

## **Strategic Briefing A Conceptual Process Model for Building Design**

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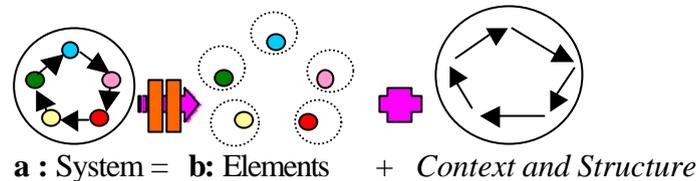
### **ABSTRACT**

Nowadays building design problems are divided in partial discipline related sub-problems. Through targeted and focused attention to sub problems however the awareness of the whole is lost. Each design participant gives his sub-problem first priority. In contrast in the past the master builder saw the whole problem as his problem first. Thus the process of seeing the design problem as a whole, as a result of prioritizing, considering constraints, or strategizing, is lost in today's practice, basically because this process is a mental and implicit process, that occurred in the brain of the multi-disciplinary master builder. In most cases it is the task of no one in a design team today. The aim of this paper is modeling this conceptual mental implicit process design using System Theory and Cognitive Psychology, trying to determine the structure of the design problem as it occurs intuitively in the brain. The result will provide us with a mechanism that enables us each time to refine a unique common design problem representation. This leads to more effective use of design team capabilities, and forms an essential basis for organizing efforts toward collaborative solutions. Also some kind of clarity is provided as to how proposed solutions are to be judged.

### **1 INTRODUCTION**

Ever since the genesis of mankind, designing is their most significant, purposeful act in seeking to fulfill higher hidden desires and needs. Process design as a mental activity occurs before any proper action (design) was always their mental implicit mechanism, allowing them to find ways to approach these desires and needs effectively. Nowadays, our disciplinary education system, forces toward multi-disciplinary participation in designing or solving problems in general, which supposes solving the (design) problem collaboratively, depending on a representation of the (design) problem as a whole. This representation is the result of an implicit mental process in the brain of the multi-disciplinary master builder in the past, and it is necessary in today's practice in order to use it as a reference in the memory of each participant, in order to steer his process of design in harmony with other design team members toward their common goal (Figure 1). The results of this ongoing Phd study, outlined in this paper, the fragmentation of the complete design task in modern practice is re-considered, making use of Cognitive Psychology where these implicit mental process of generating the design problem

representation as a whole takes place in order to reply the human needs for housing which are behind the naturally starting of this mental process.



**Figure 1: The design problem a: represented as a system, b: as elements when divided between the participants. Note the unrecognized loss of the coherence or the Context and Structure of the system, which is the difference between whole and the sum of parts**

Based on a combination of existent knowledge about the brain structure, of the way the brain processes information and forms concepts, and of the psychological human hierarchy of needs originally described by *Maslow* and reconsidered in this Phd project to fit the new knowledge, a generic model for conceptual process design was built. The aim is reconstructing the design problem as a whole by creating a direct access to the relevant information to flow into the proper locations in the brain, connecting the needs as a set of motivations on different levels of abstraction, forming an immediate symbolic representation in the short-term memory. *“The mind is a symbol system and cognition is symbol manipulation”* (*Simon, 1996*), so that the brain can decode it by engaging the subconscious or the innate intuition to find the solution.

*“The creative mind can be subdivided into the inventive, the artistic, and the logical or rational. The secret of inventiveness is to fill the mind and the imagination with the context of the problem and relax, and think of something else for change. If you are lucky, this subconscious will hand up into your conscious mind, your imagination, a picture of what the solution might be. It will probably come in a flash, almost certainly when you are not expecting it. This is true of all creative thinking whether in engineering or not.*

*It is also important to realize that our subconscious minds will hand up their suggestions in the form of symbols or pictures. The subconscious has no vocabulary. To encourage communication between the conscious and the subconscious, we should practice their only common language, which is in three-dimensional pictures. That is why all engineers should learn to do three-dimensional sketches.*

*Sir Arthur Eddington observed, “we sometimes have convictions which we cherish but cannot justify; we are influenced by some innate sense of the fitness of things. “Sense of the fitness of things” it is the nearest we can get to a positive definition of engineering artistry too. Logic is not enough”.* (*Gordon L. Glegg 1969*)

This approach is expected to enhance creativity: the intuitive human capability to convert complexity into simplicity, change chaos into order and helps bringing back the coherence to the problems we aim to solve.

The result will be introducing a design of new model called Strategic Briefing that will offer a shift from the present Data Centric approach towards Process and Concepts Centric approach in the future design of buildings. The Model is expected to provide a steering mechanism, which allows creative solutions to arise within what may appear very limited resources.

*``We need a process model of collaborative design to describe certain phenomena in which the design tasks are undertaken to possibly reach the final design. The model is important for all participants to understand his/her position in design collaboration, and for researchers to analyze design activities`` (Mao-Lin Chiu, 2002).*

## 2 THE LEVELS OF HUMAN INTERACTION WITH THE ENVIRONMENT

Human beings interact with the environment on different levels of abstraction in order to attain their desires and needs, using different combinations of sensing organs and the brain (Figure 2). *``Everything we know about the world comes to us through our senses. All human beings are born with certain basic needs, the satisfaction of which is central to their being. Original needs, once satisfied, tend to be replaced by needs of a similar though more exacting type. The satisfaction of original needs tends to breed new of a basically different type`` (Gasson 1974).*

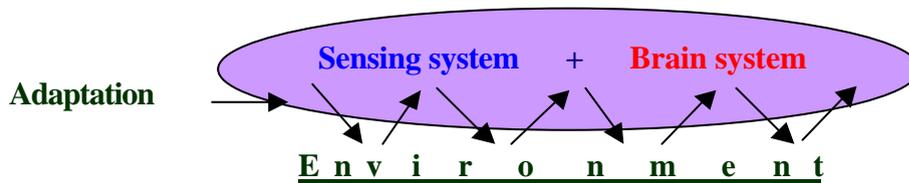


Figure 2: **Humans adapt themselves to the environment using Sensing system and Brain**

The human hierarchy of needs determines of the necessary interaction levels with the environment. The aims of interaction arranged in order to reply the needs are satisfying the Biological, Physiological, Physical, Functional, Cultural, Intellectual, Human, and Spiritual existence, allowing Humans respectively to Survive, to Propagate life, to perform Functional, Social, Intellectual and Human Role (Figure 3).

