Strategic briefing : a tool for conceptual design in the early phases of the strategic building design process

Strategic Briefing

A tool for conceptual design in the early phases of the strategic building design process

PROEFONTWERP

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To my son Ahmad, my three lovely daughters Aja, Sara and Hajar, and to my wife Sawsan

To my family and friends

Contents

Chapter 1 Introduction

1.1. Background of this PhD project problem

Designing buildings in a modern context is becoming an increasingly complex process. The main reasons behind this are the difficulties involved in defining the design tasks, the increasing number and variety of specializations, and the lack of integration between the disciplines involved. These main reasons have among other things accelerated the move towards more detailed briefing at the start of the design process, and induced the tendency to break down the design problem into partial discipline-related sub-problems without any conception of the whole. Thousands of pages of specifications, which are not related to certain design tasks, are usually needed for later design phases, and typically do not include any indications about the timing of design team members' contributions. Each design team member, before starting the design, has to read all these specifications to decide which of these specifications are related to his/her task, and has to determine to which design phase each of these specifications belongs. For these reasons and because the briefing does not include any indications of the timing of the design team contributions, each participant starts focusing his/her attention, and narrows the total design problem to form his particular sub-problem, which he/she then perceives as being of predominant importance.

Working on sub-problems, design team members can no longer see the consequences of their actions because they lose their intrinsic sense of connection to a larger whole. In the past, the master builder implicitly performed the task of conceiving the whole of the design problem first, and depending on that formed strategy, solved the interrelated sub-problems. In other words, the master builder was responsible for establishing the underlying structure for concepts that need to be developed and the conceptual process as a core of the design, which can be accrued into the design's main concepts. Glegg (1972) argued that our grandfathers, and even our fathers, could visualize and invent total machines. Today, we usually cannot hold in our minds the total requirements of a design, much less how to achieve them. This stage, which involves conceiving the whole of the design problem, and depending on that forming the strategy to solve this problem, has almost been lost in today's common practice because it is hardly anyone's specific responsibility in a design team.

Moreover, there are no models or tools to help reproduce this, although we are nowadays more than ever in urgent need of regulating this important complex information hinge between the client and the mono-disciplinary design team members. The reproduction of this stage therefore is especially important when working collaboratively.

1.2. Vision toward a solution

A building as a concrete material artifact is the outcome of a stage of an evolutionary process. Previous stages successively end with artifacts of less material substances. A design, for example, is a semi-material artifact: a drawing on an external sketchpad. Prior to this stage, there is another stage involving the conception of the design as an immaterial (cognitive) artifact in the internal sketchpad of the client's and the designers' working memories. By cognitive artifact we mean a set of underlying structures of concepts that can be intuitively translated into mental images, and ultimately into the design main concepts. In fact this artifact forms the core of the design, which can be comprehended at the start of the design process. It is through this that all participants form a common reference and a shared memory.

Explicating the drivers and the mechanism of producing these underlying structures of concepts as a core of the design provides us with a tool. This tool can regulate a complex information hinge between the client and the mono-disciplinary design team members. It can also form a common reference that is necessary for the designers in a multi-disciplinary design context working collaboratively to steer their design process in harmony toward their common goals. By doing this, we in fact return to the natural intuitive way of thinking by designing. For instance, if you were asked as a client what you want your future building (house, company…) to be like, your mind will be invited to create some shortcuts of mental images, pictures or what we articulate in general as concepts. If you were asked to try to order the same shortcuts that you have created before, but this time considering your priorities, the result you get is a series of shortcuts of mental images in a certain order. The underlying structures of these mental images in an order that reflects priorities form simply what we call the Strategic Brief.

Providing a mechanism that can help to produce these underlying structures of these mental images, which is basically the responsibility of human cognition

(Sternberg 1999), can therefore lead to the generation of mental representations and ultimately external representations. Dym and Brey (2000) have therefore proposed that design representations should be understood as cognitive artifacts for generating mental representations and (ultimately) novel external representations. The process of producing the brief, in this cognitive from, as a set of underlying structures of concepts that need to be developed is what we call Strategic Briefing. It is from this notion, that this project takes its title.

Providing a tool, which can help to produce the Strategic Brief as a set of underlying structures of concepts, means reaching the climax by filtering and encoding the essentials of the design problem representation. This suggests that the building design process should start with a minimum of relevant information, which can be accrued into the underlying structures of concepts representing the core of the design. The Strategic Brief then is like a seed that has the most characteristic aspects of the building (Jones, 1980) and has the capability to grow, indicating directions for possible solutions. These directions form the core of the design challenges, which can predominantly shape the design concepts.

Strategic Briefing therefore differs significantly from traditional practice. Instead of detailed briefing at the start of the process, *key value drivers* (Rutten, *et al.*, 1998) are determined and transformed, in the initial strategic brief, under different kinds of constraints. The transformations of the key value drivers under different kinds of constraints result in forming the cognitive core of the design as a set of underlying structures of concepts those need to be developed into the design main concepts. The strategic brief in this abstract format forms a common background, a shared memory and a reference for collaboration. By holding it in memory, participants are able to understand their positions in the context of the whole, and are also able to decide which of these underlying structures of concepts are more related to each of their specializations. At an individual level, it facilitates and directs the streams of information between problem representation and certain related knowledge that is necessary to solve the problem. Hamel (1990, pp. 54-59) argued that if a conception of the design problem is represented as a schema to the human being's working memory, it starts activating a task schema representing what has to be done. This in turn activates certain related knowledge that once was saved in the long-term memory. However, the design problem, to be represented in such an effective form, has to be in a certain format, which is not the thousands of pages of the traditional brief because our working memory cannot deal with this large amount of necessary and unnecessary information at the start of the project. Only a few chunks can be simultaneously

activated in a designer's working memory in a way that can represent the whole design problem, or the strategy reflected as a set of the underlying structures for concepts that need to be developed. This results in the action of combining the concept of limits to the immediate memory span and the cognitive processing capacity of the brain as an information-processing machine or the *concept of chunking* as introduced by Miller in (Baddeley, 1994).

1.3. Objectives

Shifting to a higher level of abstract knowledge, by assisting the reproduction of the design's cognitive core, fits the natural way of forming and transforming project information better. This is because the human mind is a symbol system and cognition is symbol manipulation (Simon, 1996). Moreover, representing the design in such an abstract manner enhances creative thinking (Glegg, 1969). In other words, the strategic brief in this abstract form encourages the designers' minds to intuitively decode it. This means transforming the underlying structures of concepts, which represent the client wishes, into the design's main concepts. Thus, by explicating this possibility, this PhD project will provide a mechanism that is supposed to regulate a complex information hinge between the client and the mono-disciplinary design team members. The goal is to trigger a shift in briefing, which can help us to manage the complexity caused by the information overload in this information hinge. Thus, working with abstract knowledge by dealing with concepts instead of data can therefore help us with the following:

- Avoiding the information overload in the early phase of design.
- Simplifying the transformation of information between the client and the design participants on the one hand, between the design participants themselves, and between the working memory and the long-term memory of each participant on the other.
- Providing a mechanism that enables us to repeatedly attain a unique common design problem representation, and form a shared vision.
- Allowing for the possibility to make very important decisions at the earliest phase when starting a project.
- Leading to a more effective use of design team capabilities.

