# The ICS Paradigm in Knowledge and Modelling

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**Abstract**

Starting from the surprise caused by the careful reading of the contributions provided in (Bjorner, 2006a) and (Bjorner, 2006b), it has become clear that the modelling activity in the software engineering is a dynamic kind of intellectual engagement, which requires numerous internal clarifications. Furthermore, it claims the right to use the fundamental cognitive abilities in order to add rigour and efficiency to the sterotypes that are used in the software industry in order to abstract various artefacts, which constitute the solution of a software system. The authors of this paper are pleased to find out that the exploration of the human thinking's limits and subtleties create valuable results in all scientific fields, including the engineering of the software systems. This paper describes the ICS (Intuitive, Circumstantial, Speculative) modelling paradigm, which aims to make the development process of the software systems more efficient.

**Keywords**: modelling, intuitive, circumstantial, speculative

## 1. Preliminaries

The two perspectives on the problematic of knowledge are the following:

- The knowledge acquired through individual excellence (KAIE[1]);
- The knowledge acquired through associative excellence (KAAE[2]).

Essentially, both KAIE and KAAE are based on the iterative and incremental consideration of the following steps[3]:

1. The identification of a problem that does not have a solution, or the existing solution is not satisfactory;
2. The specification of the objectives that synthetically define the manner through which the problem solution contributes to the improvement of the system that generated the problem;
3. The refinement of the problem statement;
4. The elaboration of the problem solution;
5. The implementation of the problem solution;
6. The assessment of the solution's impact over the system that generated the problem.

Considering each of the highlighted steps, the individual or the involved scientific community combine, considering more or less formalized rules, the following types of knowledge:

- The sensory-perceptual (intuitive) knowledge;
- The circumstantial[4] knowledge;
- The speculative[5] knowledge;

[1] The individual is the author of a singular research and modelling process.
[2] The research and modelling process is realized by a scientific community.
[3] Although these steps resemble to some specific activities in the field of software engineering, the things are essentially the same in any domain.
[4] More details regarding circumstantial knowledge in Section 2.
[5] More details regarding speculative knowledge in Section 3.

- The artistic[6] knowledge;
- The demiurgical knowledge.[7]

The combined investigative schemes that have long been used highlight the importance of a cognitive approach's iterativity and incrementality, in order to ensure an ascending trend of the knowledge from a historical perspective. Thus, it can be concluded that **the incentive to advance the knowledge is the human being's appetite to address the problems, which are often created by himself**.

Additionally, there are numerous problems implied by the laws of the universe. Their resolution is always debatable and topical.

Furthermore, there are many issues, which are determined by the human being's demiurgical mimicry. Their resolution bears the seal of singurality that is not capable to resonate in a satisfactory manner with the symphony of the big ideas, which exist at the foundation of the natural universe.

**The human knowledge, irrespective of the approached problems, is approximate.**

It is up to the human being that the long series of achievements in relation to knowledge, resonate in a more profound manner with the expectations of the absolute spirit of the knowledge, regardless of its embodiment. It is already proven that the **advancement of the knowledge is a long and difficult** process. The fundamental abilities that the human being uses during this process are the ones that have already been presented. This paper does not intend to contradict other points of view regarding the understanding and modelling of the human knowledge abilities. The obstacles that affect this approach are obvious. The human thinking is not pure mathematics, it is not reducible to philosophical sentences, it is not the art to write genius poetry, it is not even the art to just make assertions that respect the mathematical logic. The limits of these ways through which thought manifests are known. Additionally, it is difficult to understand the subtleties of the human thinking. The theory of knowledge studies the multiple dillemas that accompany the process, which tries to understand and model the human thinking. The history of the mankind does not know a relevant philosopher that didn't try to explain the role and the fundamental mechanisms of the human thinking. The mathematicians tried to establish the logical foundations of thinking.

