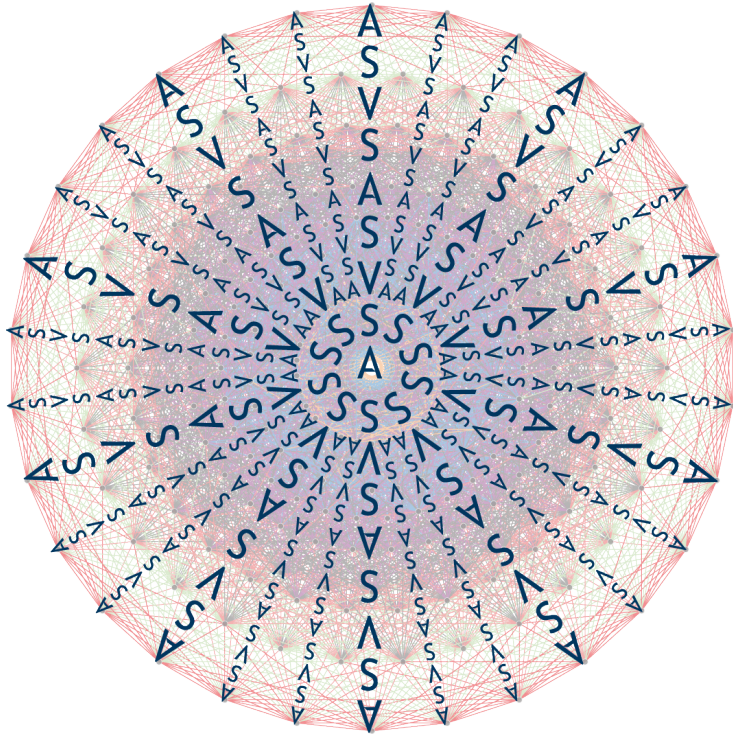




ASVSA

Associazione
per la ricerca sui
Sistemi
Vitali

Author: Sergio Barile

Title: *A viable system conceived as a universal decision maker*

Reference: *Various Authors, Contributions to theoretical and practical advances in management. A Viable Systems Approach (vSa), International Printing, Avellino, 2011.*

CHAPTER IV

A VIABLE SYSTEM CONCEIVED AS A UNIVERSAL DECISION MAKER

Sergio Barile

SUMMARY: 1. The viable system as an information variety. - 2. Distinctive features of an Information Variety: Categorical Values, Interpretation Schemes and Information Units. – 3. A Synthesis Interpretation Scheme to represent the Information Variety. - 4. The conditioning factors of the Information Variety: Consonance and Resonance.

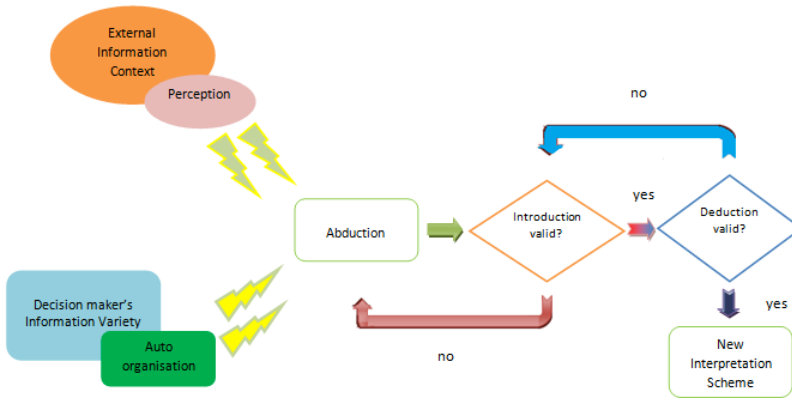
1. THE VIABLE SYSTEM AS AN INFORMATION VARIETY

Representing a viable system through the decision making activity characterizing the dynamics of decision making and the evolution of knowledge-acquiring (Barile, 2006), makes it possible for us to underscore significant properties belonging to the decision making process.

The possible paths of resolution of a specific decision making problem, starts from a perception deriving from the external context and from the information variety owned by each subject.

This process, developed through abduction, induction and deduction, can be repeated infinite times, before it gives a solution to the problem that becomes a new interpretation schemes. It can be represented by Figure 1.

Figure 1 – Possible resolving paths for a decision making process



Source: Barile, 2009:61.

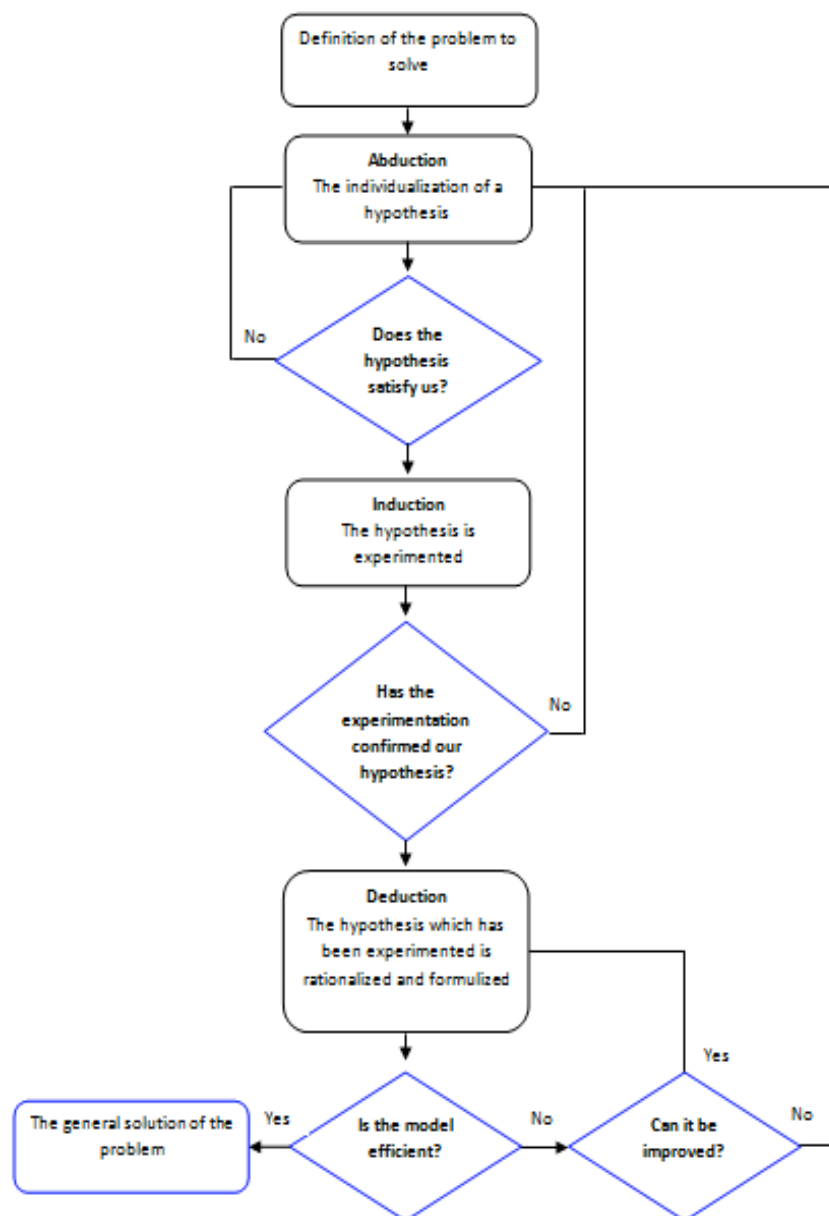
However in some cases, the sequence may not bring to a solution. This aspect of the cycle and possible reiterations is explained in Figure 2.