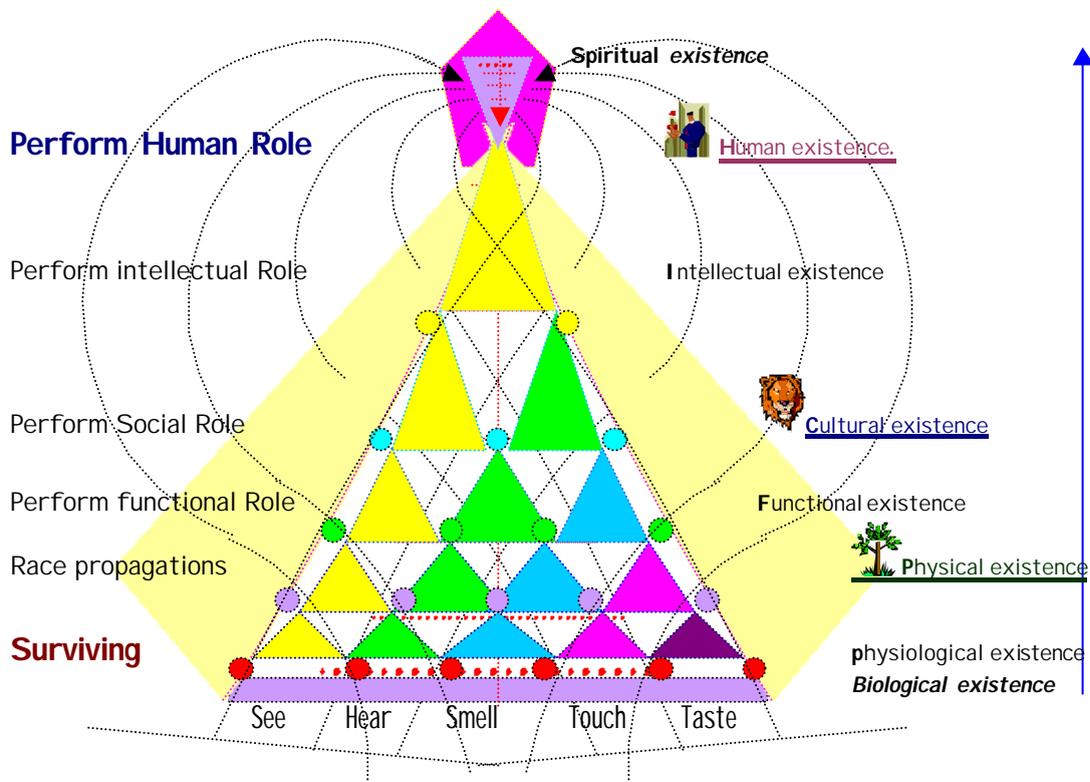


Figure 3: The relation between the human different needs to exist, the aim of this existence, and the set of the sensing organs concerned in interaction at each level

At the basic lowest level humans have to interact mechanically with the environment in order to satisfy the basic human needs which allow them to stay alive or to survive as individuals biologically and physiologically. Mechanical interaction means for example eating where human has to change the substance of foods into enzymes and vitamins etc., to be used as energy and building materials for the body. Humans also try to protect the self from a mechanical attack, for example that he crashes into an accident or be eaten by a lion. Mechanical interaction is combined mostly with less conscious interaction like Physical, Chemical, Sound waves, Electrical, Mental and Spiritual, like when eating we are physically touching, chemically smelling, hearing, seeing, thinking and inspiring. An important notice here is that the levels of interaction correspond to the engaged sensing organs, e.g. for Mechanical interaction we use the mouth to bite, and the tongue to taste, for Physical interaction the skin to touch, for the Chemical interaction we use the nose to smell, for the Sound waves interaction the ear to hear, for Electrical interaction we use the eyes to see, for Mental interaction we use the mind, and for spiritual interaction we use our spirit (Figure 4).