Moreover, the specialists that work in the field of the education sciences have formulated numerous theories that attempt to decipher the mchanisms of the human thinking, as they are perceived from an educational perspective. These specialists haven't managed to design a uniform model, but even more, there is contradiction concerning the way they understand:

- The conceptual framework that discusses about the mechanisms of the human thinking;
- The capabilities that are required in order to allow the humans to think;
- The utility of the infinity in the attempt to explain the human thinking;
- The problem of truth, as an essential premise for any system that formalizes the processes of thought;
- Etc.

This paper intends to found a research model regarding the methodic exploration of the human thinking limits, which intends to find new modalities to understand the complexity of the universe. In this context, it can be asserted that the concrete reality, which is understood through the **intuitive** and **circumstantial knowledge**, are coded and valued using the abstraction power of the **speculative knowledge**. Each scientific field is supported by its own "evangelists" that are able to elaborate reference contributions for their discipline of interest. As an example, the software engineering may consider the following such contributions:

[6] This will be discussed in a separate paper.
[7] This will be discussed in a separate paper.

- Design patterns;
- Architectural models;
- The principle of encapsulation;
- The dependency inversion principle (DIP);
- Etc.

These are examples of remarkable products of the speculative knowledge, and their significance goes well beyond the field of software engineering. The **design patterns** may be regarded as a genuine model for the creation of a thesaurus, which is made of the valuable experience that is accumulated in a certain knowledge domain. The **principle of encapsulation** abstracts a cooperation formula, which is mutually beneficial between the creator of an artefact and its beneficiaries. The **dependency inversion principle** clearly states an axiom, which finally seems to be evident in any domain of activity: "The details should depend on abstractions. The opposite is against the demands of the speculative knowledge".

## 2. The conceptual foundations of the sensory-perceptual knowledge

This paper is not necessarily an alternative to the numerous clarifications brought to the mechanisms of the human thinking by important scholars in scientific fields, such as phylosophy, psychology, pedagogy, logic, artificial intelligence, etc. The certainties that emerge include the fact that at the foundations of the human thinking, the sensory-perceptual paradigm is very important. Without the sensory-perceptual component, the human thinking is decoupled from reality. The human connection to the reality is a sophisticated process, which has its roots in the perception of reality, using the huge analytical potential of the „instruments" that the humans use in order to interact with the visible and concrete part of the reality. The human being is able to use multiple capabilities in order to receive information about the reality in the form of sensations. Nevertheless, some philosophers ironized the virtues of the sensory-perceptual knowledge, by accusing it of missing outstanding systemic-structural features. The sensory-perceptual knowledge was invented by the Creator in order to mainly support the information collection relative to the real world artefacts. The quantitative complexity of the data that can be acquired through sensory-perceptual mechanisms may pose significant challenges to the upper levels of the human thinking. As a consequence, **the next step in the effort to understand the reality is materialized in the human's ability to obtain unifying representations in the form of perceptions, considering the rich variety of the data gathered using the tools of the sensory-perceptual knowledge**.
Considering that this paper is preoccupied to understand and model the various components of the human knowledge, a few considerations will be made, which are of interest for the sensory-perceptual level.

**Definition** 1. Let us call sensation any data that refers to the state of a real world artefact, and this data has been fetched with an **essentially sensory knowledge device** (ESKD).

Thus, the ESKD devices are used in order to ensure the direct contact with the real world. It is usually asserted that the sensation is unmediated knowledge. This is a comfortable statement, which may be criticized if the operating mechanisms of teh ESKD devices are studied attentively.

The following invariant aspects are particularly important for the specialists in any scientific field:

- The sensation is a subjective representation of a feature that pertains to a real world artefact;
- The ESKD artefacts, which the humans possess, are able to learn;
- The basic method used in order to instruct an ESKD artefact is the iteration, which includes the methodical testing of the acquired data's accuracy;
- The iterative usage of an ESKD artefact is premise for obtaining more data with a sensory substrate;

- The **precision of the sensory data is inherently approximate**, as the sensation is a subjective representation of the real world.

Considering more formal than operational reasons, it can me observed that the usage/ operating schema of an ESKD artefact is iterative and incremental, which may ensure, in the long run, an ascending trend of the sensory data's quality. This evolution is necessary in order to offer consistency to the iterations that are present at the knowledge levels, which are placed above the sensory level.