To better explain this process, it can be useful to clarify the concept of deduction; it consists of the appropriate application of established models or simple interpretation schemes to future analogous situations. This definition seems to tighten its area of application. In our opinion, false conclusions resulting from valid premises, are mainly due to *induction* and not *deduction*, in other words, the application of a certain interpretation schemes which has not produced a satisfactory result, has to be improved, as demonstrated in the Figure 2.

We sustain that a decision maker's strong beliefs, convictions, and interpretation schemes are crucial in defining a problem and the dynamics which converge towards a certain choice.

A decision, in general terms and in business management, consists of prospecting a solution to a problem, but, as we have seen before, is not true in all cases. In order to be able to investigate on how the decision maker develops its (decision-making) process, according to the various levels of knowledge of the elements which take part in the process, it is fundamental to understand how knowledge is stored within viable systems.

Figure 2 – A cycle of the decision making process



Source: Barile, 2009:62.

Considering the knowledge (information variety) owned by a viable system – or rather, by the decision maker which governs it – as the factor which conditions the individualization of a choice to adapt, is possible try to answer the following questions:

How is a viable system's information variety organized?

What kind of logic is it based on?

How does incoming information and auto-elaboration of already possessed information influence the dynamics of choice making?

Which factors explain that certain hypothesis prevail on others during shared decision making processes?

The levels of *consonance* and *resonance* (Golinelli, 2000), combined with the elements of an information variety – in other words, categorical values, interpretation schemes and information units – have a fundamental role in decision making; these levels are not conditioned by a certain amount of overlapping units of knowledge, but by layers of judgements (categorical values) and by specific kinds of behaviour (general or synthesis interpretation schemes).

Fay's hypothesis will help us to understand these concepts: *the aim of any form of knowledge is to be found within a structure which favours conceptual resources, in which, and with which, the world is described and explained... with its own assumptions and preconceptions; and: Note that phenomena are never facts, but are rather a particular description [...]. In brief, facts are radicalized in conceptual patterns of synthesis* (Fay, 1996).

Aleksandr Bogdanov (1916) gives us an ulterior conceptualisation of the triadic representation of the hypothetical tasks and the instruments used during a knowledge-acquiring process. He individualizes the following elements:

- *words*: similar to what we conceive as 'information units';
- *ideas*: defined as organisational patterns, in line with our 'general and synthesis interpretation schemes';
- *social norms*: customs, laws, morals, appropriateness of behaviour or conduct. What we call 'categorical values'.

As the essential aim of a viable system is to survive in its context by interacting with other viable systems (Golinelli, 2000:110), it has

to detect the problematic areas which could threaten its objectives, and reorganize and adjust its knowledge to obtain a possible solution, thus reaching a decision (Barile, Colarusso, 2005). The number of identified solutions conditions the cycle of a viable system and determines the quality of the path to survival (Rullani, Vicari, 1999:19).

If we consider the close relationship between decisions and knowledge (knowledge is intimately connected to learning and rational thought), we can represent it as a cyclical process in which perception, intellect, memorisation and elaboration of information create a virtuous circle which raises the number of the things we know.

Knowledge can be defined as a continuous process, an everlasting elaboration of data, which needs to be structured in a determined model. This idea cannot deny that the confrontation of moment t_1 with t_2 shows how knowledge in t_1 be completely different t_2 ; this means that knowledge is related to time factor t , which we will refer to as a *viable system's Information Variety to time t* [V_{inf_t}].

The definition of the information variety possessed by a viable system refers to a synchronic definition of the variation of phenomena: *effective (or potential) variations of possible cases which can take place at the same time* (Rullani, 1984).

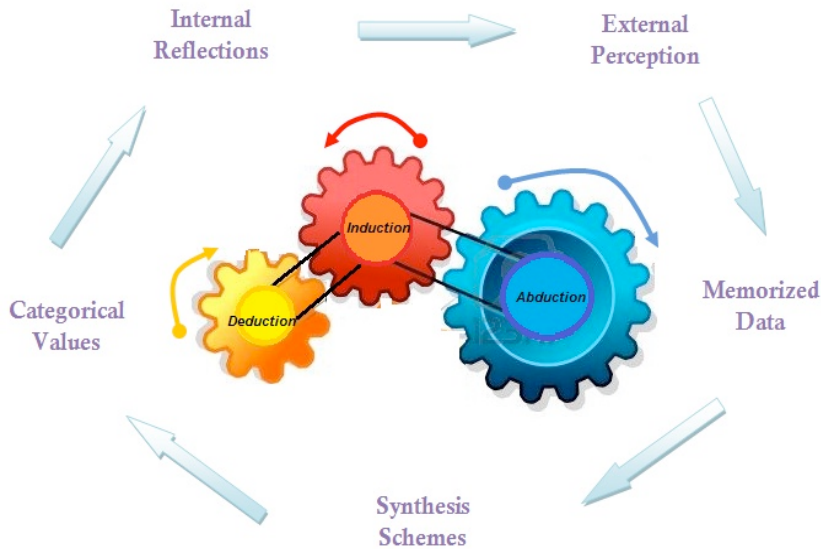
When the process of knowledge-acquiring includes the results of the action of intellect, the Information Variety possessed in a given moment has to be included as inclusive by the effects of that same action. The cognitive activity which aims to learning and understanding, is not done only through perception, but also through reflection, an autonomous determining factor of new cognitive elements. Reflection is synthesized by informational, cognitive and conceptual elements which emerge and dispose themselves on different levels of articulation of mind thought (Minsky, 1986).

A viable system represents a body which behaves in a certain manner with a specific (and dynamic) Information Variety, interacting with other viable systems when having to solve a problem; the conditions of the specific context and the factors which prevail during this process are central and the decision making process appears to be

strongly influenced from elements which are barely controllable and that are included in the area of complexity. For these kinds of decisions, the phase of abduction is fundamental, during which an idea of solution comes to one's mind in an haphazard and unexpected manner.

The following figure shows a cognitive process, and indicates how the actors are part of the mechanism. Its aim is to represent how solutions to problems depend on the decision maker (his values, models and elements of knowledge) and on context (supra-systems of reference and system of values), and of course to logical intellect (abduction, induction, deduction).

Figure 3 – The cognitive process



Source: our elaboration from Barile, 2009:68.