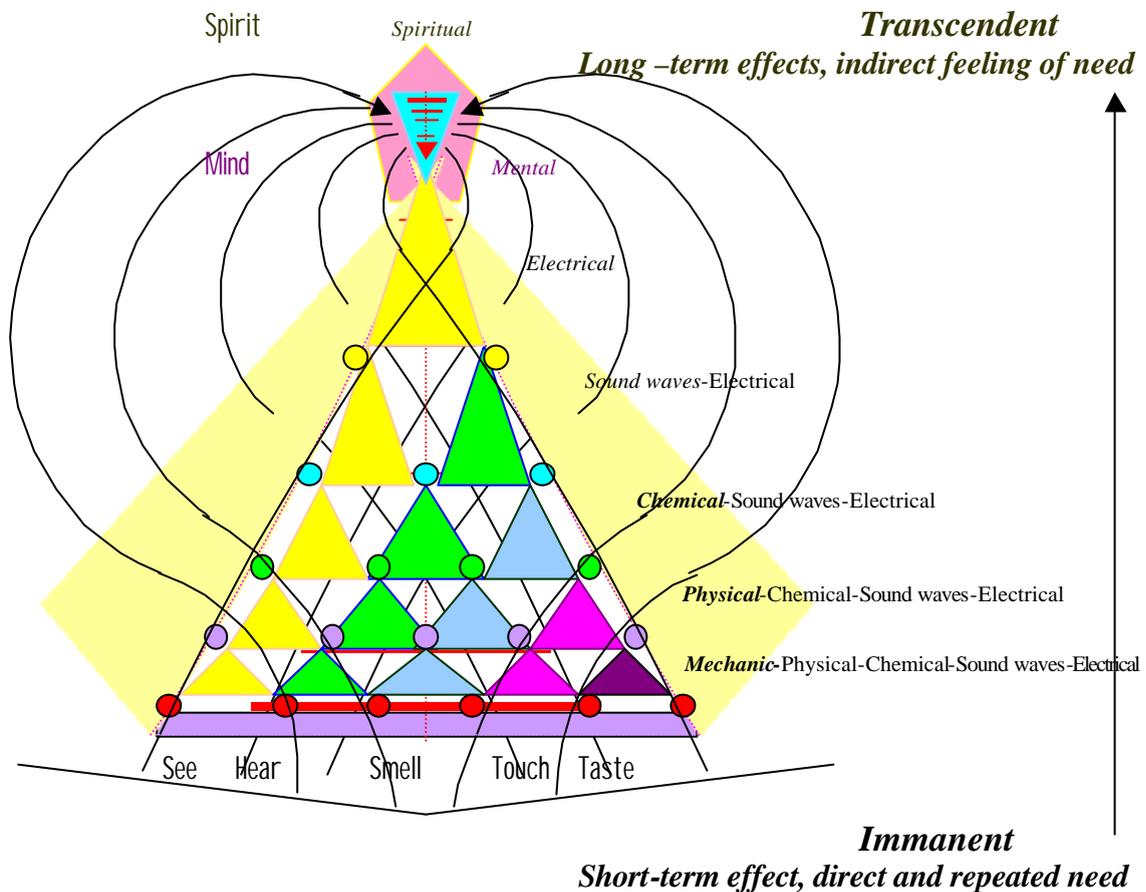


Figure 4: **General reference for understanding the outside world, which is used by humans in order to make mental illustrations of what is going on outside the self or what is needed from outside the self. Horizontal are the human equipments to interact with the environment and vertical are the levels of interaction with the environment**

Mechanical interaction can only Individually being experienced while Physical interaction can in the ring of the closer Family or friends, the Chemical interaction which can be useful for performing functional role on an Organizational level, the Sound waves interaction can be useful in the Social ring for the communications, Electrical interaction directly via the eyes to the brain, like enjoying the aesthetic of a piece of master work, or having the pleasure of reading a novel, is useful on Community level. For Mental interaction we as humans can share every thing with all other beings on Global level.

With spiritual interaction, people believe to communicate with invisible supernatural beings like God or Angels (Figure 4).

At each next level up as humans we interact less consciously, like by physical interaction we use one sense less than mechanical interaction so that we begin with touch and not any more with taste (the sensing we lose in order, when we go higher are: Taste, Touch, Smell, Hear, and See, corresponds to approximate ranges of sensing organs). At each level up we miss one sense until we leave the realm of sensing system (conscious) into the realm of mind (subconscious), which makes from each situation an image of how much we are interacted with the environment or how much we want to interact with the environment. The needs on lower levels are *Immanent* and have short-term effects and direct repeated frequency; while on the higher levels they are more and more *Transcendent*, have long-term effects and indirect feeling of need. For example we need to eat three times a day but we recognize our need to enjoy aesthetic or inspiring symbols with less urgency and repetition (Figure 4). For the translation of the General reference into the human needs for building see figure 5.

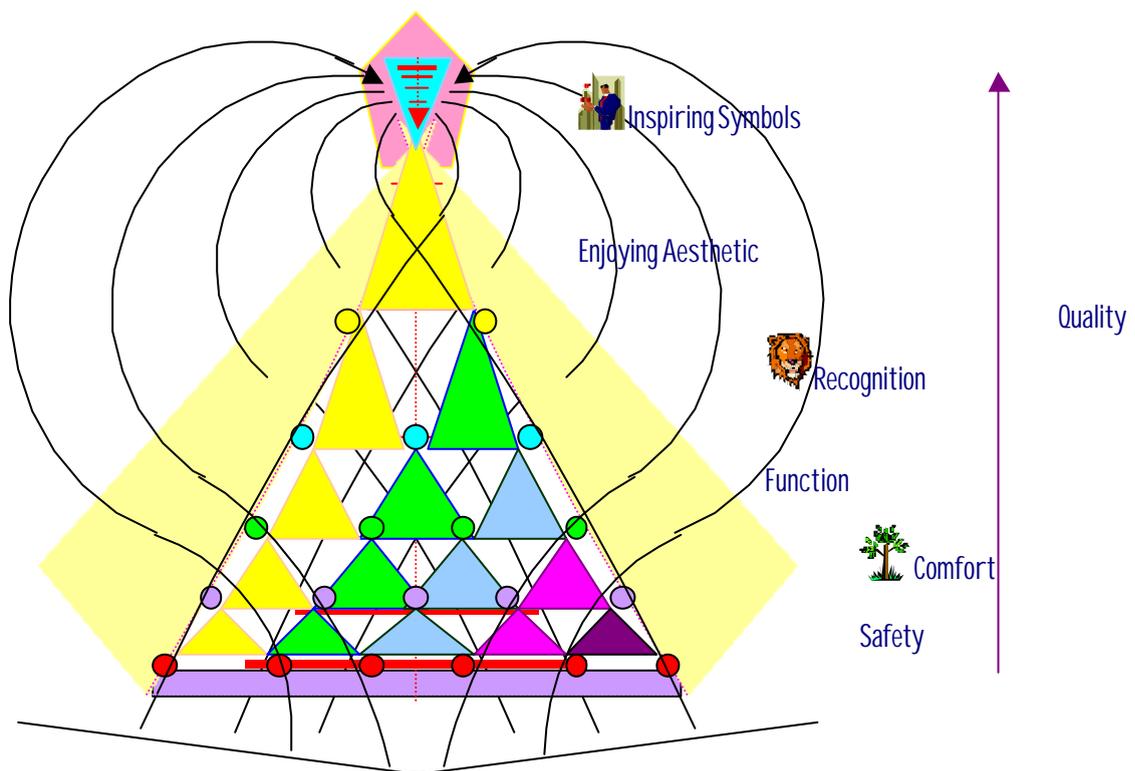


Figure 5: **Human Hierarchy of needs for building**

## 2.1 The alphabets of the mental image that illustrates the needs

“The memory is a code written in electrical and molecular alphabets” (Walter J. Freeman, 2001). The human mind reflects the needs on the memory as combinations of motivations vary according to the situations, as a code written horizontally by *Molecular Alphabets* representing the kind and the number and of the sensing organs concerned in interaction, and vertically as *Electrical Template* representing levels of interaction with the environment. See figure 6.

