happenings. Generally, we compare the explicit diversity with some intuitive commonality, inventing the appropriate terms for the both, within each special activity. Eventually, we come to the universal paradigms applicable to any activities at all. Thus, the *structural* approach summarized the achievements of formal science by the beginning of the XX century. However, its insufficiency has become evident within a few decades, and the *systemic* view was to complement structural research, reflecting the development of automated control devices. Here, I suggest complementing the structural and systemic approaches with yet another universal paradigm, which I conventionally call *hierarchy*.

The basic idea follows from the common word usage. In many practical cases, things are not only interconnected or mutually transformed, but also distinguished by a certain *level*, as compared to other things. Structures and systems of different level can coexist within the same experience, and the terms "hierarchical structure" and "hierarchical system" are widely used to refer to such "vertical" ordering, along with many other terms (like "tiers", "stratification", "subordination" *etc*.). One comes to similar ideas considering development, which is usually pictured as directed from lower-level forms to some higher level formations. Still, there is an obvious mutual dependence of the different levels, and they can only be the levels *of something*, together constituting a whole. Neither structural nor systemic approach can explain this kind of integrity. So, let us denote it somehow (for instance, as "hierarchy") and proceed with studying its universal laws and possible implications.

Of course, in this context, hierarchy is far from the original Christian etymology of the "sacred order", going back to the mythological cosmology of the first primitive societies. Since the relations between the levels of thus pictured cosmos were unknown, they seemed to be imposed by some supreme force, deity, and such an order was quite logically called sacred, hence hierarchy. This idea would not admit any freedom in interpreting the God's prescriptions, and the term "hierarchy" has become static, denoting mainly hierarchical structures, rigid sets of pre-defined levels, with fixed relations between them. This made the levels absolutely separated from each other, with no change possible, and the very existence of such levels remained a mystery. No wonder, such a picture has always been used by the ideologists of the ruling class to justify economic and social inequality.

To avoid undesirable associations, one could take a different name, or even introduce some neologism. Examples of such linguistic exercises can be found in the literature (*e.g.* "heterarchies" of E. Eliseyev). More often, however, the specificity of the idea was attributed to some other categories (like "structure", "system", "integrity", "totality" *etc*.). To stress the objective development of any stratification, I would rather use the term "idiarchy", from Greek "*idios*" (own) and "*arhe*" (order, dominance), which could be translated as "the natural order of things". However, too much artificial language may also be misleading, and I retain the old word "hierarchy" just stripping it of any mystical connotations. No term is perfect, and any understanding requires a will to understand.

Here, I only outline a few aspects of the hierarchical approach without delving in details. A lengthier discussion can be found elsewhere, but one can hardly be comprehensive enough treating a subject

that, by its very nature, cannot belong to any limited domain. Hierarchies are all around us, but we have yet to grasp their universality. This is only achieved in practical activity, recreating the world, transforming it from nature to culture. Meanwhile, a piece of philosophy might come useful to provide a preliminary working framework.

I do not need to invent everything from scratch. Hierarchical approach naturally continues the historical line of understanding complexity, and numerous hints can be found in the literature, starting from epy cuneiform inscriptions of Ancient Mesopotamia up to the most recent multimedia books. It may be strange and a little embarrassing to observe how people cannot grasp the hierarchical ideas, inventing, instead, cumbrous and clumsy conceptualizations to explain something quite obvious from the hierarchical viewpoint. We are ready for the whole, but the minds are not yet flexible enough to put together the scattered pieces. Hopefully, these pages will contribute to the universality of the human thought.

Structures, Systems, Hierarchies

The reason has always been seeking for integrity. For a primitive mind, there are only infinitely diverse situations requiring some adaptive reaction. A wiser person will also distinguish the classes of similar situations, as determined by the similarity of reactive activities. Thus the world's diversity is comprehended as a manifestation of its integrity.

Here, I am not going to consider the hierarchy of integrity in general. It is enough to say that, on a certain level of integrity, we consider the possible ways of joining isolated entities (elements) into a whole, and there are three complementary and mutually opposite possibilities, which we denote as structure, system and hierarchy. Of course, real things can never present a pure case of a particular type of organization; rather, one will speak about the structural, systemic and hierarchical aspects of the same thing.