- Providing a framework that is important for all participants to understand their main tasks in addition to their positions in the collaborative design team, which can harmonize their collaborative search for a common solution.
- Providing some clarity as to how proposed solutions should be judged.

This project therefore is one of the most relevant contributions for facilitating the very beginning of the *Strategic Design Process* (Rutten, 1996), which deals with the integral multidisciplinary design processes of buildings, and aims to provide maximum freedom for designers to meet the client's needs and wishes, as they are not hampered by too many details and therefore inadequate overloads of information in the early phase of design. This makes a significant contribution to the field of design theory and research, because it delivers a shift to another level of knowledge representation. It is a shift from a data-centric approach towards a concept-centric approach (Al Hassan, *et al.*, 2002). This is highly needed nowadays for the effective transformation of knowledge, especially by collaborative design. Chiu (2002) argues, "*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*".

1.4. Working hypothesis and approach

To achieve this objective there were no directly available means, theories, or methods in the literature. Acquiring new knowledge by designing therefore was the only way to achieve this objective. The design, which takes the form of a tool, has to explicate the client's needs or the problem space, and the strategizing process, which indicates the core of the design solutions.

The core of the design solutions may be considered the result of the interface between the inner environments, representing inborn human needs (for buildings), and the outer environment or the context in which the human being finds him/herself. Understanding this interface, which aims at attaining goals by adapting the former (inner) to the latter (outer environment) (Simon, 1996, p. 113), in light of the concept of chunking, is a basic requirement for designing the tool. We will elaborate this viewpoint later in this thesis.

One of the challenges for designing this tool is to find a theoretical basis, which can answer this design basic requirement. It is unlikely that only one field of science can help us to attain this aim. Beheshti (2000) mentioned at least ten areas that define the agents of design, and can describe the study of creativity and cognitive activities of design, such as philosophy, psychology, logic, epistemology, ontology, aesthetics, etc. This means that significant results in these research areas are needed to invoke a discussion on fundamental principles of design thinking, and to allow us to gain insight into the nature of the design as an innately human faculty (Al Hassan, *et al.*, 2005). Acquiring new knowledge by designing means a combination of an integral, holistic, intuitive understanding based on axioms and well-known information, and also on existing knowledge in the realm of design studies, cognitive (psychology) science, complexity theory, and the theory of dynamic systems may therefore be the only way to achieve our objective of synthesizing a theoretical basis for the tool design. In other words, solving this problem can probably only be done by going from abstract to concrete, from imagination to reality, which is different from other scientific research approaches. The designer invents with his imagination and then builds on the basis of this (Glegg, 1973).

1.5. Contribution to the social context

The tool, which can help explain the Strategic Briefing Process, may therefore assist clients and design partners in complex building programs in general and architectural design managers and process managers in particular. This is because the assessments and task clarification are increasingly more a special and strategic management task, especially in the case of original design. This task is very important for the formation of a shared vision and a common strategy, which can help to harmonize the efforts of the design team members to reach their common goal, because we are unlikely to hit a target if we cannot see it (Glegg, 1969). The tool also is of special interest to teachers and students of technical and non-technical universities dealing with design, process design, formulating and solving problem in general, and with creativity.

1.6. Outline of the thesis

The thesis is further organized as follows: Chapter 2 will discuss the theoretical basis for designing the tool. It shows how to combine an integral holistic, intuitive understanding based one axioms and well-known information with existing knowledge in different fields of sciences and literature. Chapter 3 gives instructions combined with illustrations and examples that aim at elaborating the theoretical basis for a more applicable format. Chapter 4 discusses the tool as an instrument, the principles of working with it, and what we need before using it. Chapter 5 illustrates the applicability of the tool in practice, i.e., illustrating whether the tool can be used by its intended users and is capable of fulfilling the purpose for which it was designed. In other words, whether the objectives and expected results of this tool as articulated in Section 1.3 were met, and the users in the three main positions (the client' position, the designers' position, and the architectural design managers' position), as explained in Section 1.5 were helped to achieve these objectives. Chapter 6 contains the conclusion and the recommendations, which indicate some future studies followed by a summary.

Chapter 2 Theoretical basis for designing the tool

The well-known information and knowledge that we start with is basically related to Simon's argument that the artificial world may be considered the result of the interface between our inborn needs (for buildings), representing the inner environment, and the context in which we find ourselves, representing the outer environment. This interface is only possible by engaging our sensing systems, because everything we know about the world comes to us through our senses (Gasson, 1974). This is in fact (1) symbolization of human needs (for buildings) or *what to find*, (2) the means of our sensing modalities or *how to find*, and (3) the outer environment or *where to search*. By performing a link between these elements (*what to find, how to find, and where to search*), our minds start generating this artificial world in the form of underlying structures for concepts. These chunks can be translated in later stages into mental images, into concepts and ultimately into external representation. For example, one can say that a building has to have an Aesthetic value related to Seeing relevant to a certain Community, *(Museum in a Greek style)*, or a building has to have the Recognition value related to Smelling relevant to a certain Organization, *(Bakery or Flavour shop).* Just by mentioning such a set of words (chunks), you recognize that your mind is invited to start imagining something, i.e., it starts generating concepts.

Generically speaking, we can say that each possible concept that our minds can generate has to have these three basic elements as a minimum. This could explain the mechanism of how our minds can encode the simplest form of an underlying structure of a concept, which is a mental map of *what, how, and where* to find. Explicating the drivers and the process of encoding underlying structures for concepts, in addition to how constraints influence this process would provide the theoretical basis for designing a tool. This tool then assists the production of the strategic brief as a set of underlying structures of concepts, representing the core of the design.

Because this design's core can relate to many different needs that a design can accommodate, the tool should necessarily be based on a general theory of human needs that forces designers to systematically think about these needs and develop corresponding design concepts. When generating concepts, we therefore argue that individuals can only satisfy their needs through their sensing system, i.e. by making or breaking relations between the inner environment and the outer surrounding

environment (Al Hassan, *et al*., 2002). Making or breaking relations between the inner and the outer environment requires us, as human beings, to use or not to use one or more of our sensing organs because everything we may need, or we may like has to be searched by our sensing systems, and everything we may need or like has to be found in our environment. Consequently, our contention is that designers should be assisted to develop underlying structures for concepts by a) making the links between design concepts and human needs, environment and sensing systems, and b) identifying how constraints influence this process of linking, which we call the strategizing process. In other words, the designers should be assisted to develop what we call the Strategic Brief.