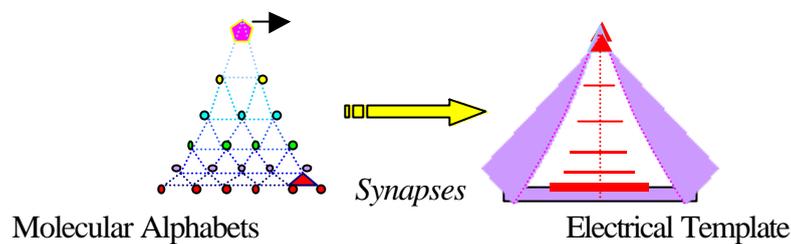


Figure 6: Mind alphabet components for forming images illustrating the outside world

## 2.2 Establishing the Structure of the (design) problem by the brain

“Conceptual design is that part of the design process in which, by the identification of the essential problems through abstraction, by the establishment of function structures and by the search for appropriate solution principles and their combination, the basic solution path is laid down through the elaboration of a solution concept. A further advantage of setting up function structure is that it allows a clear definition of existing sub-systems or of those to be newly developed, so that they can be dealt with separately” (Pahl & Beitz 1988)

As we saw earlier, satisfying desires and needs of human being means adapting the Self to the Environment in one of the following three possibilities:

- 1- By changing the self (Plant e.g. adapts the Self to the Environment in order to attain its needs by directing the self toward the sun).
- 2- By (re)-designing the environment. (E.g. birds build nests and humans also do).
- 3- Or by (re)-structuring the long-term memory, which supposes to hold all inborn and learned knowledge and experiences to serve as inner reference for evaluating the new experiences. Example: when somebody smokes a cigarette for the first time, mostly he will find it an unpleasant experience, but if the social context enforces this habit, and he begins to get used to it, he will change his first innate memory reference and begins to like smoking. (Only humans do that).

In the way of choosing between the forms of adaptations, human has first to understand the situation, which means making an illustration or a mental abstract of it. Making this abstract requires a discrimination of the incoming stimuli via the sensing systems first into relevant/irrelevant, and then into type and degree of each relevant stimulus, followed by categorizing, taxonomizing, abstracting and then holding this abstract (figure 7-C), as an illustration of what is happening out side of the self (figure 7-B), using the alphabet components of forming images for illustrating the outside world as explained earlier in figure 6. These processes of understanding - *which are the same for learning* - is an essential first step for proper action.

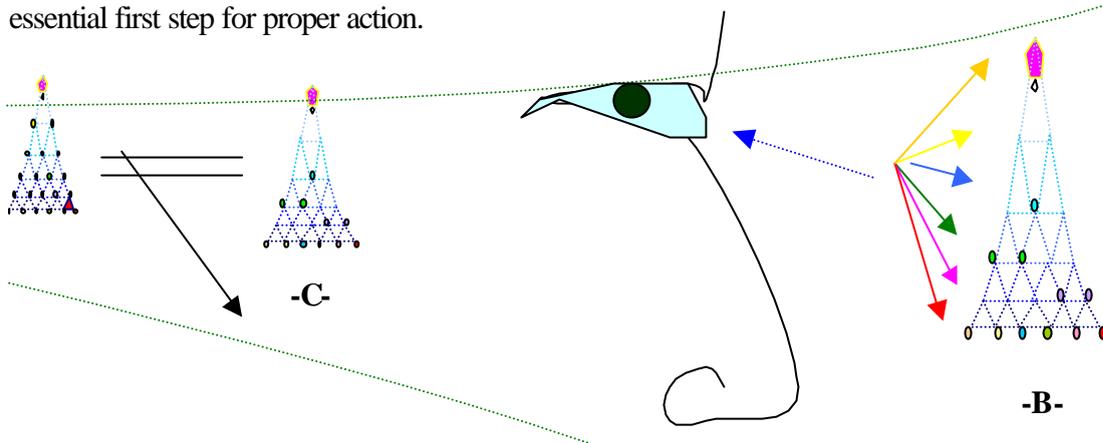


Figure 7: **B** is what going on outside the self, and **C** is an illustration of it

The second essential step for a proper action is recognizing the difference between the abstract representing the outside world incoming via Sensing System, figure 8-C, and the abstract representing the inside world or the innate, inborn and learned inner Reference, figure 8-A, responsible for evaluating the new experiences, functioning as a long-term memory reflecting the total of human needs on a certain moment in the mind.

The result of recognizing the difference is a mental third abstract (Figure 8-D), representing the optimum that the solution has to deal with. It is a representation of what man likes to have, or what man likes to change, as a set of motivations on different levels of abstraction.

But since we as individuals have different emotions towards the same set of motivations, and because of scarcity, the third abstract has to be manipulated (Figure 9-F). This manipulation results in different orders of motivations. Also considering the constraints like the finance availability, man may have to change the order of motivations, which results later on in taking another course of actions.