2. DISTINCTIVE FEATURES OF AN INFORMATION VARIETY: CATEGORICAL VALUES, INTERPRETATION SCHEMES AND INFORMATION UNITS

Behavioural studies of subjective Information Variety during decision making process have brought us to a formal definition of its dimensions and characters. According to this, the information variety is defined through three dimensions (Barile, 2006):

$$V_{inf}(k) = (U_{inf}(k), S_{int}(k), C_{val}(k))$$

where:

$V_{inf}(k)$ = *Information Variety* of viable system K ;

$U_{inf}(k)$ = *Information Units* of the information variety of viable system K ;

$S_{int}(k)$ = *Interpretation Schemes* of the information variety of viable system K ;

$C_{val}(k)$ = *Categorical Values* of the information variety of viable system K ;

The above mentioned elements $U_{inf}(k)$, $S_{int}(k)$, e $C_{val}(k)$, characterising the *Information Variety* $V_{inf}(k)$, determine a specific *information heritage resource*, and are not to be considered so much in terms of dimension; they express of specific properties found in every single form of the above quoted *Information Variety*, and thus capable of conditioning the dynamic evolution during the process of knowledge-acquiring.

The hypothesized dimensions show substantial analogies with the possible types of knowledge which have traditionally contemplated theoretical theory (Audi, 1998): direct knowledge (*I know what a chair is*), competence (*I know how to add*), propositional knowledge (*all the things which have a start and finish*). Our study does not include a method which is capable of measuring these dimensions; amongst the possible alternatives, C.E. Shannon (1948) proposes in *The Mathematical Theory of Communication*, a technique to measure informative units.

These three elements can be defined as follows.

The ‘structural’ composition of knowledge (Information Units)

Knowledge can be represented as a certain quantity of *Information Units* $U_{inf}(k)$ possessed by a viable system K , that is everything that can be perceived by the senses, or elaborated further on.

Cognitive activity has two distinctive moments:

-feeling: activity through sensorial receivers (organs and parts of them which are capable of transforming external stimulations into nervous impulses).

-perceiving: activity which organizes the activity of *feeling* (elementary sensations) in organized structures. For example, it may occur that when in a crowded place we may *feel* confusing mingling voices in which we *perceive* the voice of someone we know.

This derives from data which aims towards the formulation of elements of a subjective elaborated thought-path, and transformed into information which defines processes of knowledge-acquiring.

Different observers involved in the same specific context perceive reality in different ways and this different form of perception is linked to psychological factors, which condition perception, and to characteristics belonging to a viable system (owned information variety), and the relationship it installs with the ambiance it acts within (the aim of interaction).

Most of the concepts concerning economical, psychological and sociological organisation are strongly conditioned by factors of subjective relevance, active influence and resources used, plus other typical existential elements of a viable system.

Another important aspect that must be considered is the language, defined as the way information is conveyed. What determines the level of comprehension, without considering the subject which is perceiving, is the use of a language (not only verbal) which is shared by two entities. The first role of language is to give a name/label to the information which is perceived.

The result of perception and elaboration depends on subjects (perceiver and context). In semantic terms 'information' means data which takes form and meaning. This perception needs a conceptual effort which goes beyond Shannon's theory of communication, as expressed by Eliano Pessa and Maria Petronilla Penna (1994): *In cybernetics we would say that in this case 1 bit of information has been received [...]. As we can see, in this way we introduce a quantity of non-physical nature, like information (which does need physical support) and a subjective element, such as an 'a priori' system of probabilities of a receiver which characterizes his/her internal condition. Without this subjective element, we would not even be able to speak of information. This loss of objectivity is controlled, in practical terms, by the fact that a large number of receivers possess patterns of probability which are a priori identical, for at least certain classes of messages. One tends to identify this common a priori probability, which is assigned to various messages, with the frequency relative to the actual number of messages, within the number of possibilities. This creates two dangerous situations: the identification of frequency with probability must be mathematically corrected only if we are dealing with an infinite number of events (impossible circumstances for any receiver), on one side and, the obligation to neglect the meaning that information assumes for every single receiver and the peculiarity of his patterns of expectations.*

The next step is to qualify the Interpretation Schemes involved in the process of decision making, and not linked only to semantics. The contribution of Aldo Masullo (1962) is explicit in this sense: *While day to day language used in day to day pragmatic situations is apparently easily understandable, scientific language which has a strongly formulized structure, which may initially appear as not immediately accessible or understandable, in reality allows a more complete and greater understanding of a given phenomena.* He goes to say [...] *there is no substantial difference between day to day language, and various scientific language. There is only a difference of linguistic grades which are formulised in different levels.* What is interesting to add is that the level of formulization varies from subject to subject, and, in VSA terms, from viable system to viable system. In this situation it is necessary to keep in mind the following principle, Asbhy's "law of requisite variety".

In conclusion, the structural 'composition of knowledge' means the use of information being re-elaborated by other available information, together with internal and external data.

The perception of reality, or of even one single event, is composed of an extraordinary interaction of viable systems and components which have many varieties of predispositions, desires and operative plans. In other words, the vital characteristics and forms of expression which characterize a moment of decision making. The process of perception which is undertaken by any subject/actor, makes the multiplicity of characteristics and expression correspond to an internal/subjective representation. In other words, the capability of keeping a grip of various forms of variety depends on operative mechanisms and procedures which have a vast range of answers and are harmonic in relation to the variety of possible situations, and perceivable combinations of a viable system which reads the expressions of context limits and the flux of perceived information. It is possible to deduce the following: the conversation between two information varieties is lead by the information variety which results as inferior to the rest (Ashby, 1956).

The forms of knowledge (Interpretation Schemes)

How is information organized within an Information Variety? The concept depends the structure that data has to assume to be able to be transformed, through contextualization, into information; the forms assumed by information correspond to the specific Interpretation Schemes used by the decision maker.

The hypothesis of transforming data in information through the application of a conceptual filter defined as a 'pattern', has already been studied: "if we consider the field which has studied memorized information, research done by Bartlett in the '30s has shown the need to describe it with a 'pattern' concept, as an organized structure of present and past experience (Pessa, Penna, 1994).

The Interpretation Schemes enables us to rationally organize the various perceptions which are involved in day to day life. Without this logical structure, we would not know how to act to any kind of change, and thus continuously need to elaborate a new model of interpretation. The Interpretation Schemes transform generic data into the information related to a determined context; they cover a wide-range of addresses which a Information Variety can use.

Murray Gell-Mann (1992) states: *With new external incoming information, compressed structures spread themselves out in order to*

supply us with predictions or indications regarding types of behaviour, or even both. Compression, instead, is experienced when behavioural habits are identified and synthesized. The rest of the experience is due to changes, or slight irregularities, which are barely perceivable, and which cannot be extrapolated and compressed into a scheme. When a structure is not used, it tends to be integrated with new elements – which in general are casually generated – that are up to date, or derive from different sources of external perception. He goes on to say (Gell-Mann, 2000): *We have seen that when complex adapting systems emerge, they tend to operate in a varying structural cycle, in unpredicted circumstances, or phenotype consequences and retroactive selective action between various structures.* Gell-Mann's distinction between “compressed” and “non-compressed” patterns, as he describes them, enables us to underline the difference between General and Synthesis Interpretation Schemes, which is an important distinction to our study. General Interpretation Schemes define a vast organized matrix capable of rationalizing information.