**Definition 2**. Let us call perception a subjective representation of an artefact, which is obtained by capitalizing the sensory data acquisitions.

It is obvious that:

- The perception is a synthesis product of the human's cognitive and intuitive abilities;
- It may be considered that perception is the product of an intuitive abstraction effort;
- Perception **allows the human to report to the real world artefacts in the absence of a direct contact with them**.

It is not sensational to highlight that by learning to properly handle the perception, the human being retains the essential out of the large amount of data that can be acquired by using the ESKD mechanism. Considering the level of perception, the essential is, in contrast with the speculative idea of essential, the same thing as the tadpole is in comparison with the frog into which it eventually transforms. Nevertheless, the perception is used in order to maintain the natural link between the sensory-perceptual knowledge, and the sophisticated world of speculative knowledge.

**The perception anticipates the affinity of the speculative knowledge for the systematic abstractization, and it also highlights the need to associate the abstractions with an adequate intuitive support.**

The convergence process between the human thinking and the meaning of the data acquired using the ESKD artefacts is laborious. Considering this perspective, it can be asserted that **perception is an intermediate product, which is obtained when the human is preoccupied with highlighting the meaning of the data that is obtained using the ESKD artefacts**. The power and brightness of the acquired sensory-perceptual data meanings is valued in a superior way only if the subject of a cognitive experiment accesses superior levels of knowledge: the circumstantial, the speculative, the artistic, the demiurgical. The preceding assertion is illustrated by highlighting the important role that mathematics can play, considering its numerous branches, in order to elaborate a framework for perception modelling, while presuming that sensation is a solved problem. More precisely, **given some statistical data that represent the evolution of some processes in society, it is possible to use complex statistical models and indicators in order to extract significant ideas out of these large amounts of statistical data**.

## 3. The conceptual foundations of the circumstantial knowledge

### 3.1. Remarks regarding the circumstantial knowledge

The real world, becoming a subject of research, has to be understood and / or modelled. Understanding the world and modelling it are two activities that help humans to develop a complex relationship with the universe and its hidden creator. Understanding or modelling the world means to be producer and / or consumer of knowledge. The preoccupation for the field of knowledge means to be part of the group of people that are interested in their own intelligence.

**The human intelligence efficiently combines the monotony that is inherent to the circumstantial knowledge with the satisfaction that accompanies the vast and profound connections, which are realized by the speculative knowledge.**

**The circumstantial knowledge has the goal to describe the primary structure of the artefacts that are studied or modelled.**

The primary structure of a studied artefact abstracts the boundaries of the field in which this survives and relates.

The survival of an artefact in a certain relational concept defines its utility. Additionally, changing the analysis perspective, the utility of an artefact is conditioned by the rationality of its structural contents. The following definition has the role to better clarify the idea of circumstantial knowledge.

**Definition 3**. Let us call circumstantial knowledge any method that a human uses in order to understand and represent the structural invariants of a real or conceptual artefact.

The syntagm "structural invariant", which is mildly pleonastic, has been deliberately used in order to indicate the focus of the circumstantial knowledge towards the structure of the real world or conceptual artefacts. The first requirement that a creator manifests over the structure of an artefact is represented by a certain stability over time, which refers to the temporal invariance that allows for the artefact's structural potential to be valorized and assessed. As a consequence, it is natural to enquire why the realization of a product that aspires to the temporal invariance is the opera of a knowledge type that is called circumstantial.

The intention of the syntagm "circumstantial knowledge" is to highlight the fact that the circumstantial thinking means to relate as rigorously as possible to the circumstances that found a cognitive approach. In spite of the good intentions of a circumstantial cognitive approach, the errors, either assumed or involuntary, always exist, which naturally highlight the quality of the circumstantial knowledge products' invariance over time.