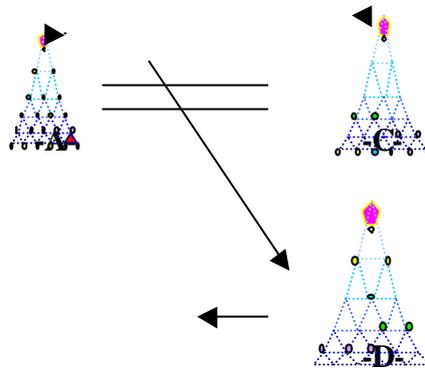


Figure 8: **D = The difference between the abstract representing the outside world C, and the abstract representing the inside world A**

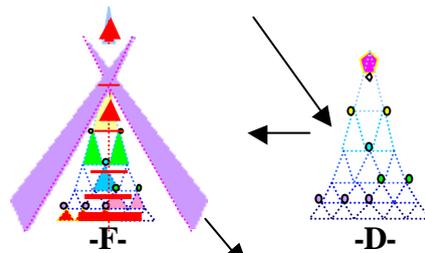


Figure 9: **Emotions and constraints attribute to motivations in order to define the direction of motion**

The result of this manipulation is then a mental representation illustrating not only the result of comparing the inner image to the outer one, but also illustrating the position, the order and the direction of motions between the intended to fulfill motivations as a system of objectives in the form of symbolic negative mental image of the Conceptual Process Design, which is how to solve the design problem as a whole, as a set of interrelated motivations in order, as occurred in the master builder brain (Figure 10).

The connection between these interrelated motivations gives birth to the concepts need to be developed in order. An example to explain these phenomena is when somebody mentions to you two points or places in a known or unknown city. If you are well known in the city, your mind will conceptualize the street connecting the two places. If you are unknown with the city, your mind will try to connect the two places by trying to collect necessary information enough to conceptualize the way between them. In both cases the concept you are trying to generate is well defined by the two points. So our conclusion from this example applied in our case is that a concept begins its life in the brain only after the determination of at least two different motivations.

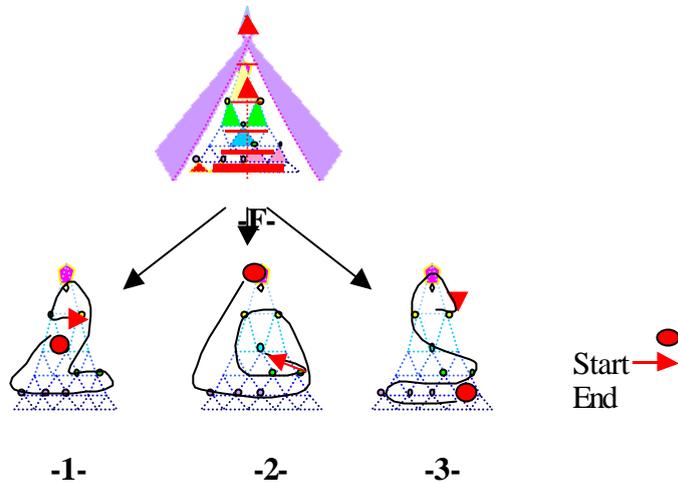


Figure 10: Different connections between motivations reflect different strategies that result in different processes of design

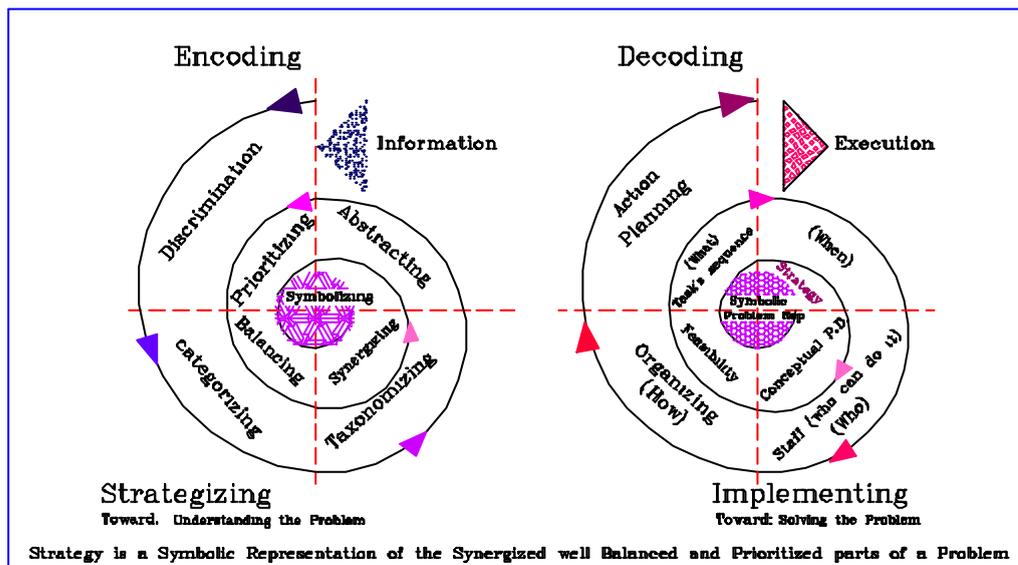


Figure 11: Encoding concludes first Understanding: Discriminating, Categorizing, Taxonomizing and then Abstracting and second Strategizing: Prioritizing, Balancing, Synergizing and then representing this Symbolically. The sub-conscious mind decodes this symbolic representation intuitively in order to solve the problem

This model as well as other models represented in this paper is intuitively built, logically reconsidered, and after that is scientifically supported by careful studies of many references that deal with the separate model parts in different contexts, like (Koen Lamberts and David Shanks 1997), (Goerg van Krogh and Johan Roos 1996), (Ned Herrmann, 1995) and (Bloom's Taxonomy)

Manipulating the third abstract considering the personal preference (emotions) and constraints is what we call Strategizing. Strategizing contains certain mental operations namely: Prioritizing, Balancing, Synergizing and then representing this Symbolically (figure 11), and that is because ``*our mind is a symbolic system*`` (Simon 1996).

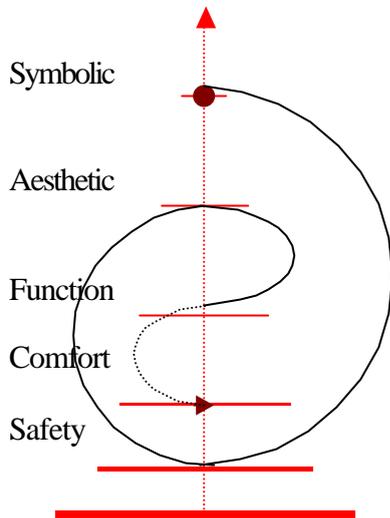
Doing that is just the same as simulating the universe, by understanding its principles of balance, and its mechanism of motion, as basics for understanding its coherence or the awareness of all parts or elements for their positions, orders and their directions of motions. The context and structure of the solar system e.g. is the coherence or awareness of positions and orders (weights), what create the balanced gravity between parts and direct their motions. It is the mechanism of motion, which is the same when emotions (weights), are attached to motivations giving direction to the motion or defines the why behind the motion (behavior), which creates the satisfying sense and the balanced feelings, when behaving.

