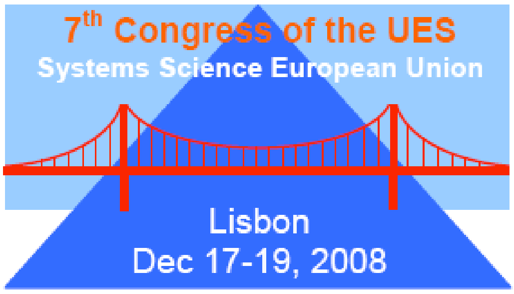
APOCOSIS

ISBN: 978-972-9059-05-6

the origin/la source : http://www.afscet.asso.fr/resSystemica/Lisboa08/duarteramosL.pdf
the title/le titre : **Hard and Soft Systems Intentionality.**
the author/l'auteur : **DUARTE-RAMOS Herminio**
the pages/la pagination : **10 p.**
the year/l'année : **2008**
& the book/la publication: **7th Systems Science European Union Congress Proceedings, Lisboa, Portugal.**

Systems Science European Union
Union Européenne de Systémique
UES

APOCOSIS



Hard and Soft Systems Intentionality

Hermínio Duarte-Ramos
Emeritus Professor, New University of Lisbon (FCT)
hdr@fct.unl.pt

Basic principles

The universe is composed of a complex set of interconnected parts, or components. This is what gives it its global nature. The interaction between the parts gives rise to different kinds of interactions between different levels of reality. These levels emerge, successively, from each other, erecting our multilevel natural world.

At the human, macro-level, nature presents us with many inanimate and living species engaged in different processes of interaction. Each macro-state corresponds to many different micro-states. These emerge from nano-states, which, in turn, emerge from lower order states, and so on, down to quantum fluctuations. At the meta-large and ultra-large levels, distant galaxies too are a conglomerate of levels.

The materiality of the world at the human, macro-level, gives the impression of forming natural objects, examples of which are minerals and animals, rivers, atmospheres and artefacts, as well as equipment and devices, molecules and particles, and even waves. Local excited states, on the other hand, are interpreted as immaterial signals. For instance, an electric pulse propagating along a neural axon modulates stimulated states, which are produced by ingoing and outgoing ions through membranes surrounding brain neurons and the spinal cord.

Material objects and non-material signals interacting in processes occupy a limited space. If we concentrate on the functions and interaction signals that make up a process, we can portray reality as a system, by using representative quantities and variables.

To be able to design systems, science develops theories based on the notion of a globally interacting reality; that is, on the idea that the functional components and interconnecting axes of a specific environment are a harmonized set of representations.

The systemic approach allows for full integration of all the components involved, both those interacting inside the system, and those interacting with the external environment. Input reference signals stimulate the operation of the system's structure, while output action signals stimulate the structure to act on the environment.

These basic principles are the foundations of a systemic theory that is capable of interpreting every motion in the natural world. Our objective is to find the universal properties of integrated systems, here called the systemic essentials.

When reality moves in real space, certain types of phenomena occur. But, in order to understand the features of these phenomena, we must detain ourselves on how to apply the systemic theory here devised.

The concept of system

Humans can observe the natural world by focusing on some of its components and mentally isolating each one of them from the environment, or system. But in order to study the concrete reality of the observable parts, we need to include interactive signals both from and to the outside of the system. The input signals stimulate the operation of the system. The output signals are responses that act on the environment.

With this concept in hand, we can design a system model. The model will be composed of mutually interacting embedded components, coherently drawn from the natural world, and imbued with an ideal final purpose.

Take a tree, for instance. We may select it to lie down under its shade on a hot summer day, or we may do so to study the properties of its wood, or to paint its shape and beauty on canvas. This means that trees are complex organized structures belonging to specific environments. That is how nature made them. But the human mind is capable of constructing an ideal representation, or model, of a tree for whichever purpose it desires at a given moment. Once in possession of this imagined ideal, the human observer can then remove from the surrounding reality all objects that are not relevant for his, or her, intention.

We can generalize the concept of system to everything that exists in real space. Such model constructs exist in the imagenality of the mind and they are objectively symbolized by the concrete materiality of the world, which is in itself a simplification of complex nature. This is true of the most distant places of the universe down to the tiniest particles of matter at quantum level.

In sum, a system is a structured organization, composed of several functional components that interact adaptively within a virtual or real boundary, pursuing an adaptive operation according to its own intentionality towards a purpose or telonomy, which tends to act on the natural environment.