Numerous definitions have been proposed by researchers from different fields in order to represent a symbolic structure of the mind:

- the schemata: the memorising of past situations to which link new situations;
- the rules of production: have facts and rules usable in any context, and then proceed by contextualizing according to specific situations;
- the semantic network: every node of a network represents a part of information of a certain concept. Recovering a version of any analyzed concept depends on how we navigate through the net;
- the frame: describes the prototype of a class of objects which is specified by a particular object, according to a given context;
- the script: proposes a structure of memory which represents stereotypical knowledge relative to certain sequences of action.

Synthesis Interpretation Schemes, instead, supply a close-knit structure of interpretation through which it is possible to filter specific information. Pier Luigi Luisi (1993) says, when referring to a General Interpretation Scheme: *Complex structures with new properties have emerged from microscopic molecules, and gone on to form the most extraordinary of properties: life itself*; Interpretation Schemes can refer to a community (of viable systems), and not only to individuals. Language seems to have the capability of supplying us with the

conditions of a decisional or operative consonance within the same community or between communities which are similar. Aldo Masullo (1966) says: *day to day language does not express ontogenetic, but rather filogenetic life style, the history of humanity and various groups rather than one single man.* In relation to this Giambattista Vico (1990) says: *common sense, judgement without reflection, commonly felt from an entire order, an entire population, nation or by the entire human kind, is proof that a common mental language exists amongst different nations and in human nature, which conceives physical objects 'as one' but also bares in mind their modifications .* Immanuel Kant's (1996) considerations are quite different: *A conscious empirical representation is perception. What I think of in relation to the representation of imagination through apprehension and comprehension (comprehensio aesthetica) of the multiplicity of perception, is the empirical knowledge of the object, and the judgement which expresses empirical knowledge is experience. When thinking a priori of a square, I cannot consider this thought as experience; I can say this when I recognize a figure which has already been drawn, and considering the square concept I can understand the multiplicity of the perception through the senses; only when thinking of an object superficially there is no moment of learning, and my representation does not depend on the object, but I am its exclusive forger.* He goes on to say: *The action of imagination which consists of giving a concept to an intuition is exhibition. The action which consists of transforming empirical intuition into a concept is comprehension. Apprehension of imagination, apprehension aesthetica (aesthetical comprehension), understanding of multiplicity in one form of representation, and in this way it obtains a certain form.*

Established strong beliefs (resistance) which oppose to change (Categorical Values)

The third factor of the defined information variety concerns the categorical values, a viable system's value system of reference, in other words its strong beliefs; they are responsible for the acceptance or refusal of certain elaborations or viewpoints rationally justifiable; they characterize the formation and the modalities of Interpretation Schemes. The philosopher Mark Taylor (2001), when referring to Categorical Values says the following: *Amongst the many things I*

have learnt from Hegel-Kierkegaard and from the events of the sixties, two appear to me as the most important. Firstly, the existence of a religious dimension in all cultures. To understand this, it is necessary to go beyond the physically visible aspects of religion, and examine the subtle complex ways it influences personal, social, cultural development. Religion often penetrates in places which we would not initially imagine. If our wish is to understand the system of a culture, it is necessary for us to learn how to individualize religion where it is less evident. Furthermore, religion is inseparable from philosophy, literature and its critics, from art, architecture, science, technology, capitalism and communism. Modern complex nets are made up of infinite strings which are tied up amongst each other, which may be difficult to undo, but can also help us trace the lines of contemporary experience and development. Categorical Values, strongly linked to the emotional level of the decision-maker, represent the subjective filter through which the Interpretation Schemes are personalized: they qualify moments of unawareness of what is perceived as 'good' or 'bad' during the moment of analysis; they establish the ethics of context in comparison to general role-models (Barile, 1994); they inspire and enable us to activate criteria which make judgement possible.

Gardner (2007) individualizes five fundamental types of knowledge: discipline, capability of synthesizing, creativity, respectfulness and ethnics. He sustains that: *there are five main kinds of intelligence involved in knowledge-acquiring; the last two concentrate on social relationships*. Gardner comes to the conclusion that there is a factor which gives form to information (synthesis schemes) and another which stabilizes how, when and where to consider these types (categorical values) of information.

Abraham Maslow (1954) also anticipates the concepts of pattern and category: *Clothing is a reaction which has adapted itself to a situation, an answer to a problem. This kind of reaction creates inertia and resistance to change [...]. Clothing is fabricated to save time, effort and concern, when facing repetitive situations. If a problem is recurrent and similar in its form, it is most likely we will save cerebral activity, if we have a habitual answer which can be automatically used to tackle it. So clothing is an answer to a problem which continuously repeats itself and thus is familiar, a reaction in a static, non-changing and constant world.*

Another significant conceptual element is the aptitude that individuals, belonging to a certain social group, have in sharing Categorical Values, as explained by Fritjof Capra (2002): *The social net then creates a body of shared knowledge – including information, ideas, technical ability – which, together with values and beliefs, contribute to giving form to characteristic costumes of a certain culture. Values and beliefs influence the body of knowledge produced by a culture; they are part of the lenses through which we perceive the world, and help us in interpreting our experience and deciding what kind of knowledge is relevant or significant. This knowledge, which is continuously modified by the net of communication, is then transmitted from generation to generation, with the culture's values, beliefs and rules. Shared values and beliefs create an identity between the members of a social net, a form of identity which is based on a sense of belonging. People which belong to different cultures have different identities because they share different kinds of values and beliefs.* Furthermore, Capra (2001) defines an interesting parallel between categorical values and the idea of culture itself: *all kinds of social phenomena are generated by nets of communication. On one hand, the net continues producing mental images, thoughts and meanings. On the other, it constantly coordinates the behaviour of its members. So the values, beliefs and rules which we associate to cultural phenomenon, derive from the complex dynamics involved in the process, and from their interdependency.*

Interpretation Schemes establish a context in which data acquire a meaning, and make information coherent to a given problematic context; they attribute 'intentionality' to thought, enabling data to pass from simple signs to information with meaning. The tendency is to conduct what happens around them to consolidated and experienced Interpretation Schemes; the risk in this case isn't that we have a large amount of data which can be hardly organized into an Interpretation Schemes but, rather, we have privileged Interpretation Schemes which we try to adapt to every form of data. The use of these so-called privileged Interpretation Schemes has derived from learning processes linked to specific areas of knowledge-acquiring (this is a tendency of areas which have high levels of specific knowledge). In these contexts, conditions of high grades of technical know-how are accompanied by limited general knowledge of a given subject. This brings to the idea of having a passe-partout which is capable of

codifying every kind of hypothesis and developing any form of knowledge, “a pattern which is good for all seasons”.