Having no reference means having no ability to recognize differences. No recognition of differences means that the third abstract representing the space of the problem needs to solve as a set of motivations stay undefined, and as a result emotions related to the motivations cannot be built. No emotion's building means no order of motivations (no priorities). No order of motivations means no direction of motion between the motivations as a result of the utilitarian balancing which means no strategy. No Strategy means no effective decision-making, and as a result no Conceptual Process Design, which means random decisions and arbitrary process. Having a reference is therefore important in order to make a proper process and was therefore an essential subject in our second chapter of this paper.

### 3 REPRESENTING THE DESIGN PROBLEM IN THE MIND

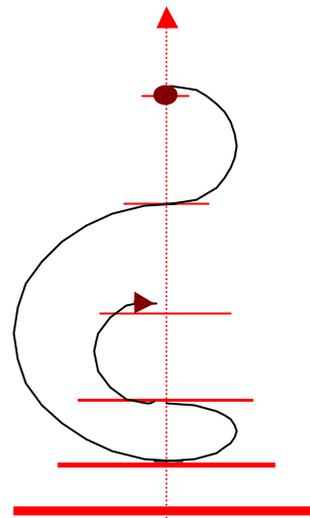
We saw in the chapter 2 about human hierarchy of needs in the architecture of building that the human motivations on different levels of interaction are: Safety, Comfort, Function, Aesthetic, and Symbolic values. In chapter 2.2 and 2.3, we explained how the brain builds the structure of a (design) problem as set of interrelated motivations, which give rise to the concepts needed to be developed. These concepts are later to be used to justify and explain explicit physical descriptions of design, and give a hint to particular skills that a participant must have in order to participate in the design team. In order to make the idea easier to understand, we would like to give more explanation using knowledge concerning some special buildings like the Pyramids. Reflecting the power and eternity of the Egyptian civilization on global or even on universal level, required the designer to connect the symbolic value into the safety value, figure 11-A, which results in, that the concept needed to be developed is looking for the most steady and stable form that human being can imagine in order to feel safe, and that was the Pyramid. The

mystery behind the building of the Pyramid stays eternal because humans are not used to make a direct mental link between motivations from the highest to the lowest levels.



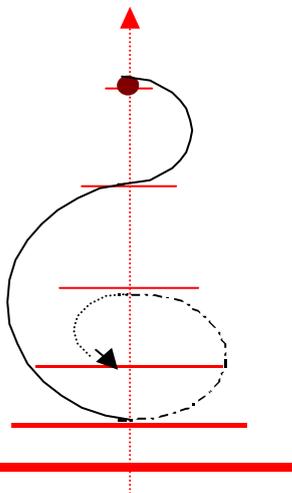
**A- Pyramids**

**Showing Power:** (Symbolic/ safety), (Safety/ Aesthetic), (Aesthetic/ Function),... (Comfort/ Function)



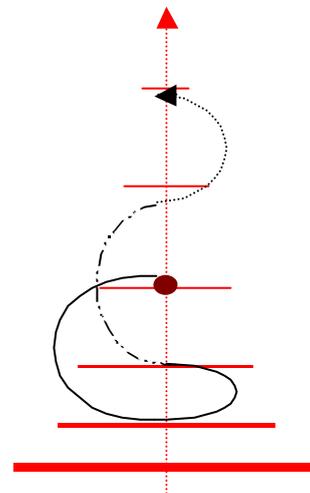
**B- Opera Sydney**

**Showing Welfare:** (Symbolic/ Aesthetic) (Aesthetic/ Safety), (safety/ Comfort),



**C- Eiffel Tower**

**Showing Prosperity:** (Symbolic/ Aesthetic) (Aesthetic/ Safety),...



**D- TUE / HG**

**Showing pragmatic:** (Function/ Safety), (Safety/ Comfort), (Comfort/ Aesthetic),...

Figure 12: Different connections between the motivations result in totally different concepts

Humans usually make mental links between motivations on closer levels. Mental linking between motivations from highest to lowest levels care for a mental chock when the impact of the link is negative or a mental kick when it is positive. This extreme mental link is astonishing when the impact is negative, and inspiring when it is positive. Notice the differences between abstracts representing different buildings (Figure 12).

### 3.1 How the brain generates a representation of the design problem

As we said earlier, Safety (S), Comfort (C), Function (F), Aesthetic (A) Symbols (S`), these are values to be perceived via the sensing systems, sub-conscious mind, and spirit have to be:

- 1- **Prioritized (P):** graded in terms of urgency, so that the most urgent one will have the priority and so on. For example: (S`, A, F, S, C). By that the brain makes relations between these motivations in terms of order, forming a set of motivations. We should notice that it is not necessary to have all of them.
- 2- **Balanced (B):** defined at which level(s) of interaction is the former set of motivations has to be placed, at: Individual (I), Family (F), Organization (O), Society (S), Community (C), Global (G), or at Universal levels. Also we should also notice that it is not necessary to use all of them.
- 3- **Synergized (Sn):** connecting the set of motivations into the levels of interaction, for example: O (S`, A, F, S, C) + F (S`, A, F, S, C) + I (S`, A, F, S, C)