As a consequence, it seems realistic any cognitive approach that makes out of the systematic doubt an ingredient that guarantees the benefits of the spiral in an iterative cognitive approach. The spiral of knowledge gives substance to the second essential attribute of a cognitive approach, the incrementality. In the context of scientific knowledge and modelling, the incrementality guarantees the authentic and effective increase in knowledge. It can be stated that the structure of an artefact abstracts:

- **The granularity of the artefact's internal structure**, which is expressed through:
  - The list of components;
  - The list of the relationships between components;
- **The granularity of the interface that is used by the artefact in relation with the environment,** which is expressed through:
  - The list of components;
  - The list of the relationships between components;
  - The list of the components' relationships with the artefact's environment;
  - The list of the components' relationships with the system's internal structure.

It is correct to mention, through anticipation, that **the comprehension and representation of the structural invariants** of an artefact can be facilitated by the circumstantial knowledge, while **the discovery, specification and optimal assessment of the structural invariants** is, in essence, the vocation of the speculative knowledge. Thus, the idea to suggest the autonomy of the two types of knowledge is unsustainable.

**The large or small progresses in the field of knowledge have been invariably obtained by combining, in an inspired manner, the monotonous rigour of the circumstantial knowledge, with the unconventional creativity that defines the speculative knowledge.**

The circumstantial knowledge helps us to anchor in the circumstantial reality. The accuracy of this process is dependent on the **horizon** and **efficiency** of the procedures that are used by the circumstantial knowledge in order to explain or model a segment of reality.

**The horizon of a knowledge method defines the momentary limits of the method. The efficiency of a knowledge method measures the accuracy and the novelty of the data that is obtained by using the method.**

**The circumstantial knowledge is mostly analytic.**

Through anticipation, it can be stated that the speculative form of knowledge **is indispensable for the elaboration of the synergetic representation models of the data that is obtained through circumstantial methods**.

Furthermore, on the other hand, the speculative knowledge is permanently preoccupied with searching the reasons for which a creator chose a particular way of structuring the produced artefact. The identification and the explanation of these reasons is possible by using analysis and interpretation methods in the context of artefacts systems. Considering the results that it generates, **the speculative knowledge is essentially preoccupied with understanding the specificity of a system, which distinguishes the system from its components, or the mechanical sum of these components**.

Thus, **it is justified and useful to recognize the preponderantly synthetic character of the speculative knowledge.**

### 3.2. Invariants in the context of the circumstantial knowledge

The following paragraphs present the essential landmarks of an approach that is centred towards the circumstantial knowledge. These landmarks may be naturally considered invariants as long as they are not affected by obsolescence.

Although these invariants are present in any circumstantial knowledge approach, it can be admitted, once more, the fact that their presentation is partially tributary to mechanisms that are specific to the field of the software systems engineering.

The invariants that are discussed, which refer to the realization of a software artefact, are the following:

- **The identification and definition of the problem** that requires the realization of the target artefact (IDP);
- **The beneficiary's point of view** concerning the features of the target artefact (BPV);
- **The expert's point of view** regarding the knowledge / modelling, relative to the realization of the target artefact (EPV);
- **The analysis of the problem** that requires the realization of the target artefact (AP);
- The abstractization of the target artefact's solution (AS) using:
  - The existing formal framework;
  - The experience accumulated by the users of the existing formal framework;
- **The definition of the conceptual artefacts** that are part of the target artefact (DCA);
- **The relationship between the conceptual artefacts**, which are components of the target artefact (RCA);
- *The appeal to the speculative knowledge in order to rethink the formal framework*[8] (ASP);

**Essential remarks regarding IDP**

The sensory-perceptual knowledge is strongly oriented towards obtaining intuitive representations of existing real world artefacts. At the same time, **the circumstantial knowledge is oriented towards solving the problems.** Regardless of their nature, the problems have to be identified and defined. The two components of an IDP approach are the following:

[8] In order to rethink its own formal framework, the circumstantial appeals to the speculative knowledge. Otherwise, the spiral of the knowledge progress loses altitude.