General theory of systems

This concept of system contains a general paradigm of integrated systemic thinking. This paradigm says that the system's structure contains the necessary and sufficient components that interactively cooperate to attain an intentional global result.

But we should consider the representation of strict reality, including all dominant material objects as system components and immaterial signals as information interactivities, and exclude those parts that are not relevant for the intended aim. According to this model, the final purpose emerges as an action.

In other words, we simplify the functional operation as much as possible by looking for the essential attributes as clearly as we can for a specific approach.

But you ask, what are the systemic essentials? An analysis of integrated systems reveals four essential structure attributes:

- acrony, or, composition by the functional components;
- axony, or, interactivity of the components by means of signals;
- aquadry, or, framework boundary of the strict functional structure;
- adaptacy, or, process of adaptation to the working conditions.

Every system that we can isolate from the surrounding world works under these systemic essentials, and from their operation emerges a purposed output. Whenever we analyse a system, we will always find these basic attributes, from which arises a fifth systemic essential, the system telenomy. This quintessence of systems means that the emergent response of the global system's operation has its own intentionality. It is what comes out from the operation of the system, emerging from the boundaries of the system to the outside world.

Systemic essentials

Let us analyse the structural attributes that are needed to understand the system's functional operation and to interpret or predict its behaviour. Generally, people think on three basic types of interconnection, referring series, parallel and feedback configurations. But we interpret the essential system attributes quite differently.

The term "acrony" (from the Greek *a* + *chromos*, or, not time) refers to the material or immaterial parts that exist inside a system apart from time. The functional components are viewed separately, according to their concrete descriptions. It is possible to analyse each component's behaviour separately. And the global performance depends on their mutual interactions.

The concept of "axony" (from the Greek *axon*, or, axis) specifies a general axis to transfer signals between pairs of components. In this way, the output of one component is the input of another, or even of itself. Interactions activate the operation of the global system. In this integrated mode, it is impossible to separate the functional parts from the total operation within a limited space.

The word "aquadry" (from the Latin *a* + *quadra*, or, not square) means the imaginary frame boundary around the interconnected functional components, which limits the real material in working processes. The system must be finite, so the limitation of space surrounds what is structured in such a way as to generate the adequate operation of the system.

The system's "adaptacy" (from the Latin *adaptation*, or, adaptation) is regarded as the evolution of the system in search of optimal functional conditions. There are two kinds of adaptacy: philogenetic evolution, which implies a mutation in the structure that drastically modifies the working characteristics of the system; and ontological evolution, which promotes running point alterations on steady characteristics. In both cases, the optimized operation requires an adaptive self-action to maintain the previous intentionality.

The system's "telonomy" (from Greek *telos*, or end or aim) is the final purpose that emerges from the adaptive operation of the integrated components and interactions within a confined space to generate its intentionality. It ought to be emphasized that the quintessential telonomy implies a concrete purpose and a real intentionality, and that these may coincide, or not, because the system's intentionality refers to its inner purpose, while the telonomy points to the outer aim that we may observe.

Fixed telonomy

Systemic theory can be applied straightforwardly to technological systems. In engineering, we take a known technology and design a system that operates according to a desired purpose. Our objective is to make several components work together in a compatible way and to prevent certain interfaces to harmonize singular functions to achieve a desired final purpose.

In fact, artificial systems are constructed with transformed natural materials, and they run under certain conditions to attain an objective. An example would be a glow lamp. Its material structure gives light whenever an electric current runs through the metal filament inside the glow vacuum. This is how the lamp behaves every time because its telonomy (that of giving out light) is fixed. The lamp has a rigid telonomy.

In variable working systems, however, the systems' telonomy can vary from a steady behaviour to other types of behaviour, according to the environments they are in. But their intentionality is invariable during each period. The transitions only occur between two steady telonomies.

In natural systems, the rigid material structure operates according to exactly the same principles. As long as the systemic essentials are maintained, the outcomes are always identical. For instance, trees produce well known features that act on the surrounding environment, as a result of their own structure.

Material systems can have several emergent telonomies. These multivariable systems, with many fixed outputs, are common autonomous and non-autonomous systems. The important thing to remember is that, whenever we talk about a rigid telonomy, we are talking about hard intentionality as a purpose for the system, and that it can either be rigid or variable, but fixed for a certain time.