Abraham Maslow (1954) says: *The consequence is that the presence of a piece of clothing can be considered worse than an absence of reaction, because it demands a certain resistance and a construction of a new reaction, necessary to the new situation.* The process which conditions the use of a particular Interpretation Schemes – the way and the possibility of reaching a synthesis of information – is not identical to all decision makers, and not objective or absolute, but relative to different subjects (viable systems).

The following experiment expresses this (Barile, 2009). Ask a group of professionals to give a solution to problems concerning:

- a) *politics;*
- b) *healthcare;*
- c) *environment.*

We will notice that an eventual solution will come from typical interpretation schemes, according to different professional viewpoints.

An engineer will be orientated towards a certain solution, giving attention to structure, to the components, and quality, of the organisation. He will probably propose an improvement of the quality and technical know-how of certain politicians, and a reconstitution of an ecosystem in the sanitary and medical domain.

A lawyer's answer will adapt to various situations: his solution will be less precise, more vague, and depend on context.

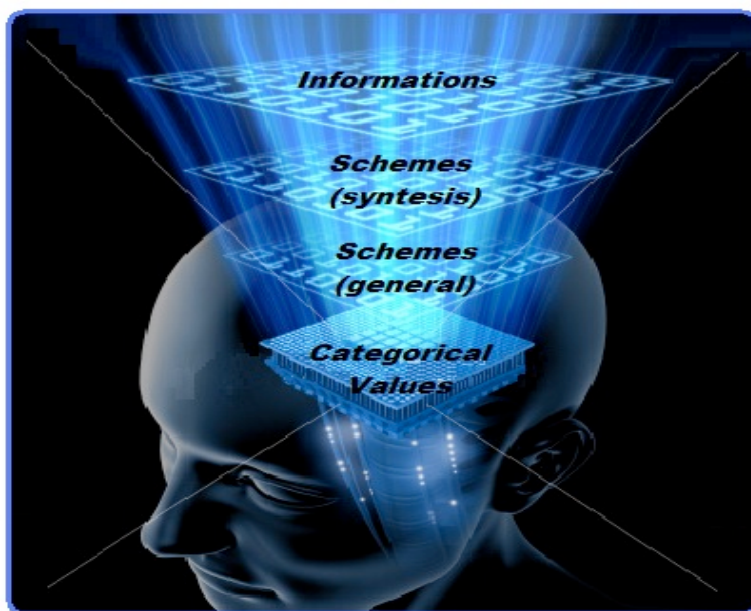
A doctor will probably believe that a solution already exists, and only has to be individualized.

‘Focalized knowledge’, typical of people who may not be capable of expressing specific forms of knowledge (niche knowledge) or be considered as knowledgeable, but are capable of defining best choices, even in difficult situations. In popular culture, people who have not had the possibility of getting higher education can be considered as wise and manifest a certain amount of sensibility towards challenging topics. In our opinion, they base their analysis on fundamental Categorical Values, upon which they interpret occurrences and individualize paths of resolution.

3. A SYNTHESIS INTERPRETATION SCHEME TO REPRESENT THE INFORMATION VARIETY

After introducing a way of representing the knowledge possessed by a viable system and its various levels of articulation, where Categorical Values support the application of certain Interpretation Schemes (general or of synthesis), which intervene in conditions of rising entropy, we can now represent the four levels upon which an Information Variety is articulated. Figure 4 shows a possible representation of an information variety.

Figure 4 – The four levels of the information variety



Source: Barile, 2009:84.

A useful metaphor must be able to explicit how the relation between various levels of knowledge should not be intended on a cause/effect basis. It is erroneous to believe that a specific Categorical Value in relation to a determined Interpretation Scheme gives way to a specific Synthesis Interpretation Scheme and thus to an objective resolution. The interaction of the factors which compose an Information Variety should rather resemble a chemical reaction than the motion of a mechanism. As certain chemical reactions are highly

influenced by context, by climatic factors, by its assessment or non-assessment and by the quality of the agents a ‘chemical’ metaphor enables us to imagine an Information Variety as a component, as a mixture in which we can individualize molecules and atoms.

A possible objection could be that the high level of variability of these conditions (chemical and climatic conditions), in a deterministic prospective, can be predicted. The answer lies in the fact that the articulation of the various problematic areas enables us to overcome difficulties. One subject may consider a certain situation as problematic in an area of certainty, another may consider it as problematic in an area of complexity, and yet still be assimilated to the above-mentioned chemical reaction (Barile, 2009).

So, what happens if we compare an Information Variety with the structure of an atom¹? It is not necessary to consider the two entities similar in form and behaviour. As established, an atom has a stable structure; only a significant quantity of energy can destabilize an electron from its orbit. The modification of its nucleus requires enormous amounts of energy. Information Variety, in the same way, needs an energetic contribution (perception and auto-reflection) to modify the position of electrons (Information Units) and of the nucleus (Interpretation Schemes and Categorical Values), but it is necessary to clarify that Information Variety, in relation to atoms, is characterized by a different grade of stability. A viable system and its Information Variety vary continuously. This parallel, which does, to a certain extent, describe the typical behaviour of variety, seems inadequate when having to explain the way in which two or more kinds of varieties interact.

A Information Variety is not material, and no physical experiment is possible, yet the structure of an atom appears as the most adequate model to represent the anatomical and physiological characteristics of a variety involved in interacting in a specific context with other forms of variety.

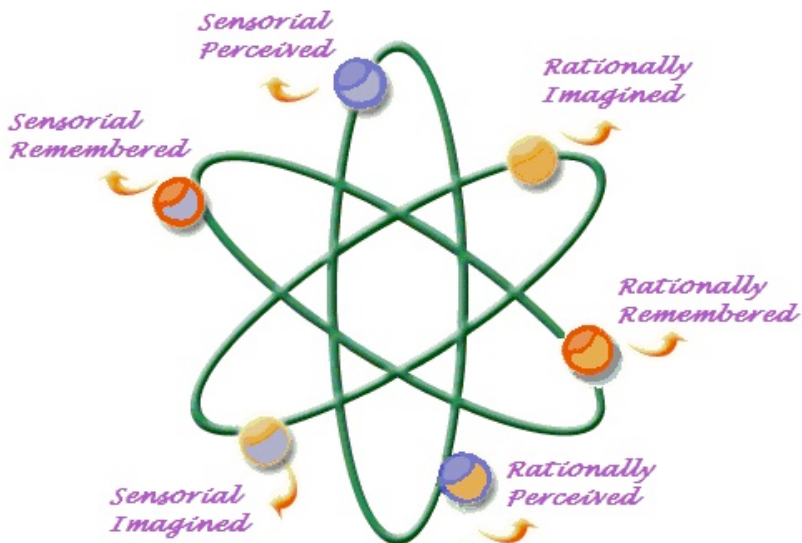
Keeping on with this metaphor, Information Units can be imagined as the electrons which orbit around the nucleus of an atom,

¹ This assimilation makes it possible for us to understand certain specific aspects, and does not present further parallels.

positioning themselves on a certain orbit. In figure 5, Information Units are represented according to two different dimensions: the first distinguishes the difference between sensorial and rational Information Units, the second specifies in perception, remembrance and imagination.