2.1. The process of designing the tool

Designing a tool, which can assist strategic briefing, has to deal with explicating the encoding of the client's needs and the strategizing process or how constraints influence the process of generating underlying structures of concepts. This means we must perform the following steps:

- The first step that has to be made is to explicate the phenomena of generating concepts. This means defining which kinds of things belong to the three main elements, the human needs, the sensing systems, and the outer environment, and then to develop three taxonomies corresponding to each of them. This means that we first need to discuss the taxonomy of the human needs (for buildings) or the inner environment, the taxonomy of the human context or the outer environment, and the taxonomy of sensing systems.

- The second step is to explicate the process of linking between these taxonomies, which is in fact the process of generating underlying structures for concepts.

- The third step is to explicate how constraints influence the process of generating underlying structures for concepts or the strategizing process.

2.2. A taxonomy of human needs (values)

Abraham Maslow's theory (1943)[1], states that people are constantly motivated by needs, which he diagrammed in his famous model of the human hierarchy of needs. However, by analyzing this model we find that it does not recognize the difference between the kinds of existences and our awareness of them, which gives birth to what he called needs, and the recognition of these needs, which reflects what we call values. In addition, Maslow's model is limited to human needs in the social context, while our interest is in human needs for buildings. This requires us to reconsider this model, develop a generic model of human needs, and then derive a particular model, which can fit the human needs for buildings. As a result of this reconsideration, we argue that the origin of these sharply distinguishable and shared human needs is related to the different kinds of existences of human beings, which we have arranged as follows: the biological, physiological, physical, functional, cultural, intellectual, human and spiritual existences (Figure 1).

Seeking to survive or to enjoy one or more of these levels of existence means first bringing this driven awareness as a value to the conscious mind (Ross, 1985). Huitt (1999) argues therefore that becoming aware of our human needs is a subcomponent of conation and the first aspect of successful self-direction. Sternberg (1999), emphasizes the cognitive nature of these human needs, and argues that the concept of mental representation is fundamental to cognitive sciences. These values arranged in the same order correspond to the awarenesses of these different kinds of existences are as follows: being safe, feeling comfort, performing function, getting recognition, enjoying aesthetics, and inspiring symbols (Figure 1).

As portrayed in Figure 1, this spectrum of driven awarenesses, which reflects basic human needs, varies from *Immanent to Transcendent.* The awareness of these needs at the lower levels, like safety and comfort, are immanent, have short-term effects and a high frequency. In contrast, the higher levels like getting recognition, enjoying aesthetics, or inspiring symbols are more transcendent, have long-term effects and produce an indirect feeling of need.

[1] *There are many other theories, like of Hertzberg F. (1966), but we preferred to mention Maslow because he was the founder of the concept of the human hierarchy of needs.*

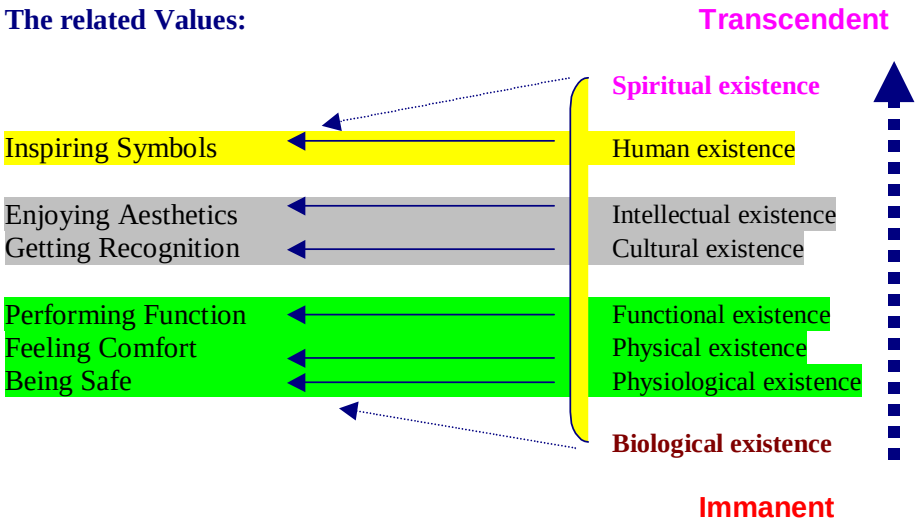


Figure 1: Different levels of existence and the recognized values related to each of them

This can be simplified and reflected in a taxonomy of human values, which can be related to the designing of buildings as illustrated in Figure 2.

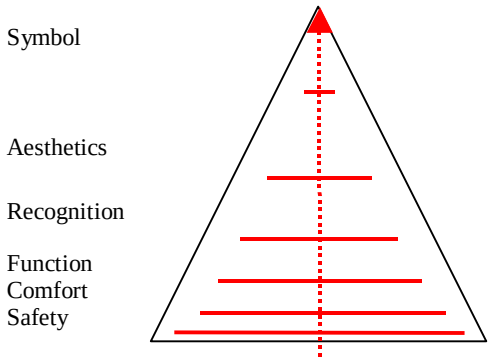


Figure 2: A taxonomy of human values related to the design of buildings

This taxonomy reflects our human awareness of the needs for buildings of three types:

1- Material well-being: like satisfying the biological, physiological, physical and functional necessities. In the field of design, these basic necessities can be translated into safety, comfort and better using or functioning of buildings.

2- Psychological welfare: such as getting recognition, being told about something (related to audible thus), followed by intellectual (related to visible), such as enjoying the aesthetics of buildings.

3- Mental prosperity: like being (mentally) inspired by the symbolic meaning of buildings.

2.3. A taxonomy of the human environment

The human environment or the context in which a human being's mind finds itself, and where it searches to fulfil the needs are arranged as follows: Individual body (you, biologically and physiologically), Family (a group of individuals), Organization (TU/e), Society (the Netherlands), Community (European Community), Globe (the World), and the Universe. Human values (as reflected by driven awarenesses of needs) can therefore be searched and experienced at different levels (Figure 3).

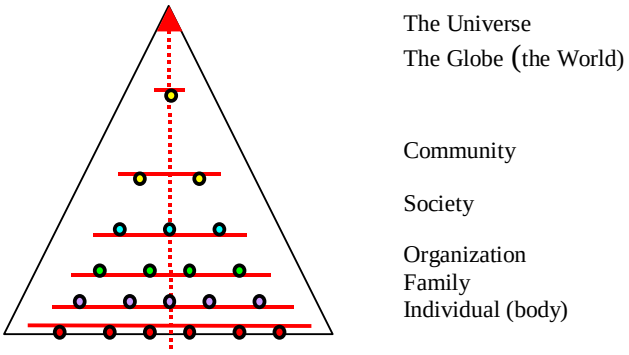


Figure 3: A taxonomy of the human environment

2.4. A taxonomy of sensing

Sensing systems are a kind of human equipment necessary for interacting at all levels of the environment to satisfy different kinds of awarenesses of existences (values) (Figure 4).