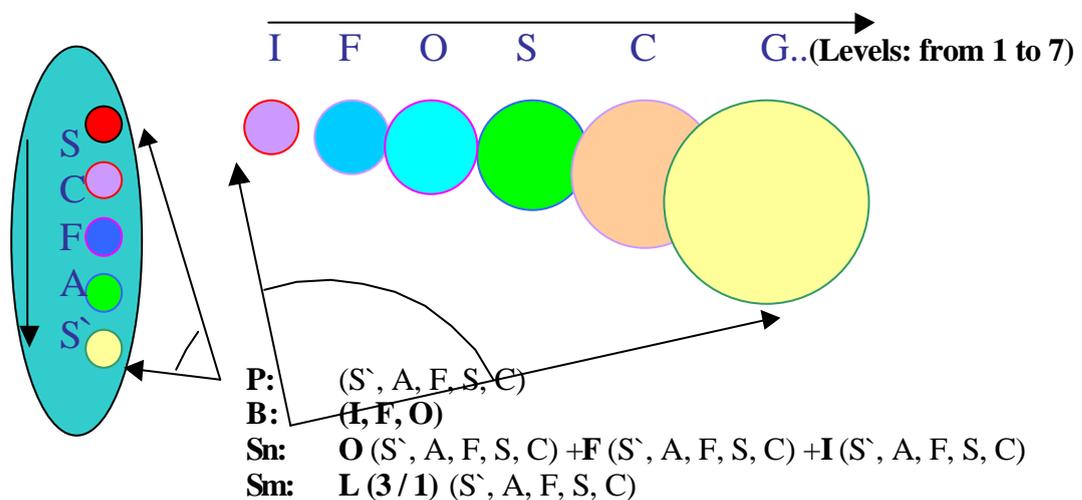


Figure13: For every project an initial analysis is necessary to analyze the requirements representing the design problems qualitatively, and abstracting to identify the essential problems

- 4 **Symbolized (Sm)** abstracting the former result by recognizing the interval of interaction levels and the set of motivations for example from Level 3 down till level 1 multiplied by the prioritized set of motivation (S, A, F, S, C). Important to notice that the brain ordering as well the motivations as the levels of interaction from high to low as follows: S, A, F, C, S and: **G, C, S, O, F, I** resp (figure 13).

#### 4 THE SHELL OF THE SNAIL AS METAPHOR FOR OUR CONCEPTUAL PROCESS DESIGN MODEL

“Every problem-solving effort must begin with creating a representation for the problem- a problem space in which the search for the solution can take place” (Simon).

When the initial requirements are well understood from a generic point of view, we can establish our Snail Shell model, depending on:

##### *Orbits: the wanted interaction levels*

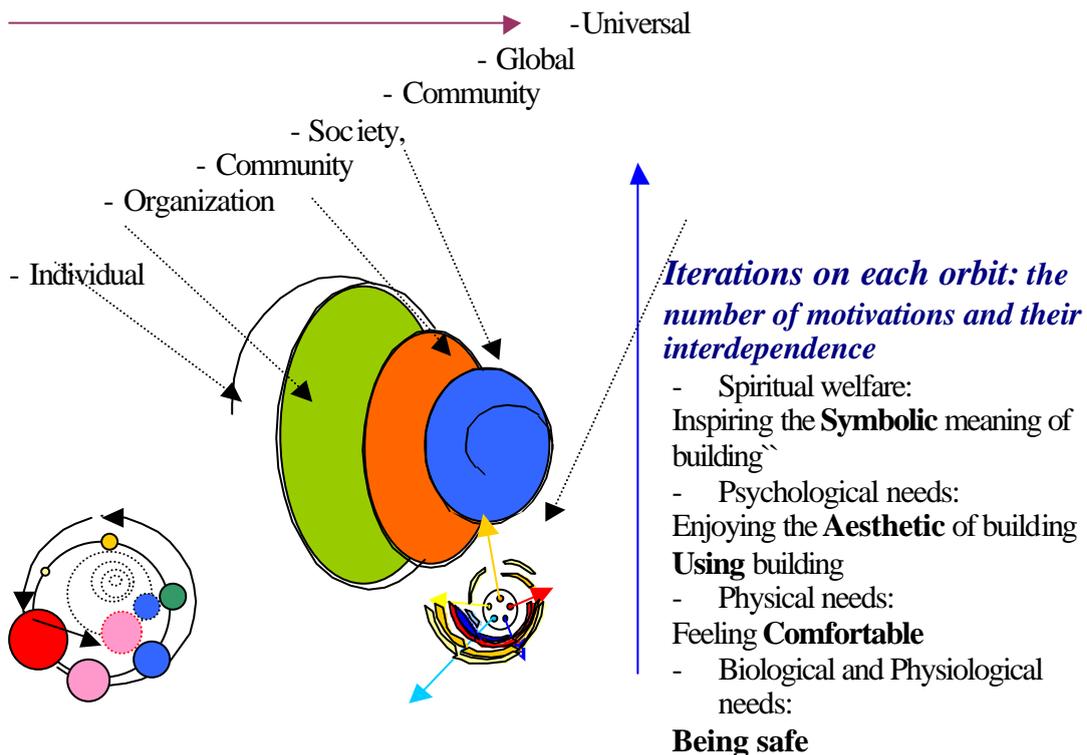


Figure14: The Snail Shell Model as a generator for Conceptual Process Design

*“Conceptual variables are the schemata that provide the underlying order and structure for an aspect of an architectural design” (Ömer Akin, 2002).*

The motivations and their interdependence (Symbolic, Aesthetic, Function, Comfort and Safety), and the Client wanted interaction levels with the environment: Mechanical, Physical, Chemical, Sound waves, Electrical, Mental, and Spiritual. Corresponds to: Individual, Family, Organization, Society, Community, Global and Universal. We can determine how much iteration in each orbit, and how many orbits we have to run. See figure14.

#### **4.1 The Benefit**

*“The mind is a symbol system and cognition is symbol manipulation, and the most intuitive leaps are acts of recognition. Chess game: The information associated with familiar patterns may include knowledge about what to do when the Pattern is encountered. The expert recognizes not only the situation in which he finds himself, but also what action might be appropriate for dealing with it” (Simon).*

The immediate benefit is that by recognition of the information structure illustrated as a Snail Shell, human can intuitively estimate the time, the costs and the quality of the product according to the number of motivations and their interdependence, and the wanted interaction level with the environment. See figure 15. For example if the work has to start getting the values in such a sequence like: Symbolic, Aesthetic, Function, Comfort and Safety then the estimated time, costs and quality will be higher than when the work starts getting the values of Function, Comfort and Safety.