Flexible telonomy

The mind in the human body is the output signal of the configurations of the brain's active neurons, at each instant in time. The immaterial nature of the mind distinguishes the imagenality from the materiality of the observable world. Mental representations are merely running images. Something similar happens with the computer screen. We see an image on the screen, but the reality behind it is a dense pixel collection of multiple signals. The image doesn't exist at all.

A cognitive system displays the same systemic essentials as any other real process. The acrony is biological, including the sensitive organs and the central nervous system, particularly the neuron and glial cells. The axony represents the global connections of the active cell configurations, especially the parts of the brain, and the bidirectional signal transfers of body-mind supervenience and mind-body subvenience. In time, the aquadry varies according to the nervous components that are triggered inside the body. In such a variant system, adaptacy plays a very important role, continuously promoting self-adaptation between body and mind in order to harmonize the different simultaneous partial operations of the five sensitive systems and the multiple brain units.

The content of the mind is the output of the cognitive system. This telonomy of the mind acts on the internal environment of the body, which includes the brain itself and the distributed nervous system. The actions of the body (speeking, gesticulating, walking) which act on the external environment, emerge from this process. When we see the movements of people and hear their speech, we are looking at the ultimate emerging effects of the mind, where consciousness was the mind's telonomy. Such dynamic telonomy is constantly changing, in response to random fluctuations. It does not follow a previous fixed program, because humans are independent and self-ruling beings.

In flexible telonomy, we attribute soft intentionality to the system as a reference, which, in itself, is mutable.

Simplexity and complexity

Both in completely defined systems, where all the structural functions and parameters are known, and in observable systems containing accurate observers for unknown variables, it is possible to predict with precision the system's behaviour, because rigid telonomy is expressed by a precise set of variables.

Technological processes belong to this type of simplex systems. They can be simple or complicated, but both can be analysed and processed with more or less difficulty and accuracy. Why? Because we know all of their essentials: the definite acrony, the complete axony, the certain aquadry and the determined adaptacy. This is why we can specify the expected telonomy.

But this is not always the case. It happens when we don't know the true components of the system or the connections of the structure, either functions and parameters, or links and interfaces. The system can be more complex. Indefinite acrony prevents us from attaining precise knowledge of the systems' behaviour. The incomplete axony falsifies the final interpretations of behaviour. The uncertain aquadry implies an ambiguous boundary in real space. The undetermined self-organizing adaptacy disturbs the diagnosis of modifications.

These complex systems, whether simple or complicated, are much more difficult to analyse, and unexpected telonomies can emerge. When analysing a complex system, we have to integrate partial systemic essentials in our model, and so it is possible to expect an answer that is very distinct from the real one, because the global operation of the system is not fully taken in account.

We name systemic simplexity the feature that characterizes simplex systems that operate with hard intentionality or fixed telonomy. Analogously, we consider systemic complexity a property that characterizes complex systems that operate with soft intentionality or flexible telonomy.

Telonomy gap

All natural systems operate by sending their telonomy to the local environment. Even artificial systems are designed to operate for a desired purpose. Variable structures adapt their working conditions, so the final aims are as near as possible to a fixed telonomy. A response gap between the real output and the reference intentionality may occur, because the adaptive adjustments may not be effective.

Sometimes, the inner intentionality differs from the achieved outside telonomy, and which can be rigid and variable, or dynamic. In technological systems, we specify quantities as errors to judge how important the telonomy gap is. The soft intentionality of mental process also induces greater or minor gaps, if the telonomies are more or less coincident with the desired responses.

The intentionality of the system that expresses what must emerge from the global structure operation is the theoretical telonomy or potential output. The system behaviour that emerges from the operation of the functional structure is the practical telonomy or real output.

Sometimes, the final system action differs from the desired response, for it depends on the system structure itself. For instance, the system operation can be optimized or it may be working under tolerable conditions after a breakdown. Even in normal conditions, a system may operate with a gap between telonomy and intentionality.

We say that a telonomy gap is equal to the difference between the real attainable telonomy and the potential desirable intentionality. We try to minimize this gap as much as possible, for it is clear that the telonomy gap is an action error in simplex and complex systems.

There are many reasons to accept an actual purpose that is not far from the intentionality. One is in the case of disabled living entities, another in technological products running with disrupted devices. Tolerant systems are good examples in modern technology, especially in highly interconnected networks.

Telonomy and emergence

What emerges from a system? It was said that the system output denotes the final response, meaning a tendency of the global operation towards systemic telonomy according its intentionality. In this sense, emergence is a trivial notion for an environmental observer, signifying the same as the intentional telonomy of the system itself.