The first five are taste, touch, smell, hear, and see. The sixth one is the mind, which is the sense of the whole encoded or decoded sensory information (Harth, 1995). The seventh one, which is the spirit, will be left out of consideration in the further discussion in this thesis (Figure 4). To satisfy their awareness of needs (values), human beings are urged to interact with the environment. For the purpose of survival at biological physiological levels (the basic lowest levels) for example, human beings may need to interact with all sensing systems like when they eat. When eating, we taste, touch, smell, hear, see, and mentally inspire (Figure 4). By contrast, human beings try to protect themselves and to ensure their safety at the biological physiological levels, for example, from experiencing the pain of an interaction with the environment while most or all sensing systems are engaged like being victims of buildings' collapses.

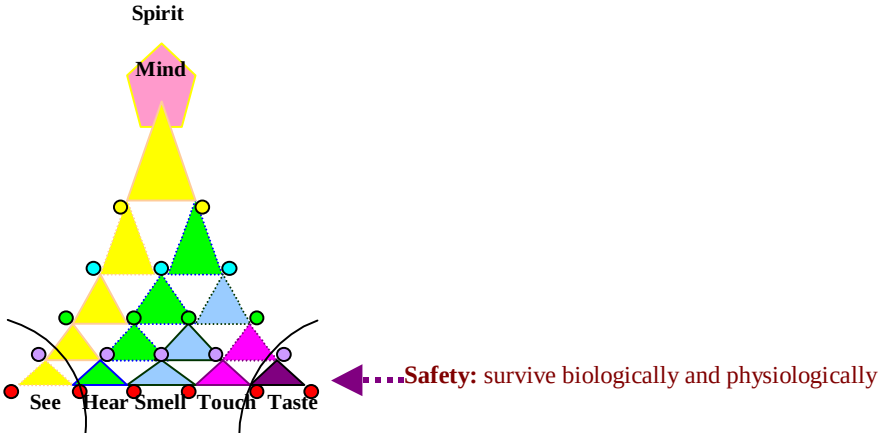


Figure 4: A taxonomy of sensing systems

It is important to note here that the levels of interaction correspond to the engaged sensing organs, and to the successive higher levels of perceiving the values (Figure 5). For an interaction at the family level, we use one sense less than at our individual

level. The sense we lose in order, when we go higher is taste, touch, smell, hearing, and sight; correspond to approximate ranges of our senses, and to the natural and gradual awareness. At each level up, we miss one sense until we leave the realm of the sensing system and enter the mind, where the encoding and the decoding of the total sensory information takes place. By striving to achieve higher values, human beings use fewer sensing modalities (Figure 5), which mean interacting less consciously.

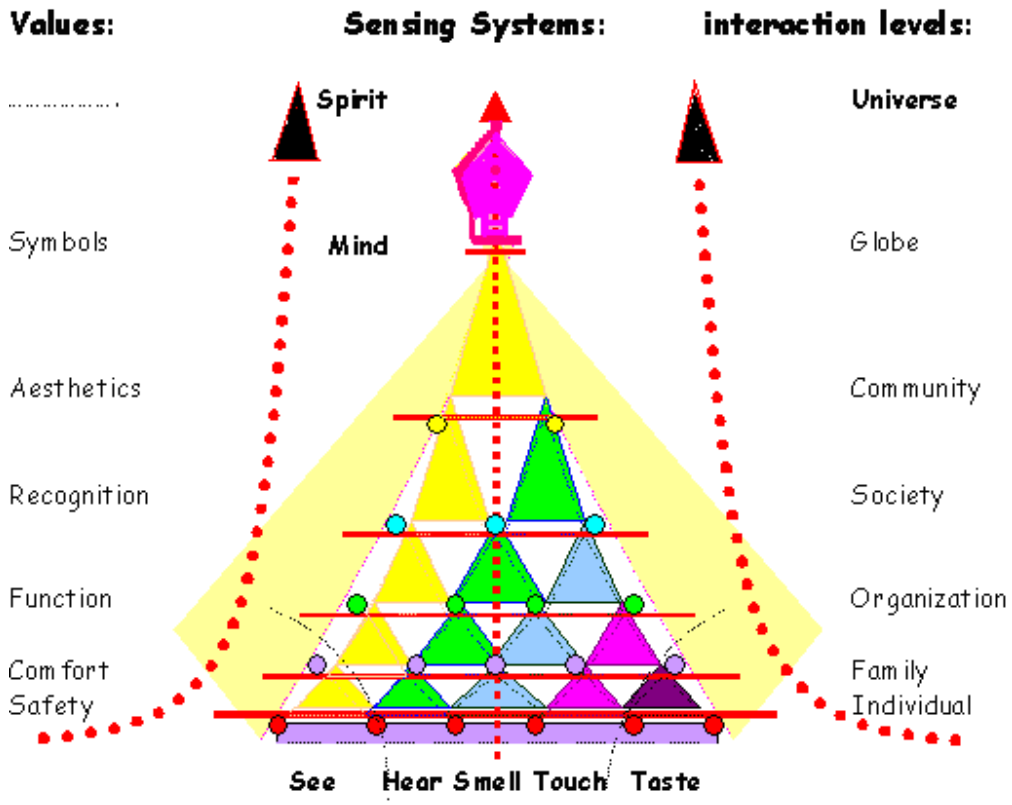


Figure 5: The different interactions with the environment in relation to the values and to the sensing organs concerned.

For example, seeing on the lower level is different from seeing on the fifth level. Seeing on the lowest level (mostly combined with other sensing modalities) supports

the aim of surviving, and the quality of escaping danger, which is in our case Safety, while seeing on level 5 is just for seeing, e.g., seeing to enjoy Aesthetics. Only human beings can be affected when missing these higher values, over a long span of time.

It should be articulated here that we did not present this theory as an explanation of human behavior or values. As we will see later, this or any other similar theory forces designers to think about the design brief in terms of the common set of values that buildings can accommodate.

Having discussed these three taxonomies of human values, the sensing modalities, and the environment allows us to discuss the process of linking them. This introduces what we call the Self-Graph for generating underlying structures of concepts.

2.5. The Self-Graph for generating underlying structures of concepts

The above (three) mentioned taxonomies define the components of what we wish to introduce as the Self-Graph (Figure 6).