Also when the Client’s wanted interaction levels with the environment are defined in following order: Mechanical-Physical-Chemical-Sound waves-Electrical- Mental - Spiritual, corresponds to: Individual, Family, Organization, Society, Community, Global and Universal, the expected results will be less qualitative than from an order like Spiritual- Mental - Electrical- Sound waves- Chemical- Physical and Mechanical corresponds to: Universal, Global, Community, Society, Organization, Family, and Individual.

The horizontal and the vertical lines in the structure of the snail which form the intersections between the levels of interaction and the extracting lines of iterations define the timing, the order or the sequence of concepts need to be developed (Figure 16). The needed skills and capabilities of the candidates who are going to participate in designing, can also be determined when the levels of interaction and the motivations are defined as high or low, e.g. if the design problem asked for developing a concept that connect two higher motivations like symbolic and aesthetic laying on global level of interaction.

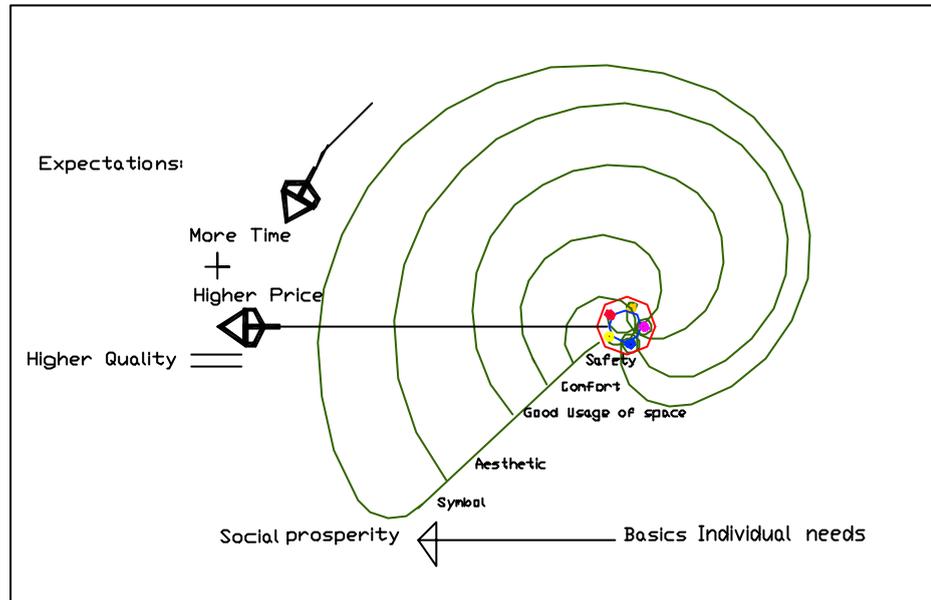


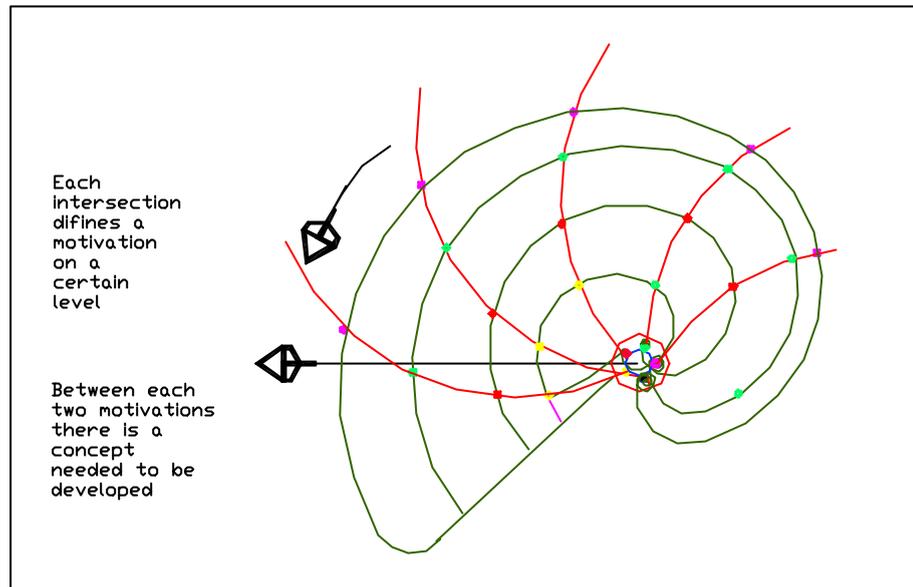
Figure 15: Mind represents the design problem as an image that can be sub-consciously or intuitively decoded for estimating the time, the costs and the quality

Then the skills and capabilities of the candidates who are going to participate in designing also have to be high, because not every architect for example can translate the concept of connection between the symbolic and the aesthetic values on a global level in an adequate design.

## 5 CONCLUSIONS

This paper provides a basic understanding of how the brain generates an abstract symbolic representation of the (design) problem as a basis for generating the concepts need to be developed in order to solve the design problem as a whole, which is necessary for supporting the collaborative design of building.

This basic understanding represented in the Snail Shell Model shows that the relationships between project objectives is interconnected and Process Design is the understanding that stating objectives in different order (Encoding) means explicating different priorities. As a result the Decoding of the structured information results in a specific process design. That means different iteration cycles each time that refines new design concepts, unique team organization and differences in time and costs.



**Figure16: Mind representation of the design problem, determines the sequence of concepts needed to be developed, and the skills of participants aiming to participate in designing**

The information structure in form of a Snail illustrating the design problem would contain a code about how the project is to be managed which makes it explicit how each domain consultant interact with other members of the design team.

The Model as represented in this paper will be further discussed in relation to other field of knowledge like Cognitive science and Cognitive Psychology, and applied in practice for testing and improving. The result will be the Phd thesis, expected to be finished end this year.

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