Structure refers to the inner complexity of an object. The object consists of a number of *elements*, with some *relations* between them; when one element of the structure is immediately related to another, we could say that there this element is linked to that. When an element is related to two other elements, these latter become related *via* their common relation; thus an element of the structure may *mediate* the links between other elements. Such *mediated* (or *indirect*) links can be rather complex, with numerous intermediate elements and multiple alternative mediations. The collection of all direct and indirect relations between any two elements in the structure is called their *connection* in that structure. Since the inner distinctions are determined by the quality of the object, structural description is essentially *static*.

System is the way to describe the outer (apparent) complexity of an object; we often speak about the object's "behavior", or, rather, "functioning". In general, a system would *input* something from its environment, and produce some *output*, depending on the system's *state*, which comprises both internal and external factors that do not belong to the input or output channels. In other words, system is the way of transforming one structure (input) into another (output), the mechanism of this transformation being determined by the structure of the system (comprising both inner structure and the structure of the system's environment). The systemic description of an object is *dynamic*, since the sequences of its reactions to various external influences are of interest. Different systems can be "wired" to each other, becoming the components of a wider system.

Hierarchy assumes the transformation of the external aspects of the object into its inner complexity, and conversely, the inner organization becoming an explicit distinction. Reflexivity (or self-reflection) is the key to comprehending such transformations. For instance, a system can change its environment so that its input gets affected, as in the common feed-back schemes. However, the portions of the environment that provide such a feed-back can be included in the original system, which thus becomes hierarchical, with one level corresponding to the original "pure" functionality and a higher level introducing a kind of "self-regulation". Similarly, rearranging reflexive links will make a structure hierarchical. Considered as an objective phenomenon, such reorganization of structures and systems is

commonly known as *development*.

Though these three levels of organization are qualitatively different, describing the complementary aspects of the whole, they are mutually reflected as well. The structural traits can be reinterpreted in the functional terms, and a system's functioning can, in some respects, be described in the structural terms. For example, in physics, structures are often considered as invariants of the dynamic groups, while time coordinate is treated along with the spatial coordinates, so that dynamics is represented by the geometry of space-time. Similarly, hierarchical order can be modeled in physics introducing various effective quantities (average potentials, self-consistent fields, asymptotic conditions *etc*.). However, all such models cannot entirely reduce structures to system, or systems to structures, and, of course, hierarchies can only be structurally or systemically represented in a very limited way. In particular, the time coordinate does not represent time in all its respects; one needs the hierarchical approach to comprehend historical time as different from mere systemic dynamics. Developmental study synthesizes both static and dynamic descriptions, considering the same thing as a sequence of its developmental phases reflected in the levels of its hierarchy.

From philosophy, we know that any definite thing has three complementary aspects. Primarily, it consists of something, which we call its *material*. There is nothing in the world that can exist without some material, though, sometimes, it may be quite a nontrivial task to tell what its material exactly is. Still, the material does not yet completely characterize the thing; many different things can be made of the same material, and the way they differ from each other is their *form*. In particular, the visible shape of the thing is a characteristic of its form. However, the separate consideration of the thing's material and form does not tell us why this particular material has to take this particular form to produce this particular thing. Neither the material, nor the form implies its necessity, its unique place in the world. There is something in the thing that has to do with its being itself, the history of its birth, development and annihilation. A philosopher would call it *content*, the unity of the material and the form.

Structure, system and hierarchy as the levels of organization all pertain to the form of a thing. However, one could observe that the stability of structure is related to the material composition of the thing, while the content of the thing has to do with its development, and hence hierarchy.

The important difference of the hierarchical approach from considering mere hierarchical structures and hierarchical systems is that the existence of multiple levels is explained by objective development, while within the structural or systemic approach it can only be postulated, imposed from the outside. As soon as we accept hierarchy to be different from system, or structure, hierarchical structures are readily understood as the imprint of the object's development on its internal organization, while hierarchical systems manifest the dependence of an object's functionality on its natural history.

Fundamental Principles

To introduce the hierarchical approach, one could try to formulate its basic principles. Of course, this list can hardly be exhaustive; other enumerations would emphasize some other aspects of the same. The very thought of a complete inventory of relevant categories and principles is incompatible with the hierarchical approach. However, any practical application requires some mental framework, and this summary could be as useful as any other to grasp the general idea of hierarchy as an intrinsic mechanism of any development.

Holism

The category "a hierarchy" conveys the idea of a self-contained thing that remains the same in all the possible contexts. Though it may differently exhibit itself in different respects, all such special manifestations are intrinsically interconnected, being determined by the same organizational center, the whole of the thing. While interaction with the environment is necessary to define to form of the thing and its motion, the thing's development is initiated by its inner dynamics, albeit externally regulated and shaped.