It is worth looking at both points of view. The concept of telonomy refers to the real emergence content, that is, to the output action of the external environment. If we look at the system output from the inside, we will talk about global intentionality or final telonomy. If we look at the same response from the outside, we can say that there emerges an action that affects the environment.

So emergence means the apparent action on the environment which is completely different from the internal structure of the system. It is also important to note that emergence may correspond to an expected telonomy in simplex systems and to an unexpected telonomy in complex systems.

We consider that a complex system model doesn’t describe the full structure, nor does it specify all the main operation functions. Therefore, the real system operation may show an unexpected telonomy. In reality, it is possible for very dissimilar actions to emerge, depending on the known systemic essentials.

We ought to note here that emergence derives from both simplex and complex systems. Emergence is surprising only in cases of unexpected systemic telonomy, which explains why so much attention is being paid, nowadays, to understand the complexity of systems.

Degree of complexity

Generally, people try to quantify system complexity in the same way they do for computational complexity in computer science. I believe this to be incorrect, because systemic complexity is quite different from computation: it is, instead, a physical or an organizational feature, in which it is the quality of the intrinsic complexity of the systems that matters. Clearly talking, what is unknown in the actual process?

There is real acrony (partial functions). There is true axony (interaction signals). There is imaginary aquadry (virtual or concrete boundaries). And there is possible adaptacy (working point change). If the resulting purpose does not comply with the expected intentionality, the system's telonomy is different and something in the system is indefinite, incomplete, uncertain or undetermined. When this happens, we have before us a complex system.

This is a good reason to study complex systems with different degrees of complexity according to the accuracy of their known essentials. False telonomies have several causes. Each one may produce distinct complexities, linked to various hypothetical emergences. The degree of systemic complexity must indicate the difficulty to overcome these systemic essential gaps between the conceptual system model and the reality of the process.

Usually, very mashed systems are complex because it's easy to discard some of their structural functions or to ignore some of their interconnections, to disregard some of their framework boundaries or to miss their self-adaptation capabilities. Many social systems are supposed to have non-precise data. Natural environment systems are studied with a lot of information lacking. This means that efforts to refine system models are well suited to lower complexity degrees.

Such a discussion promotes the analysis of systemic complexity based on essential gaps. This is our proposal. The degree of complexity order depends on the number of totally unknown systemic essentials. For instance, if we do not know with precision all the interactions between the components of the system, we will say that the system exhibits a first order degree of complexity. In all, there are four basic system orders, but we can have higher orders with mixed systemic essential lacking.

We note this way of thinking ignores the profundity of knowledge, being apparently unsuitable for discriminating complexity degrees. The problem is not easy to solve, even if we remain at the quality level, because *a priori* essential gaps are not clear. And *a posteriori* observations are problematic when it comes to purifying a systemic model. We need more adequate knowledge. We need more focused research to develop this idea.

Soft intentionality in humans

The billions of neurons spread out in the brain are an example of a complex system. The brain is divided into several parts, each carrying out well defined mental functions. In the last decades, neuroscience has made great advances in modelling brain behaviour, but there are still numerous unknown properties to discover. In spite of this, it is possible to design a primordial cognitive system and to interpret crucial aspects of cognition, one of which is consciousness.

Beginning with the philosopher Hegel, in the 19^{th} century, some thinkers have pointed out that human intentionality specifies our consciousness. Our desires and beliefs are related to states of mind that conduct our thoughts to what we wish and decide at any given moment.

In their technology-aided search to find new ways of understanding consciousness, some neuroscientists are coming up with new knowledge about regions of the brain. But the systemic cognitive model interprets consciousness as the soft intentionality of mental telonomy.

We will not discuss the complete cognitive system. We will only make a brief reference to the acrony of the sensation and perception components; the axony of memory to mind, the supervenience signal transfer and the reverse subvenience; the aquadry, restricted to the central nervous system; and the adaptacy that controls mind itself through intentionality.

The mind emerges from brain processes as a signal. It is an imagenal signal. It is not a common signal like non-material signals in free space, such as an electromagnetic wave for light. The mental signal is a process-signal, meaning that the signal itself has all the systemic essentials: the acrony forms the superposition of recovered signals from memory, the axony is the steady interaction between the recovered signals, the aquadry limits the space of the mind-body process, and the adaptacy endeavours to stabilize the emergent soft intentionality. From the systemic mental signal, consciousness emerges as the telonomy of the mind, implying soft intentionality.