- **The analysis of the system at a certain moment, which is oriented towards the identification and the definition of its circumstantial limits;**
- **The analysis of the system at a certain moment, which is oriented towards the identification of its evolutive potential's limits;**

In other words, **the problem statement is drafted considering the state of the system and its environment at the moment when the IDP approach is conducted**, but also **by anticipating the changes that may occur in the system's environment**. These may contribute to the system's degradation or disappearance over time.

**Essential remarks regarding BPV**

The process of solving a problem always has its beneficiaries. The proper knowledge concerning the points of view of the problem's beneficiaries has the following essential advantages:

- **It contributes to the adequacy of the solution relative to the demands of the environment that will value it** (the mission of the artefact – the managerial perspective, the vision regarding the realization of the artefact – the managerial perspective);
- **It assures an optimal framework for the assessment of all the component artefacts, and the target integrative artefact**, during the entire problem solving process;
- **It contributes to the elaboration of reliable models, which allows the solution to relate to the inevitable changes of the problem's statement.**

**Essential remarks regarding EPV**

Without minimizing the importance of IDP and BPV, EPV represents a defining moment for the process that has the role to solve a problem. It is sufficiently demonstrated by the accumulated human experience regarding the problems solving in various domains, the fact that **"each problem has several solutions"**. **The duty of the expert is to find the most attractive solution at a certain moment**. Thus, the solution of a problem can be assimilated to an artefact with certain particular features. Considering a non-exhaustive perspective, it can be stated that such an artefact is attractive if:

- It is ingenious;
- It is easy to implement;
- The data that it produces become input for other artefacts, with reasonable costs;
- Etc.

As a consequence, it is natural to state that the vision, which founds the realization of the artefact that embodies the solution of a problem, is essential for the attractiveness of such an artefact. The formation of the specific abilities for an expert that belongs to a certain field of knowledge / modelling is a process that is conditioned by proper individual and associative evolution (i.e., KAIE and KAAE). **The cognitive abilities of the expert at the circumstantial level must excel not only through the vastness of the data concerning the domain that is researched / modelled, but also through the optimal interpretation / valorization of this data, using speculative patterns that are already substantiated and operationalized.**

**Essential remarks regarding AP**

The analysis is an old method for starting the embodiment of a vision, which an expert adopted in order to obtain the solution of a problem. The motivation that underlies the vision orientates the analysis activity in a certain direction. Each vision represents, in fact, a compromise that the expert makes with the hope that a systemically attractive artefact will be realized.

**The analysis activity should produce circumstantial data, which are strictly required in order to found an abstraction approach for the optimal solution of the problem. The choice of the abstraction method should also be the subject of the analysis activity.**

**Essential remarks regarding AS**

Enhanced with the ability to abstract, **the human may widely open the gates of the unknown**. All the data that is obtained about the invisible and visible world become the raw material, which fuel the human's capacity to abstract. Considering the vast list of the invariants that manifest during the human abstraction activity, let us mention the following;

- The identification and definition of the essential considering the two perspectives:
- The essential as a circumstantial ingredient;
- The essential as a speculative ingredient;
- The formalization of the conceptual schemes for the refinement of a problem's solution;
- The optimization of the abstraction effort's reusage;
- The planned management concerning the complexity of the artefact's elaboration process;
- The rationalization of the artefacts' adaptation schemes to persistent changes;
- The methodic **storage of the most performant abstraction schemes.**

The essential, as a circumstantial ingredient, is discovered following the abstraction effort's focus on multiple behavioural stereotypes of the artefacts in the environmental context, at the moment when the abstraction approach is effected. The choice for an essential set of stereotypes is a problem, which has a solution that is naturally affected by obsolescence. Nevertheless, the obsolescence has to be slow, and it should not threat the essential structural equilibria of the artefacts.

The essential, as a speculative ingredient, considering the remarks in section 3.1, **is indispensable for the elaboration of the synergistic representation models of the data that is obtained through circumstantial methods**. The speculative knowledge is the only one able to define the reasons why a creator chooses a certain way for structuring the artefact that is produced.