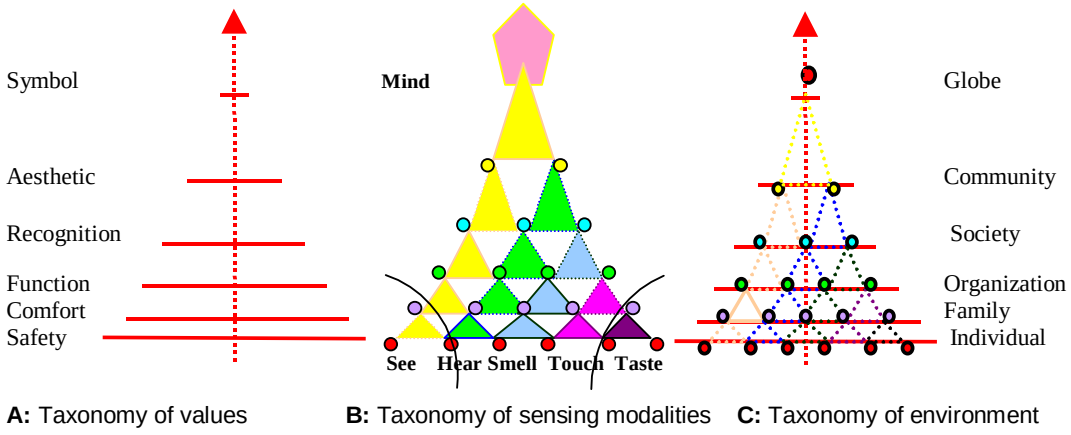


Figure 6: The Self-Graph components

These components are as follows:

- **A-** A taxonomy that reflects the awareness of certain kinds of existence articulated as a value.
- **B-** A taxonomy of sensing modalities concerned with the interaction with the environment to satisfy certain values.
- **C-** A taxonomy that represents the levels of interactions with the environment, where the values can be searched.

The recognition of a certain value at a certain hierarchical level of the Self-Graph activates a certain sensing modality. In turn, the sensing modality activates a certain level of interaction with the environment (Figure 7). For example, your building can have a symbolic value related to seeing relevant to a certain society. This process of linking between components that belong to the three taxonomies of the Self-Graph, which we will call Synergizing, describes the mechanism of encoding the simplest form of an underlying structure for a concept (Figure 7).

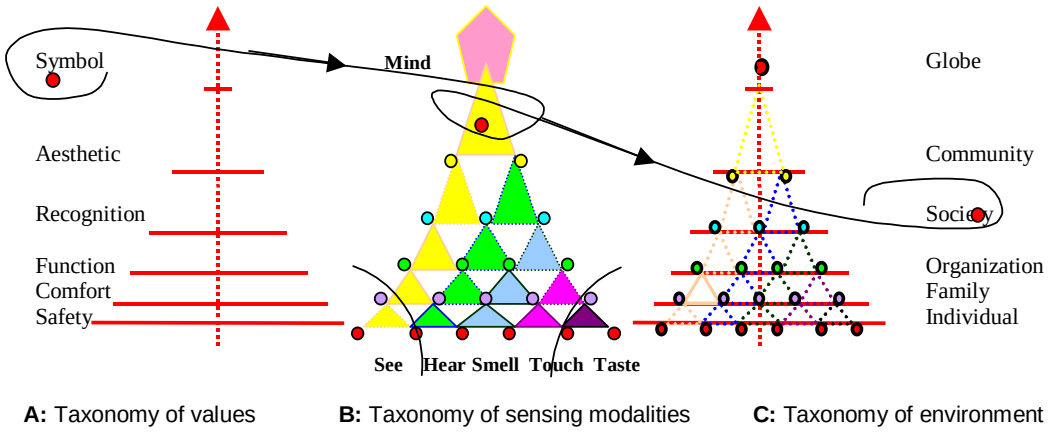


Figure 7: The mechanism of encoding the simplest forms of underlying structures for concepts

The Self-Graph that holds the three taxonomies of human beings' values, sensing, and the environments, and the mechanism of relating them will then work as a "*center of narrative gravity*" (Harth, 1995). This center, which can be used for intertwining the

client's brief as a set of underlying structures of concepts, contains what Akin (2002) called the "*conceptual variables and the schemata that provide the underlying order and structure for an architectural design"*. Mastering the process of synergizing between the components of the three taxonomies of the self-graph helps designers to encode the client' wishes in the form of underlying structures of concepts. However, we still need to discuss how external constraints influence this process of generating underlying structures for concepts, or the process of generating concepts in scarcity.

2.6. Generating concepts in scarcity

In their dreams, people can think as they like and develop any concepts they like. There is only one restriction in our dreams: our internal mental preference, which can be related to our kinds and levels of intelligence. In most other situations, the contexts in which we live defines different constraints such as ideological, social and/or pecuniary, which can restrict the process of generating concepts. Because of that, designers need to take into consideration the different clients' preferences, and also their different external constraints. The concepts that can be generated by the same person when choosing in abundance (variety) therefore are different from those he generates when choosing in scarcity (Boonstra, 2004). When choosing in abundance there is no external constraint, e.g., there are no ideological, social and/or pecuniary restrictions. When choosing in scarcity, the situation is different, usually we reconsider the concept resulting from choosing in abundance, by taking into consideration the external constraints.

The reconsideration changes the structures of the underlying structures of concepts and their orders, which can take place at two levels:

1- The product that we are going to design has more than one value (or even all of them), like the case of the design of buildings, while the resources are limited. For example, if you want to have a house while your resources (money) are limited, you will look more for the functioning, the comfort and the safety of your building. Other values like aesthetics or symbols may become simply non-existent or are pushed into the background. This means that the most prepotent value will monopolize and the less prepotent values will be minimized, even forgotten or denied. Maslow (1943) therefore argued, *"It has been observed that an individual may permanently lose the higher*

wants in the hierarchy under special conditions". This means that by encoding the brief, we need first to prioritize between these values (safety, comfort, function, recognition, aesthetics and symbol) in terms of personal preference or/and urgency (internal or/and external constraints), so that the most preferred/ urgent one will have the priority and so on. Prioritizing between these values results in restructuring of the underlying structures, i.e., it redefines the quality and the final conception of the product as a whole on the highest level.

2- The associations between values (in cases of more than one value product) add attributes, which can define other values and direct the searching. For example, if you say that your building has to have a Symbolic Safety related to Seeing relevant to the whole Globe, then you have better specified in which direction the symbolic value has to be searched. In other words, the symbolism has to be related to safety, thus when seeing the building, the building has to tell us that it is safe, and this impression has to be perceived by everybody on this globe. A different example is that the concept that needs to be developed is Symbolic Function related to intuitive Mind decoding relevant to the whole Globe. In other words, the function of the building has to be symbolically interpreted by the mind in the same way globally. This process of associating between each value to the other values, which defines the direction of searching, is called Synthesizing[2]. These extra two dimensions add two elements to the simplest form of an underlying structure for a concept:

- The first determines the relations between all values in a process of Prioritizing.
- The second determines the relations of each value to the other values in a process of Synthesizing, which defines the direction of searching.

This is in addition to the previous relations of each value within a certain sensing system, and for a certain level of interaction with the environment or the process of Synergizing. Here we would like to add that the synergizing defines the quality of each concept that belongs to the final product. For example, in the previous example, if we reduce our ambition to develop the same concept but at an organization level or an

[2] *In order to discover which of these two values is the main value and which contributes to the definition of the direction, we will give the main value an adjective state, while the second value(s) stay as they are in the noun state(s).*

individual level instead of a global level, then the invoked concepts will be qualitatively lower.