The main complexity factor consists of a very flexible telonomy that controls all the mind-body processes. In this sense, consciousness is no more than the continuous dynamic telonomy of the mind, the constantly implicit and dominant soft intentionality.

Hard intentionality in robots

Robots are machines that emulate human behaviour. The behaviour of robots is very similar to the behaviour of humans, profiting from the unconsciousness machine operation. Fortunately, that emulation is economically successful. But in order to have robots acting more like us, it is necessary to design them according to the characteristics of human psychology. When we do that, the boundaries between inanimate and living species will come even closer.

An elegant way to characterize such artificial intelligence is to say that a robot is a system with hard intentionality. Robotic telonomy is fixed. It may be multivariable, but it is not dynamic in flexible sense. It may be variant, but it does doesn't mutate. It can optimize very quickly and can act very fast, but a rigid telonomy will always emerge from the operation of its mechanical and electronic structure. A robot can be very effective, but it will always be an elector of solutions, not an interpreter, as humans are. They choose solutions without interpretation.

Humans are intelligent because they read inside the situations to find solutions for new problems. Robots will always are machines. They are not intelligent, because machines decide by electing a solution among implemented concurrent possibilities. This means that manufactured products have intellegence, not intelligence.

It is clear that robots are not intelligent. They can be very effective, they can perform tasks much better than humans by using optimised algorithms and higher speeds or superior accuracy, but a limited fixed telonomy produces machine intellegence, which is very different from human intelligence.

Human-machine systems

Intellegent machines are much more effective than traditional artefacts. A classical lever extends the human arm, and a hammer empowers the hand motion, both without intelligence or intellegence. New information equipments possess, or will possess, software resources to choose the best fixed telonomy so that we can attain higher performance levels. Intellegence capabilities in human-machine systems reinforce the body and brain extension by merging intelligence and intellegence within global integrated systems.

People say that the boundary of memory is the brain and the skull. Today, new technologies extend human memory with PDAs (personal digital assistants). In the future, we will combine intellegence to enrich our intelligence in social interactions.

New perceptions of processed information from devices extend cognitive aquadry in versatile human-machine integrated systems. Perception forms a link between the mind and the outside world. So the computer notebook and the smartphone (like iPhone or Blackberry) become a part of human cognition, extending the brain to an external registry. This new instrument enhances the mind's memory, remembering things for the processes of cognition.

External devices are integrated into human-machine systems, which then work together in intelligence-intellegence cooperation to retrieve information. They also extend the human body to the world, not only to the near environment. When we hit a PDA keyboard, we are extending our actions to remote interfaces.

Soft intentionality in collective systems

In the natural world, there are individual and collective systems. An individual system contains a heterogeneous acrony, formed by several components of different types, working together for a global telonomy. A collective system has many components of the same type, with identical or related intentionality, so that its homogeneous axony, formed by repeated components, acts cumulatively for the emergent telonomy.

If individual telonomies of a collective acrony are fixed, hard intentionality is created in the system emerging a global fixed telonomy also being rigid. For instance, the free electrons inside a copper rod have a natural thermal motion colliding steadily with the neighbouring atoms. If an electric field is applied to the rod terminals, a drift motion will be superimposed on the random electrons, and an electric current will emerge. This current is the fixedd telonomy of the electric system.

If individual telonomies of a collective acrony are flexible, then a soft intentionality emerges and the global system telonomy also becomes dynamic, because the variant axony can change the operating conditions. A collective system may have an unpredictable telonomy. In fact, the singular behaviour of a unique component can stimulate the remainder to a completely different intentionality from the initially expected. An example would be when a human group follows a leader in crowded social events. It happens in a football stadium.

It is also happening in our societies due to the financial crisis triggered by the disruption of the American banking system. The well-known domino effect occurs in social systems when an abnormal event triggers cascading repeated behaviours. Such emergences are outputs of complex collective systems when their soft intentionalities differ from the flexible telonomies, because their known systemic essentials are illusions, not reality.

Complexity of dual motions

Zen philosophy says that a signal negation creates a new signal. This is also true in solid state electronics. When we apply an electric field to the material of a semiconductor a current is formed by the negative electron drift motions summing up positive hole motions in the opposite direction. An electron is a signal inside the solid matter and a hole means a non-electron or a vacant electron. So the place where an electron no longer exists, i.e. a non-signal called hole, acts as a signal. Solid electronic science masters the properties of that integrated current. In fact, the degree of complexity of a semiconductor system is zero. Today, a semiconductor device is a simplex system.