Hierarchical structure

Each hierarchy manifests a number of distinct levels, with the higher levels dominating over the lower levels in certain sense; this distinction depends on the aspect of hierarchy under consideration. The elements of an upper level may, for instance, represent classes of lower level elements, or some integral characteristics of lower level motion. In any case, the higher levels are "built" on the basis of lower levels, and they cannot exist without them, despite the apparent higher level control over lower level behaviors.

Hierarchical system

At any instance, each hierarchy interacts with its environment as a hierarchical system, transforming some hierarchically structured input into hierarchically structured output. This assumes some inner hierarchy of the system, which can be formally represented by the hierarchy of the system's states. Hierarchical systems are impossible without a hierarchy of feedback channels, and systemic motion is hierarchically structured by feedback cycles. The distinction between "inner" and "outer" structures hence becomes relative, typically determined by the characteristic times of the cyclic processes.

Infinite divisibility

The relations between any two levels of a hierarchy constitute a specific entity which may be considered as a level of the same hierarchy lying between the two original levels. Therefore, there is no "final" structure in any hierarchy, since one can always find a new level between any two previously discovered. This procedure will be referred to as *unfolding* the hierarchy.

Foldability

The collection of intermediate levels between any two levels of hierarchy can be treated as mere mediation of their connection. All the intermediate levels are thus considered as the inner organization of the connection, which does not determine the interrelations of the two selected levels. *Folding* that mediation, we observe the two levels as adjacent. In this way, the total number of levels in a hierarchical structure or system can decrease, and we arrive to grosser view, which presents a logical inverse of hierarchical unfolding.

Convertibility

Any hierarchy can be folded, and then unfolded in a different way, hence manifesting a hierarchical structure or system quite unlike the original (another *position* of the hierarchy). Therefore, no hierarchical structure or system should be considered as absolute and rigid; the hierarchy is thus comprehended as the unity of all its possible positions. This multi-faceted nature of any hierarchy is referred to as its *convertibility*, and the transition from one hierarchical position to another is called *conversion of hierarchy* (or *rotation*).

Relativity of subordination

Because of convertibility, there is no absolute "topmost level" in a hierarchy, though any hierarchical structure or system will certainly have one. Any element of hierarchy can become its topmost element in some hierarchical structure, thus representing the hierarchy as a whole.

Strong integrity

Within hierarchy, the distinction between the elements and their relations can only refer to a particular position of hierarchy, and therefore this distinction is relative. In the same way, any functional distinctions (like input and output, inner and outer) are related to a particular hierarchical system, a specific position of hierarchy.

Self-conformity

Any component of hierarchy is a hierarchy too, and it may be unfolded in the same way as the whole hierarchy. The very distinction between the part and the whole therefore becomes relative, and any

part of hierarchy may be said to contain the whole of it, the part being virtually equivalent to the whole. To put it differently, a hierarchy is reflected in any one of its elements.

Qualitative infinity

Hierarchy does not imply any strict ordering of levels; it rather is a multidimensional formation. The number of its dimensions is "infinite", in the same sense as the number of levels. However, every position of hierarchy implies a one-dimensional ordering of levels, and any level of hierarchical structure or system has a definite dimensionality.

Conversion of Hierarchies

Thought hierarchy always manifests itself as a sequence of levels (hierarchical structures of systems), this layering is not as rigid as in the structural or systemic consideration. Hierarchical conversion is the key to understanding hierarchies. Convertibility of hierarchies provides a solid base for integrative studies. Basically, we observe that, treating something in a specific *respect*, we deal with its specific *aspect*. The same thing can be involved in many activities (processes, relations) and it may look quite differently in different circumstances, up to becoming almost unrecognizable. In the hierarchical approach, such different manifestations of the same hierarchy are called its different *positions* (in analogy to the possible positions of a musical chord).

However, the positions of a hierarchy are never arbitrary; they always reflect its overall organization. This means that any hierarchical structure or system is never imposed from outside as immediately given; the context can only favor one of the elements, and the rest of the layered construction unfolds itself according to the inner ties between the elements.

For example, imagine a crumpled net lying on the floor in a heap. If you pull one of the nodes, it will drag out the nodes immediately connected to it, and they will, in their turn, take out the nodes connected to them, and so on. In the end, you will have the net hanging down from the node you hold, with each node at its own height above the floor. You have produced a hierarchical structure. If you start with a different node, the result will be essentially the same, but the nodes will hang at some other distances from the floor, in a different order. Thus, varying the initial (topmost) element of the hierarchy, you produce different hierarchical structures.