Even though perception in psychology refers to sensorial activity, we consider remembering perception as an information unit referring to the memory of a certain perception. Like for example a Pavlovian reflex: lip licking when remembering a tasty dish.

Figure 5 – A distinctive representation of the Information Units

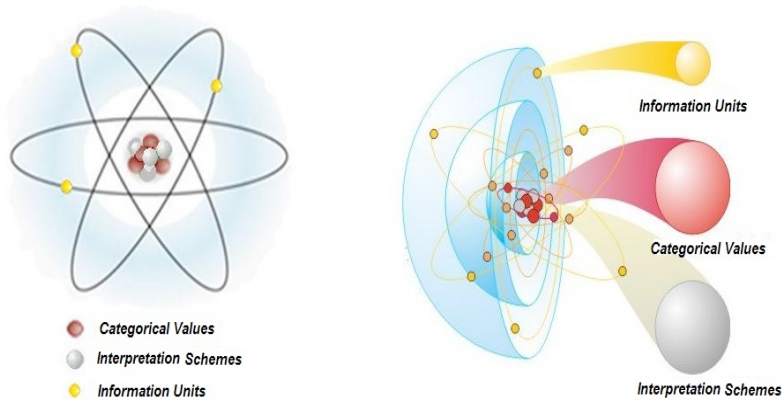


Source: Barile, 2009:87.

So, if the Information Units are the electrons, it is now necessary to individualize the elements which correspond to Categorical Values and to Interpretation Schemes. These factors are obliged to interact with the Information Units they enact with; their role is to grasp and keep Information Units in relation with each other. This conception reminds us of the physical aspect of an atom, and the action that the nucleus exercises on electrons, similar to the way the sun attracts the

planets, balancing their orbit. The model above proposes that the nucleus be formed by Categorical Values and Interpretation Schemes, as shown in the following figure. The Information Units are the electrons which, depending on their characteristics, position themselves on specific orbits.

Figure 6 – The information variety represented as an atom



Source: Barile, 2009:88.

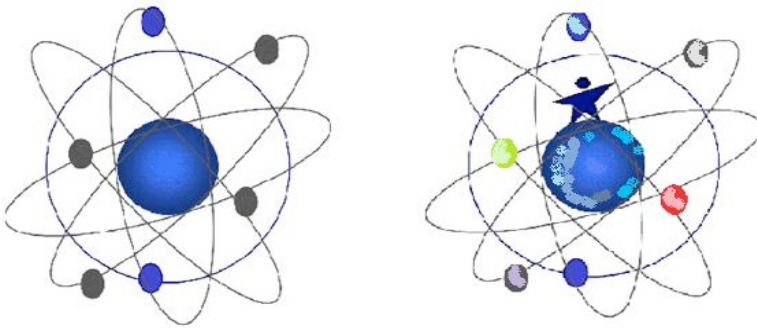
Information establishes a certain position on an orbit according to its level of understanding. Information which is easier to understand can be more easily interpreted through the Interpretation Schemes of a decision maker, and when compatible with his Categorical Values. Knowledge varies constantly in time, the movement of Information Units causes variations in Interpretation Schemes and then on Categorical Values.

Our model needs to keep in consideration the specific context; it can be described as a shapeless multitude of viable systems, in other words by a large number of Information Varieties, similar to atoms. It is also necessary to distinguish two types of Information Varieties: only active or active and passive. Information Varieties interact with others, some have the capability of influencing and modifying others, while some do not. Like a book and its reader (i.e. an Information Variety), which modifies the variety of the reader, but is not modified itself.

The following figure represents these two kinds of Information Varieties according to the structure of an atom.

The figure on the right indicates a structure which is modifiable, active and passive; the one on the left is non modifiable, remaining active. The Information Varieties which are non-modifiable have well-defined, standard colours, while the other kind, typical of a viable system, are gradient, inhomogeneous, with irregular blotches. Our aim here is to underline how a passive Information Variety is continuously stimulated by the context it lives in.

Figure 7 – Active and passive information variety



Source: Barile, 2009:89.

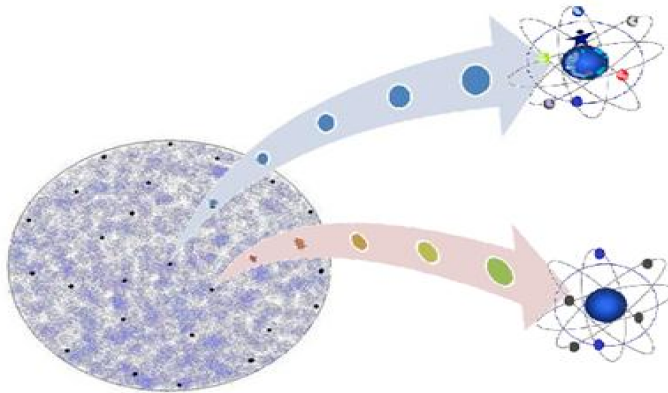
Even though we have distinguished two kinds of Information Varieties, the conception of one or the other depends on the observer. A book, an only active variety, can be considered as stable in the eyes of one observer during a certain period of time. Readers can take different content into account, and timing is central. Someone who has read a book which he has already read in the past, could perceive it differently, due to his or hers different experiences. The possibility to receive specific information from a certain variety is closely linked to the level of consonance between the variety itself and a perceiving subject.

So it must not alarm us when some people do not understand things which for others may seem banal. Young children, for example, at the beginning of their formation, have difficulty understand many concepts which belong to the adult world.

The following figure represents this aspect. The blue atom represents forms of variety which are modifiable in comparison to others which are not (the green atom). The two arrows show the condition of variety of a viable system in a specific context. The structure continuously undergoes fluxes and interacts with a 'conditioning' context. This process cannot yet be formally described with the psychological and neurological knowledge that science disposes of, but we do know that 'mood' is a determining factor. A viable system reacts according to the Information Variety it disposes of. The way mood chaotically conditions our state of mind, is an example of the same way context haphazardly conditions these viable systems.

Le scienze (2008): *the effect is due to priming, the capability of environmental stimulations to alter our behaviour which unconsciously brings specific mental constructions to memory.*

Figure 8 – Changes in information varieties



Source: Barile, 2009:91.

Context is made up of systemic and structural components. The systemic components, such as Information Variety, can be both modified and unmodified (Golinelli, 2003). In a turbulent context, where the possibilities of collision between viable systems are high, the configuration of variety is in continuous evolution.

In such a context every modality of knowledge transfer, results as inadequate (as in the school system) because of the low level of consonance between various factors. The tendency towards *consonance* is spontaneous during the interaction of varieties of information, measured and determined by the *resonance* concept.