There are complex systems with integrated systemic essentials that we do not know, but they follow the same dual law of signal and non-signal, or object and non-object, motions. This is what happens when a line of stopped cars starts to move forward on a street.

By studying this type of dual integrated motions in social systems, we can turn a complex system into a simplex one. A case in point would be the interpretation of the disruptions in the world's financial system. This shoes that complex system theories help us understanding real, worldwide, complex systems.

Intrinsic and extrinsic intentionality

In general, systems have a concrete telonomy. Usually the built-in fixed telonomy systems are engineered to react with the desired steady functions. In these cases, they possess an intrinsic hard intentionality. The refrigerator is a common example.

Other systems are more versatile, acquiring distinct telonomies. We can change their parameters by giving them different operation functions from the outside. We adapt their structural acrony to respond as we wish them to. For instance, a wash-and-dry machine may perform one of two different tasks by selection of the adequate operation, either wash or dry. A multivariable system can be used for two or more related purposes. It operates with an extrinsic intentionality, because the user manipulates its telonomy to obtain the desired result.

From this viewpoint, a human being is an intrinsic soft intentionality system. His consciousness is not fixed, and it is imposed autonomously. However, in social life, his dynamic telonomy can also be manipulated from the outside by other people. This explains why weak personalities are influenced to follow, uncritically, the opinions of leaders. So we can speak on extrinsic intentionality of the human mind.

In the world, there are emerging extrinsic soft intentionalities in social sects. Criminal groups are another example, as terrorism is. But extrinsic intentionality is not only used for evil. It is also used to educate people for new arts and new professions.

Intentionality and ethics

Guidance is needed to define the right telenomies. A good example of this is when manufacturers deliver instruction manuals to advise users on how to optimize technological operations of their products. We make systems work with the proper, hard, intentionalities, by applying specific technical rules. In our technological society, the main intellegent feature is security, for, every day, we see new security systems being inserted into complex societal systems in order to prevent crashes and catastrophes.

But human behaviour is guided by moral laws, which are derived from cultural ethical principles. This is why soft intentionality – objectively, human consciousness – obeys intelligent features based on ethics.

In our technological society, we need both types of telonomy. In the constantly increasing human-machine systems, intelligency-intellegency control requires the integration of soft and hard intentionality to properly carry out systemic complexity.

Ethics is a crucial turning point to understand practical telonomy. Who are you? Who am I? To where are we going? Complex systems have potential ethical implications. But for that, we need to investigate the acrony, the axony, the aquadry and the adaptacy of each real system, in search of its telonomy. We need a global understanding. But the mastery of complex systems is difficult. So we try to solve it through soft intentionality.

This is the way for the future. This is the way to live.

Systemic theory

I will conclude by summarizing the fundamentals of systemic theory and its application to human behaviour.

A system is a structured organization with functional components interacting within a boundary and operating adaptively for a final purpose. Their global characteristic features are the systemic essentials of acrony, axony, aquadry, adaptacy, and telonomy.

The system emergence is the action that occurs in the environment as a result of the system operation, but which doesn't exist inside the system's components. It refers to the telonomy, and implies an inner intentionality. Eventually, it results in a difference between the telonomy and the intentionality of the system, which we call telonomy gap. The number of unknown systemic essentials in a system model may be used to indicate the degree of complexity.

There are two types of system telonomy: one is fixed, related to hard intentionality, either rigid or variable; the other is flexible, related to soft intentionality, which is dynamic or mutable. They define two types of real systems: a simplex system, which has simplexity because all the systemic essentials are known, and which shows fixed telonomy or hard intentionality; and a complex system, that derives its complexity from unknown essentials, and which exhibits flexible telonomy, or soft intentionality.

The intrinsic intentionality refers to the system's own telonomy. The extrinsic intentionality refers to a telonomy implemented from the outside. Both individual and collective intentionalities are at the core of ethics.

We integrate mind and brain in cognitive systems. In a systemic cognitive model, human consciousness becomes the telonomy of the mind. Intelligence is the human ability to read into situations, and to solve new problems. Intellegence is the machine's ability to elect solutions for situations, but not to solve new problems. We have to combine human-machine systems as a whole to profit from nature to human well-beeing.

Systemic theory tries to interpret, and explain, the complex world in a global, holistic, manner. The mastery of systemic complexity makes our knowledge of reality more and more robust. Systemics is a unified view of the systems in the world and its aim is the building a more reliable future for life in complex environments.