Similarly, pulling up a point of a horizontal cord, you obtain a hierarchical structure ordering the points of the cord by their distance from the flat surface:
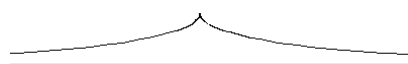
Pulling up a different point, you obtain a different ordering of the points:
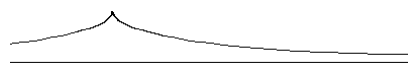
This new hierarchical structure is yet another *position* (or another *turn*) of hierarchy. To understand why the idea of rotation is invoked, consider another example. In the simplest hierarchy, there are two elements and one link between them. The two possible positions of such a trivial hierarchy can be pictured as

$$
\begin{array}{ccc}
B & & A \\
\Uparrow & \text{and} & \Uparrow \\
A & & B
\end{array}
$$
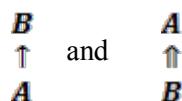
Note that the link from *A* to *B* is of a different kind as compared to the link from *B* to *A*, which is stressed by the notation. The example of a triadic hierarchy gives even stronger impression of rotation:

$$
\begin{array}{ccc}
A\!\!-\!\!B & C\!\!-\!\!A & B\!\!-\!\!C \\
\diagdown\diagup & \diagdown\diagup & \diagdown\diagup \\
C & B & A
\end{array}
$$
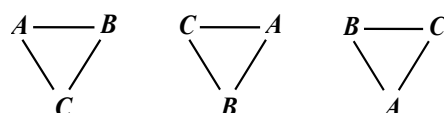
Of course, such simple examples do not convey the whole spectrum of hierarchical convertibility. However, they illustrate how a hierarchically organized thing can turn its different aspects to the world, changing as well as remaining the same in the same time. In addition, the above examples of the net, and the rope, demonstrate yet another important feature of refolding: to get to a specific turn of the hierarchy, the original structure must first be *folded* to some neutral state, and then *unfolded*, starting from a single element that *represents* the hierarchy in this particular position (new hierarchical structure). In the discrete case these two operations are not as obvious, but they still have to be involved.

Unfolding Hierarchies

The logic of unfolding is based on the relativity of distinction between the elements and links. Thus, in the scheme

$$A \to B,$$

the link $\to$ can be considered as an element M mediating the connection of A to B:

$$A \to M \to B.$$

As a result, one obtains three levels of hierarchy instead of the initial two. Any link between the neighboring levels can thus be represented by an intermediate level, and the hierarchy will unfold itself again and again. This is an example of qualitative infinity inherent in any hierarchy.

Once again, one must observe that the quality of links between the elements and levels in any hierarchical structure depends on the way of unfolding, and similar structures may represent quite different positions of hierarchy. There are numerous examples in modern mathematics, where the same notion (*e.g.* a set) can be introduced in the context of very different conceptualizations (like the number theory or the categorial approach), with all the properties preserved, but in a different sense. Sometimes, this difference can become apparent, like in the case of Riemann and Lebesgue integrals, which coincide in the non-singular domain, but can lead to different results for singular integrands.

Despite of its apparent difficulty, hierarchical unfolding is quite common in our everyday life. Thus, when we first meet somebody, we usually pay attention to some particular details of the person's appearance or behavior, and our further acquaintance with that individual proceeds through extension and moderation of this primary impression. Similarly, to develop a large project, we split it into relatively independent stages, which can further be split into even smaller subtasks.

In nature, hierarchical unfolding is often associated with a fluctuation, a violation of symmetry, or "bifurcation" (in the sense of the catastrophe theory). In any case, this is a natural process, co-relating a thing with its environment.

Folding Hierarchies

The inverse process of folding a hierarchical structure treats every indirect (mediated) link

$$A \to M \to B$$

as a direct link of a different type:

$$A \Rightarrow B.$$

Intuitively, this corresponds to the common figure of reasoning that, if two things are related *through* some other thing, they *are* related. The focus shifts from the mediation of connection (its mechanism) to the connection itself, since, in many applications, we do not need to know about the details, as soon as we get the overall result.

Folding is a transition from one hierarchical structure to another structure, which is simpler than the original in certain respects. In our everyday life, a typical example of hierarchical folding is provided by *learning*, when a complex action is first performed operation by operation, but it gradually folds into a single operation that does not require conscious control of the intermediate steps.