**Essential remarks regarding DCA**

Fully aware of the importance of abstraction, the experts in research / modelling have to assume the definition of the component conceptual artefacts, which prepare an optimal framework for the implementation of the artefact that is the final goal of the abstraction approach. In this context, a series of decisions are taken, which can be assessed from a formal and personal perspective, that is, essentially from a circumstantial perspective. The definition of the component artefacts is, in theory, continuously perfectible. Nevertheless, in circumstantial terms, it can be completed after the aspects regarding the relationships between the artefacts are addressed.

**Essential remarks regarding RCA**

The responsibility regarding the specification of the relationships between the component conceptual artefacts can be considered the ultimate challenge for an expert that aims to excel by using the circumstantial potential, which exists at a given moment. The definition of the component artefacts imposes certain limits to the utility of an artefact. The relationship between the component conceptual artefacts of a problem's solution, imposes limits to the adaptation of the solution to challenges, such as:

- The changes in the domain of the problem;
- The technological changes;
- The changes concerning the speculative paradigms that are used;
- Etc.

**Essential remarks regarding ASP**

Considering any domain of activity, the progress is conditioned by the appeal to the speculative knowledge, in order to rethink the formal framework in which the activity occurs. In the absence of this systematic approach, stagnation is the optimistic variant, while the pessimistic variant, the regress and the dissolution of the infrastructure that may keep an ascending trend of the knowledge in a community, is not excluded. The consideration of the speculative knowledge does not have only scientific or artistic connotations. Each step forward in science or arts may bring oblivion on truths and beauties that once seemed to be eternal. Thus, **the consideration of the speculative knowledge is a tool that can be used, in principle, only by the wise without provoking imbalances in the universe that makes use of the speculative knowledge**. Consequently, it seems not only reasonable, but also useful, the activity to develop the ethical dimension of any human speculative approach. The speculative knowledge is responsible for the way the human cognitive abilities support his moral aspirations.

## 4. The conceptual foundations of the speculative knowledge

### 4.1. The definition of the speculative knowledge

First, let us define an as reasonable as possible definition of the speculative knowledge, in order to prove its usefulness.

**Definition 3**. Let us call speculative knowledge any method that is used to discover new meanings in a certain circumstantial context.

In other words, the speculative knowledge can help us to discover the usefulness of a circumstantial cognitive approach. Naturally, the discussion about usefulness does not only imply the advantages, but also the disadvantages of a certain way to structure reality. These disadvantages may be obvious or subtle.

Furthermore, the speculative knowledge is responsible for defining a correct formal framework for the elaboration of a circumstantial cognitive approach.

Consequently, observing the field of manifestation of the speculative knowledge at a high level of abstraction, it is possible to emphasize two hypostases in which the speculative knowledge is very useful:

- The retrospective speculative knowledge (RSK), which refers to an individual's ability to see the way forward, in order to determine the true structure of an artefact that is directly observed. It can be stated that such an individual has the gift of the retrospective speculative knowledge (RSK).
- The anticipatory speculative knowledge (ASK), which refers to an individual's ability to see beyond the farthest artefact, which can be observed by the human eye. It can be stated that such an individual has the gift of the anticipatory speculative knowledge (ASK).

It can be mentioned that both RSK and ASK are main branches of the speculative knowledge, which have links with creativity. This is an implied ability for someone that manifests in a certain domain of knowledge.

The high level creativity, which surprises through novelty, astonishes through the complexity of the connections, and excels through the simplicity and originality of the solutions, cannot exist outside of RSK and ASK.

### 4.2. Invariants in the speculative knowledge

The model of the spiral is important for the research and modelling processes. Following, a brief perspective concerning the invariants that operate in the speculative knowledge is presented ( The detailed presentation of this invariants constitutes the subject of a future paper):

- The identification / definition of the research / modelling domain;
- The elaboration of the support paradigms for research / modelling;
- The expert's point of view in the scope of knowledge / modelling;
- The analysis of the problem;
- The abstraction of the solution using;
- The existing formal framework;
- The experience accumulated by the users of the existing formal framework;
- The definition of the conceptual artefacts;
- The relationship between the conceptual artefacts;
- The *appeal to the speculative knowledge in order to rethink the own formal framework*[9].