Various factors tend to interact due to the concept of Consonance. This phenomenon can be compare to the law of gravity. The interacting factors can be individuals, organisations or communities. In a viable system scope, all these factors are considered as viable systems, and so, Information Varieties.

4. THE CONDITIONING FACTORS OF THE INFORMATION VARIETY: CONSONANCE AND RESONANCE

After describing the qualifying factors and specific characteristics of our definition of an Information Variety, we can define its dimensions, responsible for determining the possible paths of evolution of the Information Variety of the viable systems, called Consonance and Resonance.

Firstly, it is necessary to underline that a *Information Variety* [V_{inf1}] is transformed when interacting with other *Information Varieties* [V_{infk}], and that any form of expression with a meaning can, and ought to be, considered as a Information Variety itself. The evolution of any kind of Information Variety is done by mental elaboration, even though this formulation may initially be confusing. Knowledge, even when conceived as a continuum, in our study must be considered as a discrete form of representation, capable of photographing in a precise moment a 'structure', that is a viable system's knowledge heritage.

If a viable system, during a determined moment t^2 , is capable of transferring its knowledge heritage to a physical backup, this backup would enclose the Information Variety of an individual during time t .

² We are referring to the action of a governing body, which can be an individual, an association or any kind of social group.

It is necessary to underline this because it enables us to clearly represent the meeting point between a dynamic and static Information Variety. It is clear that a Information Variety contained in someone's mind can evolve, has a role which is both active and passive, can influence and be influenced by other Information Varieties. It now seems handy to define the varying dynamics of a Information Variety when interacting with incoming information (the meeting point of other Information Varieties); in fact, information can come from external 'feeling', or internal 'thinking'.

Let's consider these elements:

- ✓ u expresses a quantity of *Information Units*: $u_1 + u = u_2$;
- ✓ v_2 is the *Information Variety* relative to the quantity of *Information Units* u_2 ;
- ✓ Considering the of *Information Variety* V_{inf1} to a total of u_1 *Information Units*;
- ✓ **Cons** the *Consonance* between initial *Information Variety* v_1 and final variety v_2 ;

we have the following expression:

$$C_{ons} = \lim_{u_1 \rightarrow u_2} \frac{V_{inf1} - V_{inf2}}{u_1 - u_2}, \text{ then:}$$

$$C_{ons} = \frac{\partial V_{inf}}{\partial u}$$

Substantially, C_{ons} expresses the *Consonance* between two different *Information Varieties* V_{inf1} and V_{inf2} and defines, in terms of the *Information Units* used ($u = u_1 - u_2$), the major or minor potential that the two *Information Varieties* have in aligning their knowledge. The word 'alignment', is appropriate if referred to vector space and indicates the capability of reciprocal comprehension between the two viable systems, with their *Information Varieties* being expressed as V_{inf1} and V_{inf2} .

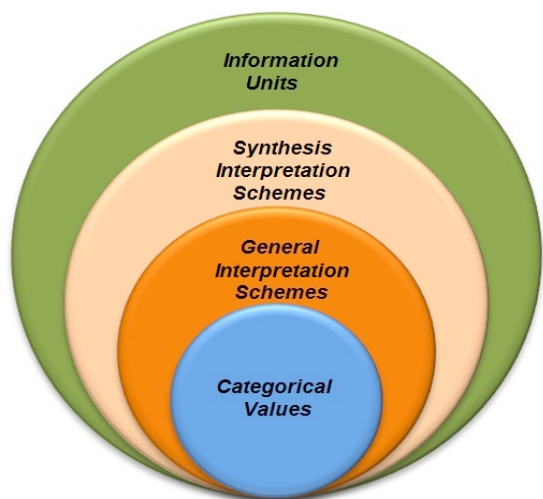
People who get along very well, who understand each other with a simple look in the eye, have a high level of *Consonance* between

their Information Varieties. On the contrary, others who are less harmonic, capable of discussing for days and days without ever reaching a compromise, means that there is a very low level of Consonance.

The way some people are capable of understanding each other by a simple glimpse of the eye, is emblematic (Barile, 2009) : $(U1 - U2) = 0$; or those who have lived a whole life together and still don't understand each other $(U1 - U2) = \infty$.

The following figure, with its different colours and intensities, simulates the content and the intensity of the composing factors of a Information Variety. Indeed, Categorical Values, Interpretation Schemes and Information Units (Information Variety's components) have different levels of intensity, and condition the possible paths of Consonance with other viable systems.

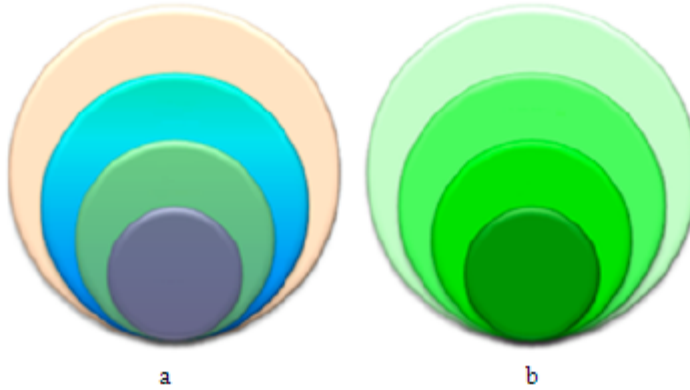
Figure 9 – A representation of the information variety



Source: Barile, 2009:95.

Let us imagine two viable systems which are characterised by varieties a and b, shown in the following figure.

Figure 10 – Different consonance according to different information varieties (1)



Source: Barile, 2009:96.

An objective assessment of the level of Consonance between these two is not possible; but considering the colours and their distribution on the various levels, we can establish that it's superior to the Information Varieties represented in figure 11 a and b, while it's inferior to the Information Varieties represented in figure 11 c and d.

Figure 11 - Different consonance according to different information varieties (2)



Source: Barile, 2009:96.

It seems evident that the level of Consonance between two Information Varieties must necessarily be correlated to the composition of the forms of variety itself, and thus to the Information

Units, Interpretation Schemes and Categorical Values which compose it.

The 'weight' of the various dimensions is different; pupils in a primary classroom, for instance, are not necessarily highly consonant, even though we assume that they have received the same notions and information from their teachers. It seems more sense to consider Consonance as a result of viewing things, the way problem solving is done, rather than as what we know or do not know. The level of Consonance depends significantly on the Interpretation Schemes used during a specific process and on Categorical Values. If two decision makers are involved in problem solving, who have the same Categorical Values such as authority, responsibility, justice, they can be considered as consonants. On the contrary, if decision makers have diverging interpretations, they result as having a low level of consonance.

Categorical Values need to interpret an abstract concept, and have to define a method which is capable of representing it. This representation is what we have defined as a Interpretation Scheme. The concept expressed by Categorical Values, together with the Interpretation Scheme (general or synthesis) that it engenders, moulds a form in which the level of Consonance manifests gradual growth, when more Information Units are added. In other words, the levels rise due to Resonance. Where a strong level of Resonance is established between Information Varieties, and in doing so raises the level of Consonance, the inevitable result is that initial Consonance is limited, and Resonance, after an initial peak also conducts Consonance to its starting point.