In principle, a hierarchy can be folded into a single element; commonly, however, the process of

folding stops at some level, with following unfolding in another direction. The "neutral" state, to which the hierarchy becomes folded, can therefore be complex enough, and there can be a hierarchy of such neutral states.

Multidimensional Structures

In a hierarchy (idiarchy), any element, or link, is a hierarchy itself, and it can be unfolded in its own way, regardless of the current position of the parent hierarchy. Thus, the scheme $A \Rightarrow B$ could become something like

$$\begin{pmatrix} S_2 \\ \uparrow \\ S_1 \end{pmatrix} \rightarrow \begin{pmatrix} R_2 \\ \uparrow \\ R_1 \end{pmatrix}$$

Since any part of the hierarchy is connected to any other part, schemes like that always imply missing links, which can be restored in different ways. For instance, one could consider parallel unfolding of each of the primary levels:

$$\begin{pmatrix} S_2 \\ \uparrow \\ S_1 \end{pmatrix} \begin{matrix} \rightarrow \\ \rightarrow \\ \rightarrow \end{matrix} \begin{pmatrix} R_2 \\ \uparrow \\ R_1 \end{pmatrix}$$

Quite often, however, there is no parallel development of different levels. Thus, the hierarchical structure of the lower level (as the result of its unfolding) can be represented by one of the higher level elements; the rest of higher level development is only indirectly related to the lower level structures:

$$S_2 \rightarrow R_2$$
$$\uparrow$$
$$\overline{S_1 \rightarrow R_1}$$

There are many directions of unfolding a hierarchy, and the number of dimensions in the resulting hierarchical structure can grow to infinity. Nevertheless, all the possible unfoldings (positions) of a hierarchy are determined by the hierarchy as a whole and, in that sense, they are contained in it. Every individual thing, at every moment, is in infinitely many relations with the rest of the world, in every one of which it is represented by a specific hierarchical structure. In human activity, that infinity is normally handled using the idea of convertibility, applied to the hierarchy of admissible rotations of hierarchy: at any instance, we only see a particular turn (the topmost element), with the rest serving to enrich it with inner complexity.

Sequencing

Saying that the levels of hierarchy represent the stages of its history, we assume that any development can be considered as a sequence of distinct phases. However, the very way of distinction depends on the level of detail, and those considering three stages may be as right as those who distinguish twenty. The process of development is hierarchical itself. Each phase of development can be "split" into many smaller phases, and so on without limit. Conversely, minor changes can be merged in larger units, thus providing a grosser scale for the whole process. Such folding can merge phases in different combinations, and the resulting higher level sequences will be different:

$$\ldots A \rightarrow B \rightarrow C \ldots$$

unfolds into

$$\ldots A_1 \rightarrow A_2 \rightarrow B_1 \rightarrow B_2 \rightarrow C_1 \rightarrow C_2 \ldots$$

which folds to

$$\ldots (A_1 A_2 B_1) \rightarrow (B_2 C_1) \rightarrow C_2 \ldots$$

or

$$\ldots A_1 \rightarrow (A_2 B_1) \rightarrow (B_2 C_1 C_2) \ldots$$

or

$$\ldots A_1 \rightarrow (A_2 B_1 B_2 C_1) \rightarrow C_2 \ldots$$

etc.

This is a special case of *conversion* of hierarchies, which makes them exhibit quite different hierarchical structures and systems (the different *positions* of hierarchy), remaining the same integrity. Each of the possible positions corresponds to a possible route of development.

Hierarchical Development

A thing of any nature, as soon as it is distinguished from the other things, is also related to the rest of the world. The very distinction of two things is already a kind of relation binding them together. When related to different things, any particular thing manifests its different qualities (the different positions of hierarchy). Eventually, getting in touch with all kinds of things, it will reveal every possible unfolding, thus becoming related to the world as a whole.

Distinguishing what belongs to a thing from what is outside it, we observe that the internal hierarchy of the thing is complemented by the hierarchy of its environment. The inner and the outer hierarchies are mutually reflected. In particular, every individual thing is related to itself through its environment, and hence it plays the role of environment for itself and is reflected in itself. Such reflexive interaction with environment is the principal mechanism of development, the process that changes the thing itself.

So, the roots of any development are in *reflexivity*, the thing's relatedness to itself. Such a relation always implies other things mediating this relation. Thus, for structures, we complement distinguishing their elements and links as *internal* to the structure by a look from the outside to the structure as a whole. An element of the structure becomes related to itself due to its relation to the whole structure. Various feedback schemes implement reflexivity on the systemic level. On the higher level, the *external* systems that mediate feedback directing a portion of the main system output to its input become the parts of the main system; this is an example of a developing system. In general, reflexivity makes the very distinction between the internal and the external relative, which is an important feature of hierarchies.