## 5. Brief considerations at the boundary between circumstantial and speculative

In the context of the presentation of a cognitive approach's particularities, which efficiently combines the circumstantial and speculative knowledge, the remarks contained in **Table 1** and **Table 2** are useful.

*Table 1. The human being as a subject of the knowledge, from curiosity to the nostalgia of the absolute truth*

| **The human, as actor of the knowledge, is motivated by:** | **The human, as actor of the knowledge, is capable of:** |
|---|---|
| Curiosity | Intuitive circumstantial knowledge |
| Personal interest | Stereotyped circumstantial knowledge |
| The appetite for abstraction | • Intuitive speculative knowledge<br>• Formalized circumstantial knowledge |
| The appetite for the speculative reasoning | • Formalized speculative knowledge at the niche level (RSK)<br>• The refinement of the support formalisms for the circumstantial knowledge (RSK) |
| The nostalgia of the absolute truth | • Unifying speculative knowledge (ASK)<br>• Reinventing the support formalisms for the circumstantial knowledge (ASK) |

Considering the information that is presented in Table 1, let us study the synthetic ideas that are contained in Table 2.

*Table 2. Five maturity levels for a subject of the knowledge*

| **The level of the knowledge's subject** | **The behaviour of the knowledge's subject** |
|---|---|
| The curious man | *Collects data out of curiosity*, approximately in the same way that the bee collects pollen, without questioning or dramatizing. |
| The man that is guided by interest | *Collects and stores data with a well determined goal*, in the same way the mole fills its storeroom with carrots, in order to have food during the winter. |

[9] The speculative knowledge critically examines its own efficiency

| | |
|---|---|
| The man that has appetite for abstraction | *Collects and stores the data using the advantages of formalization* (the control of redundancy and the optimization of the scenarios). He has the soul warmed by the hope that the monotonous appearance of the data may communicate a lot about the beauty of the moment and the fantasies of the eternity, if the data reaches an optimal level of structuring. |
| The man that has appetite for the speculative reasoning | *He knows that the limits of the knowledge exist, and their inertia can only be addressed using the instruments of the speculative reasoning.* |
| The man that has the nostalgia of the absolute truth | *He is continuously looking for a speculative formula, which is using the absolute truth, in order to give meaning to the existence of mankind and, eventually, to the existence of the universe.* |

Thus, there are five maturity levels of a cognitive approach's subject, which may be synthetically characterized as follows, cosidering the objects that the subject of the cognitive approach relates to:

- Level 1: Implies real world objects, as they are perceived by their users;
- Level 2: Implies the external representation model of the real world objects. This representation is thought to be accessible and useful to the experts in the problem's domain;
- Level 3: Implies the internal representation model of the real world atomic objects. This representation has the role to facilitate and optimize the processing that is specific to the implied objects. These models represent the entrance door of the objects represented in external format into the operating logic of a problem's solution. Consequently, the internal representation model of the real world atomic objects is part of the specific formalism that operates in the domain of the solution;
- Level 4: It corresponds to the durable representation models of the artefacts, which are featured by a significant structural potential;
- Level 5: It involves the elaboration of investigative methods, which aim to find the optimal modelling **variant of the artefacts.**

## 6. Conclusions

Modelling the knowledge itself is an old wish of the researchers. Understanding and especially simulating some of the cognitive skills of man are challenges, which force the rethinking of the links with the world of intelligent systems, with the intelligence itself. Considering the modest quantitative and qualitative achievements in the field of the artificial intelligence, and the numerous applications of the classical computer science that may benefit of some added intelligence, thus becoming super smart artefacts, it becomes clear why this paper draws a vision of knowledge from the ICS perspective.

The next step is represented by the refinement of the ICS paradigm, such that, as an example, the software engineering and the computer programming map in a more natural fashion on the patterns of the natural intelligence. This may offer to the specialists in the field of the software systems engineering an approach with unsuspected virtues in other paradigms.

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