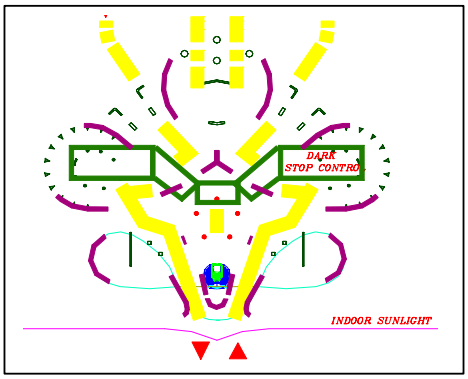
In conclusion we argue that the process of generating concepts in scarcity contains the following cognitive operations:

1- Prioritizing between the main set of values.
2- Synthesizing between each value and other values.
3- Synergizing of each value (synthesis) within a certain sensing system, and for a certain level of interaction with the environment.

By explicating this process we performed the second theoretical basic step for designing the tool. However, we still need to relate this mechanism of generating underlying structures of concepts to the design of buildings. This is because the design problem can have many levels, for example the city level, whole building level, or workplace level (Boekholt, 2000).

2.7. Encoding the core of the design

By introducing the Self Graph and the mechanism of generating concepts in scarcity, we explicate the process of generating concepts' underlying structures in general. However, we still need to relate this mechanism to the different levels of the building design problem. In other words, relating each underlying structure for a concept to a certain level of the building design problem, such as to the whole building level, a building-section level, or to a workplace level. This adds an extra dimension to the simplest form of an underlying structure for a concept. An example of an underlying structure of a concept of designing an Airport Building could look like this: Functional Comfort, related to Mind intuitive decoding, relevant to the whole Globe. The design problem is on the Building sections level (the departure and arrival halls in the airport building complex). Figure 8 is an example of how to develop such a concept. In this concept you recognize that using daylight for natural orientation preserves the feeling of spontaneity and directness from the main entrance to the visitor destination. This can direct the movement of passengers to their different aims, which results in comfort for the functioning of the departure and arrival units. Buildings with a uniform light level confuse this intuitive natural orientation.



- The indoor sunlight in buildings gives the impression of a cheerful welcome.
- Gives a hint for easy orientation inside the building and intuitively leads to the right direction to find the final destination.

Figure 8: An example of developing the following underlying structure: Functional Comfort related to Mind intuitive decoding, relevant to the whole Globe. The design problem is on the Building sections level (the departure and arrival halls in an airport building complex).

The next section will explicate the strategic briefing process for encoding the core of the design as a synthesis of underlying structures for concepts.

2.8. The strategic briefing process for encoding the core of the design

The strategic briefing process contains the following operations:

1- Prioritizing:

By prioritizing we mean grading the values: Safety (S), Comfort (C), Function (F), Recognition (R), Aesthetics (A), Symbol (Sym) in terms of personal preference or/and urgency (internal or/and external constraints), so that the most preferred/ urgent one will have the priority and so on. This defines the design problem on the highest level as a *system of values*. It defines what drives us to design or *why* we start generating concepts. By defining relations between these values, we order these values forming an ordered set of values.

2- Synthesizing:

By synthesizing we mean making associations between the values beginning from the highest value or the value marked as number one, and the rest of the values. This is followed by the value marked as number two and the rest of the values, and so on. Making associations between the values therefore creates motives (value with direction of searching) necessary for directing the search. Take **Sym**bolic **S**afety, for example. This transforms the system of values into a *system of motivations* or *what* to find.

The whole set:

[(Sym+A), (Sym+R), (Sym+F), (Sym+C), (**Sym+S**)]
[(A+R), (A+F), (A+C), (A+S)]
[(R+F), (R+C), (R+S)]
[(F+C), (F+S)]
[(C+S)]
[(S)].

3- Synergizing:

By synergizing we mean relating the system of motivations into sets of sensing organs and the levels of interaction with the environment. Both define the *how* and the *where* to find. Saying that you want symbolic safety for example, will directly invoke two questions:

a- How do you want to perceive this symbolic safety in your building? For example by seeing or by hearing or…etc.
b- With whom do you want to communicate this symbolic safety? With only yourself, your family, your organization, a certain community, or the whole globe?

The result of these processes has to be reconsidered when facing pecuniary constraints, like the capacity to finance. In such a case, the ambition level can be reduced. This can be realized by reducing the desired interaction level with the environment. For example, reducing the ambition from designing a building that has a symbolic value on a global level, into a symbolic value at only an organizational level or even an individual level.

Thus the symbolic safety **(Sym+S),** for example, can be related to any sensing system: [Mind (intuitive decoding), Seeing (**Se**), Hearing (H), Smelling (S), Touching

(To), Tasting (T)] and also to any interaction level with the environment: [Individual (I), Family (F), Organization (O), Society (S), Community (C), Global (**G**), Universal (U)]. For example **(Sym+S)* [Se] * [G]** means: Symbolic Safety related to Seeing has to be perceived Globally. `When seeing my building, everybody has to get the impression that it is safe here`. This transforms the system of motivations or the `What` to find, into a *system of orders,* with two components of *How* and *Where* to find. We also must not forget to decide at which level the design problem has to be solved, i.e., which Architectural units we have to consider in our solution.

4- Symbolizing:

By symbolizing we mean mapping the results of the previous processes by connecting *why* to search, *what* to find, into *how* to find, and *where* to find for each design unit. The ``why`` searches for the main values we want to achieve. The ``what`` searches for the association between these values, which gives the search a direction. The ``how`` chooses the sensing modalities related to perceiving these values, and the ``where`` defines the context of searching, all related to a certain level of the design problem or to an architectural unit (Globe[3], Continent, Country, City, Building, Building section, or Work place level). An example of such an encoded order is the following mental map of an underlying structure of a concept of designing an Airport Building. Develop a concept: [(R+F) * Se * G] _ B; which can be articulated in words as Recognized Function, related to Seeing, relevant to the whole Globe. The design problem is on the whole Building level, i.e., the building function has to be visually recognized and means the same for everybody on our globe: Airport & Fly.

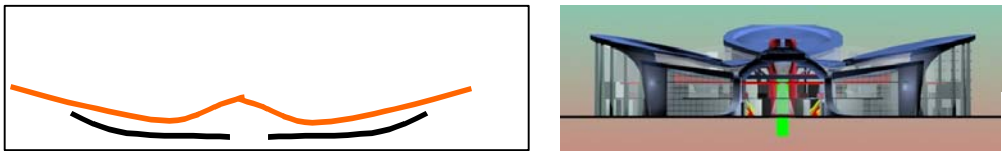


Figure 9: An example of developing the following underlying structure: [(R+F) * Se * G] _ B], or articulated in words as Recognized Function, related to Seeing, relevant to the whole Globe. The design problem is on the whole Building level of an airport building complex.