Hierarchical development occurs when a number of things form a higher-level integrity, which obviously results in the reflection of this integrity in each component, and hence the growth of their inner hierarchies. That is, hierarchical development is of an *active* character, and things do not merely "undergo" or "experience" some evolution, they change their environment, and change themselves due to the reverse influence of their own products.

Any act of an object's interaction with the world implies a cycle of alternating phases of action and being acted upon, which can also be considered as the levels of some hierarchy. When a thing acts on some other thing, it undergoes certain changes; the inverse action partially restores the initial condition. Thus the thing keeps being *reproduced* in every such cycle of action/counteraction, but, in general, not exactly as it was, with some changes gradually accumulated. In the simplest case, such reproduction is reduced to conversion of hierarchy, leaving the object the same and merely changing its form, appearance, or its position in the world. This is referred to as *simple* reproduction; it has to do with all kinds of homeostasis and adaptation. Simple reproduction always brings systems to a stationary state, provided there is no external perturbation.

More commonly, things change in their reproduction, which is then said to be *augmentative* rather than simple. In the very common case of *extensive* reproduction, or *expansion*, a larger portion of the world becomes involved in the object's environment, while the character of interactions remains generally unchanged. This results in further unfolding the object's hierarchy. The world becomes deeper reflected in the thing, and the thing imprints itself on a wider portion of the world.

True development (*intensive* reproduction) implies a shift of the boundary between the thing and its surroundings, the change in the very notion of "the internal". This means that the object's hierarchy will change through the synthesis of its own hierarchy with the hierarchy of another thing that formerly was a part of the outer world. This "absorption" of outer things should not be confused with mere consumption. Indeed, consumed things cease to exist; they become entirely disassembled, to provide building blocks for some other structure. This is an extensive process, which is rather characteristic of mere expansion. In hierarchical development, several bodies become involved in some higher level activities, retaining much of their original functionality. One could speak about the formation of a collective body.

As the unity of the internal and the external, hierarchy can develop in two complementary ways, either "zooming in" and unfolding itself into a number of relatively separated inner hierarchies, or growing via binding several things in one. These processes of *differentiation* and *integration* can be mediated or inverted, which can produce very distant mutual influences of things in the world. Virtually, every two things become connected, so that the environment of a thing is reflected in that thing and, conversely, the thing becomes entirely represented in its environment. The whole world thus comes to the state of unity, which, however, is essentially hierarchical: it cannot be comprehended as a given entity, or a process—it is a synthesis of the both.

Like any hierarchy, development manifests itself as a number of hierarchical structures, with the levels of hierarchy representing the stages of development. However, because of convertibility, the same hierarchy can manifest itself as different hierarchical structures. This means that, since there are many ways for a thing to interact with the world, development may follow different routes, and different positions of hierarchy indicate the possible directions of its development. This distinguishes the hierarchical approach from other philosophies of development, which either assume a rigid sequence of stages, or picture development as a series of random changes. In reality, development is never random, but it may proceed through different stages in different circumstances.

Growth of hierarchies provides the basis of understanding *time*. A cycle of a hierarchy's reproduction is a natural *time unit*, associated with this particular path of development. Thus defined, time must obviously be hierarchical, since every cycle of reproduction looks differently at different levels of hierarchy. There is no fixed collection of reproduction cycles to serves as an absolute "clock". Every hierarchy can exhibit quite different hierarchical structures and hence different *time scales*. This hierarchical time differs from the sheer time variable representing time in physics and many other sciences. The latter is rather a structural parameter, referring to a specific hierarchical structure; in general, time is a measure of the level of development, *hierarchical complexity*. This conforms with intuitive idea of time, implying a definite direction from the past to the future, the existence of a finite "now" within each reflection cycle and the difference in "natural" time flow for different classes of things.

Since any development implies fusion of different hierarchies, the idea of development (and hence the idea of time) is inapplicable to whole world. There is nothing "outer" to the world as a whole, and any distinctions can only happen within the same global entity. However, since any portion of the world can reflect its entirety, each such portion can serve as a world to its inside, and a smaller creature living in such a "world" could conceive the existence of other "worlds", and eventually get in touch with them. However, the birth, existence and death of such partial "worlds" do not have to do with the universality of the world in general, which stays the same, beyond space and time, while incorporating all the possible modes of motion.

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