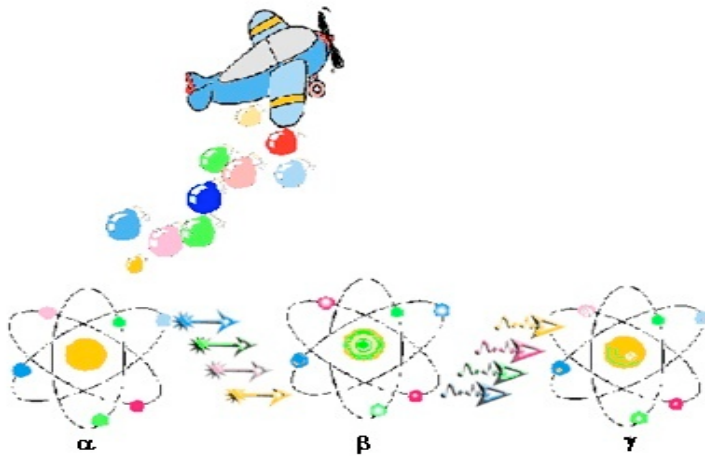
Resonance: what do we intend when referring to this concept? Resonance modifies the level of Consonance and orientates choices. The way in which a Information Variety v transforms itself dynamically, expressing its vitality within a given context, represents its level of sensibility with the supra-systems it interacts with when perceiving new incoming information. Like Consonance, it is mathematically defined as a vector, with a specific module and a direction.

We can define *Resonance* R_{is} with the following formula:

$$R_{is} = \lim_{u_1 \rightarrow u_2} \frac{C_{ons1} - C_{ons2}}{u_1 - u_2}, \text{ then: } R_{is} = \frac{\partial C_{ons}}{\partial u}$$

Resonance R_{is} represents the change of *Consonance* during the blooming period of a *Information Variety*. It expresses the intensity with which the level of sensibility of *Consonance* when perceiving new incoming information. Figure 12 graphically describes how information, represented as various different coloured ‘bombs of information’, dropping on a *Information Variety* α , transforming it into *Information Variety* β , and, due to the effect of the ‘resistance’ opposed by its nucleus (*Categorical Values and Interpretation Schemes*), how information variety stabilizes itself with configuration γ .

Figure 12 – A representation of the ‘information bombs’



Source: Barile, 2009:98

Take note that the so-called ‘information bombs’ are of various colours and dimensions. This has been done in order to distinguish the different roles that content and the origins of information have. Content is represented by dimension, while origin, in other words the position of relevance of a supra-system emitting a signal, is represented by colour. It is important to underline that colour and dimension are generally parameters which belong to subjects, the *Information Variety* which receives the impact.

The passage from variety α , through β and then to γ is worth taking into consideration. During the first transformation, the ‘bombs’ are not only perceived but also auto-generated by the intimate reflection of a variety. The transformation from β to γ , is the expression of how it reassesses itself to the configuration of initial level α , losing part of the effect. This is determined by the influence of *Categorical Values* which bring the *Information Variety* back to pre-existing conditions (positions) which have been established in time.

REFERENCES

- ASHBY, W. R., 1956. *An introduction to cybernetics*, Chapman and Hall, London.
- AUDI, R., 1998. *Epistemology, A contemporary Introduction to the theory of knowledge*. Routledge London.
- BARILE, S. (eds.), 2000. *Contributi sul pensiero sistemico in economia d'impresa*. Arnia.
- BARILE, S., 2008 (2005¹). *L'impresa come sistema*. Giappichelli, Torino.
- BARILE, S., 2009. *Management sistemico vitale*. Giappichelli, Torino.
- BARILE, S., COLARUSSO, V., 2005. *A business management model based on the viable system approach*. Giappichelli, Torino.
- BAILLY, A., 1933. *Giulio Cesare*. Bemporad & F., Firenze.
- BOGDANOV, A., 1916. *Essays on organisational science*. Theoria s.r.l., Roma.
- CAPPELLI, P., 1971. *La teoria matematica delle comunicazioni*. Etas Kompass, Milano.
- CAPRA, F., 2002. *La scienza della vita*. Rizzoli, Milano.
- CRANE, T., 2003. *Fenomeni Mentali*. Raffaello Cortina Editore, Milano.
- GARDNER, H., 2007. *Five Minds for the Future*. Kindle Edition, Harvard Business School Press.
- GELL-MANN, M., 1995. *The Quark and the Jaguar, adventures in the simple and complex*. W. H. Freeman & Co, NY.
- GOLINELLI, C. M., 2003. *Il territorio sistema vitale*. Verso un modello di analisi. Giappichelli, Torino.
- GOLINELLI, G.M., 2000. *L'approccio sistemico al governo dell'impresa*. Vol. II. Cedam, Padova.
- GOLINELLI, G.M., 2002. *L'approccio sistemico al governo dell'impresa*. Vol. II. Cedam, Padova.
- GOLINELLI, G.M., 2005. *L'approccio sistemico al governo dell'impresa*. Vol. I., II ed., Cedam, Padova.

- GOLINELLI, G.M., 2010. *Viable Systems Approach. Governing Business dynamics*. Cedam, Kluwer.
- GOLINELLI, G.M., 2011. *L'Approccio Sistemico Vitale (ASV) al governo dell'impresa*. Cedam, Padova.
- INGLIS, B., 1977. *Natural and Supernatural*. Hodder & Stoughton, London.
- KELSO, J. A. S., 1995. *Dynamic Patterns. The self-Organization of Brain and Behaviour*. Mit Press, Cambridge M.A.
- LUDWIG, R., 1994. *Critica della ragion pura*. Garzanti, Milano.
- LUISI, P. L., 1993. *Defining the transition to life: self-replicating bounded structures and Chemical Autopoiesis*, in STEIN, W., VARELA, F. J., *Thinking about biology*. Addison Wesley.
- MASLOW, A. H., 1954. *Motivation and Personality*. Harper & Brothers, New York.
- MASULLO, A., 1962. *Struttura, Soggetto, Prassi*. Libreria Scientifica editrice, Napoli.
- MINSKY, M., 1986. *The society of mind*. Simon & Schuster, NY.
- PANATI, G., GOLINELLI, G.M., 1991. *Tecnica industriale e commerciale*. Vol. I. Nis, Roma.
- PESSA, E., PENNA, M. P., 1994. *La rappresentazione della conoscenza*. Armando editore, Roma.
- RULLANI, E., VICARI, S., 1999. *Sistemi ed evoluzione del management*. Etas, Milano.
- SARACENO, P., 1973. *Il governo delle aziende*. Venezia, Libreria Editrice Universitaria.
- VICO, G. B., 1990. *Opere*. Mondadori, Milano.