[3] *Sometimes the design problem has to be solved by taking into consideration the global dimension. For example, by designing a mosque in any place on the globe, the building has to be situated according to the direction of Mecca.*

Designing the roof of the airport building complex to look like flying wings, a bird, or any other form related to flying can invoke similar impressions. Figure 9 is an example of the development of such a concept.

Symbolizing therefore is the last stage of the encoding processes. These processes result in a symbolic representation of the design challenges or what we call the strategic brief. This brief in fact forms the core of the design, which can be comprehended at the start of the design process. Through this all participants form a common reference and a shared memory, and can translate it into mental images representing the design main concepts. Bequette (1998) therefore argued, *"That engineers and particularly process engineers are symbolic analysts. Symbolic analysts identify, solve and brake-down problems by manipulating symbols. They simplify reality into abstract images that can be rearranged, juggled, experimented with, communicated to other specialists, and then, eventually, transformed back into reality."*

2.9. Feedback

The synergizing between the three basic components of each underlying structure of a concept (the values, the sensing modalities and the environment) indicates what we need to achieve as declarative knowledge. If there are constraints then we need to strategize. This means restructuring the previous underlying structure of concepts. The restructuring aims at redefining the previous underlying structure of concepts as follows:

- By Prioritizing we redefine the order of achieving the main values.
- By Synthesizing we redefine the direction of searching for achieving these values' associations.

This is in addition to relating each underlying structure of a concept to a certain design problem level, which will define at which level we need to start solving the design problem, and in which order.

The restructuring, which is the result of the cognitive operations (prioritizing, synthesizing and synergizing), therefore adds procedural knowledge of *how to achieve* to the declarative knowledge of *what to achieve*. These are the two main elements of a

strategy (Hamel G., 2002), or the two sides of strategy the *content* represented by what to achieve, and the *process* represented by how to achieve (Bowman, *et al.*, 1997). In other words, the manipulations of the original Self-Graph structure, as a result of the cognitive operations (prioritizing, synthesizing and synergizing), result in procedural knowledge that can be attributed to the declarative knowledge forming the strategic brief.

The above forms the theoretical understanding of how we can encode the structure of the design problem in its most abstract form, forming the core of the design challenges as a synthesis of the underlying structures for concepts that need to be developed by the designers in order. This will replace the stage of envisioning the design as a whole, which can offer the client as well as the design team members, in multi-disciplinary contexts, a shared memory of the final product (building) before starting the design.

Envisioning the design in this very early stage of the design process allows the design team to make important decisions on how to manage the human resources for working collaboratively and effectively. Pahl and Beitz (1988, p. 59) summarize this by saying that the establishment of an optimum function structure constitutes some of the most important steps of the conceptual design phase, because once the core of the problem has been clarified to some extent it becomes much easier to formulate the overall task in terms of the essential sub-problems as they emerge. Moreover, the clarification of the problem as a whole helps to focus the designer's attention and greatly increases his particular level of information.

The next chapter gives instructions combined with illustrations and examples that aim at simplifying, visualizing and elaborating the theoretical basis into a more applicable, and useable format.

Chapter 3 Application protocol

Chapter 3 outlines and visualizes the theoretical basis. This will take the form of an application protocol. The application protocol will therefore elaborate and visualize each operation of the strategic briefing process (prioritizing, synthesizing, synergizing and symbolizing) in successive steps. Next to each step, we give an example of how to proceed, followed by a small test to be sure that the user is able to deal with it. The application protocol is an interim stage between the theoretical design of the tool (Chapter 2), and the tool as a practical instrument (Chapter 4). This application protocol will be outlined as follows:

Prioritizing:

Step 1: Grade the six values Safety, Comfort, Function, Recognition, Aesthetics, and Symbol in terms of personal preference (when building your own company, house, etc.), once with and once without taking into account your financial ability, using the values carrier shown in Figure 10.

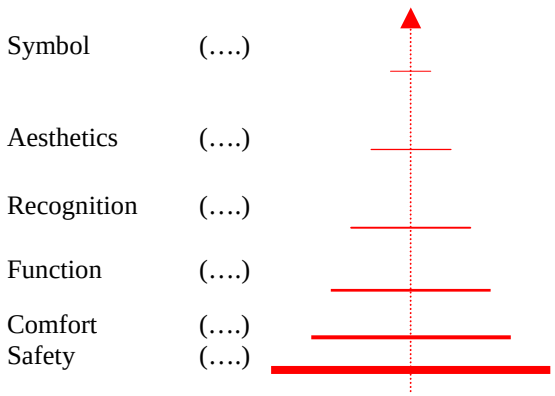
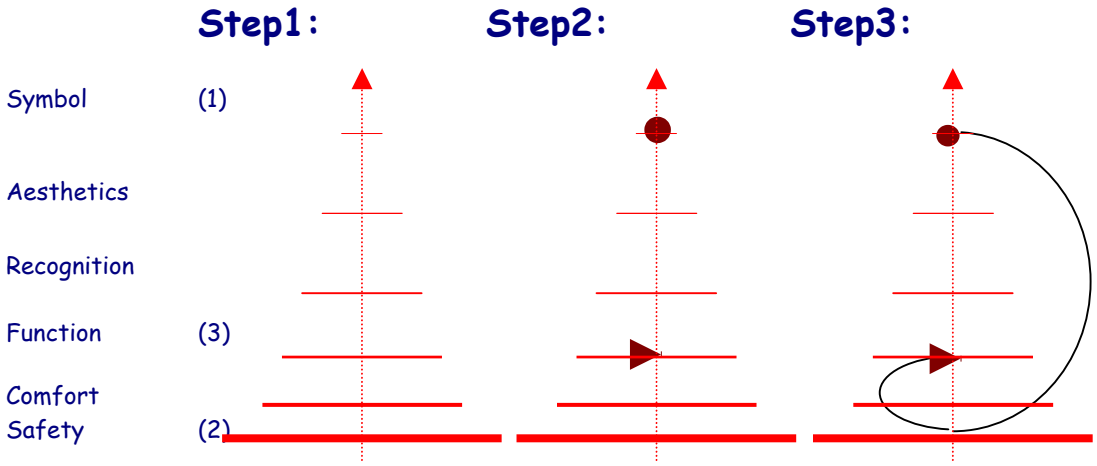


Figure 10: The values carrier

Step 2: For the value given the highest grade use the symbol:
For the value given the lowest grade use the symbol:

Step 3: Define your pattern of choice by drawing a line[4] between your graded values that satisfies the priority order.

Example: **Safety (2)**, Comfort (….), **Function (3)**, Recognition (….), Aesthetics (….), **Symbol (1)**.



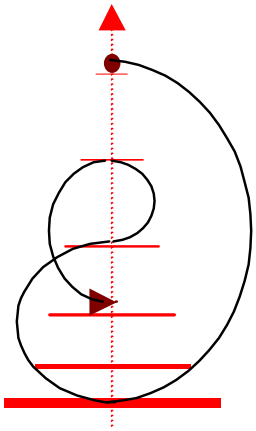
To practice:

1- Try to draw the value profile for a building that you already know (such as Vertigo or your own house), using the technique mentioned in steps 1 to 3.
2- Try to draw the value profile for a very well-known building (e.g., the Eiffel tower or the Taj Mahal), using the technique mentioned in steps 1 to 3.
3- Compare the two lines and consider the differences between the patterns of choice in the value profiles for both buildings.

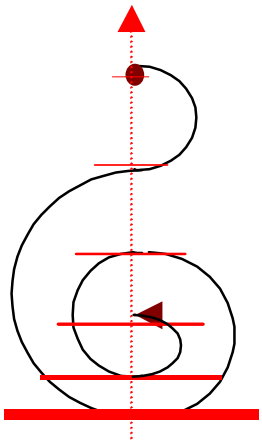
[4] *We will call this a value profile*

Example: **The value profile for the Pyramids and Sydney Opera house.**

A-Pyramids, Showing Power:
(Symbolic/ Safety / Recognition / Aesthetics / Function…



B- Opera Sydney, Showing Welfare:
(Symbolic/ Aesthetics / Safety / Recognition / Comfort / Function)



Synthesizing:

Step 4: Give the value 1 (the value given the highest grade) an adjective state.

For example Symbol: **Symbolic**

Step 5: Give the other values that are beneath it (according to the Self-Graph), a noun state.

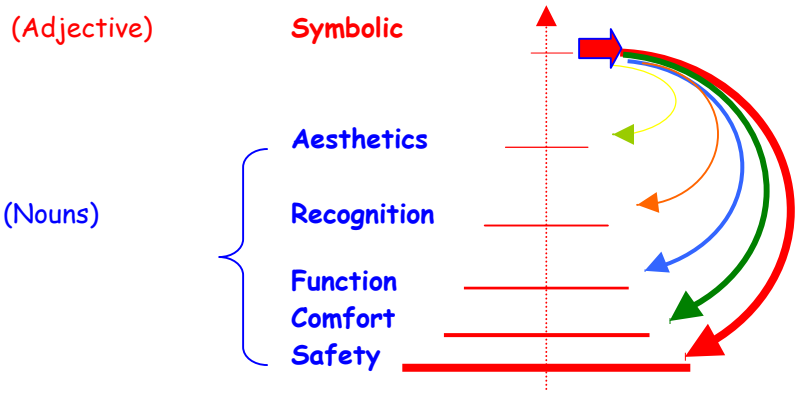
For example: **Aesthetics, Recognition, Function, Comfort and Safety**

Step 6: Synthesis

With {

The adjective that has the value (1): **(Symbolic)**

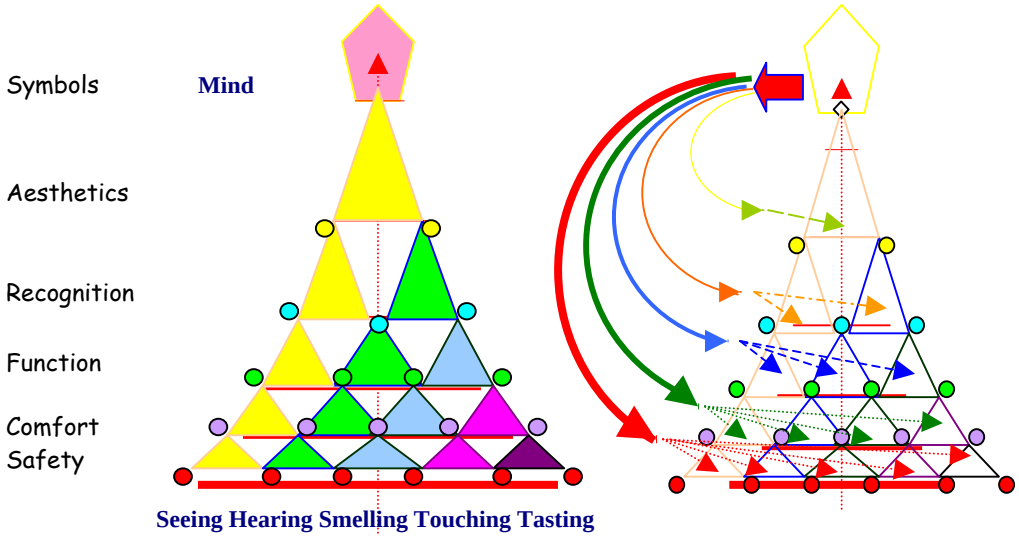
The noun(s) that have the other values: **(Aesthetics, Recognition, Function, Comfort and Safety)**



The result: [(Symbolic Aesthetics), (Symbolic Recognition), (Symbolic Function), (Symbolic Comfort), (Symbolic Safety)].

Synergizing:

Step 7: Connect each noun to its attributed Sensing organ(s), using the Self-Graph as a general reference representing the human hierarchy of needs for buildings related to the sensing organs.



The Self-Graph representing the human hierarchy of needs for buildings related to the sensing organs.

Examples:

Symbolic Aesthetics related to: Seeing

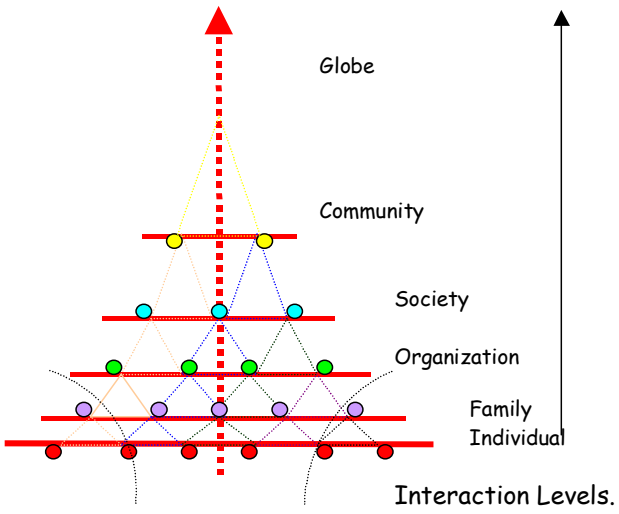
Symbolic Recognition related to: Seeing and Hearing

Symbolic Function related to: Seeing, Hearing and Smelling

Symbolic Comfort related to: Seeing, Hearing, Smelling and Touching

Symbolic Safety related to: Seeing, Hearing, Smelling, Touching and Tasting

Step 8: Specify to whom the concept Symbolic Safety, related to Seeing, is relevant, using the interaction levels with the environment according to the Self-Graph.



The interaction levels with the environment according to the Self-graph.

Thus, it could be relevant to the following interaction levels with the environment:

An Individual
A Family
An Organization
A Society
A Community
Or maybe to the whole Globe.

Example: the concept that needs to be developed is as follows:

Symbolic Function related to **Seeing** relevant to the whole **Globe.**

Symbolizing:

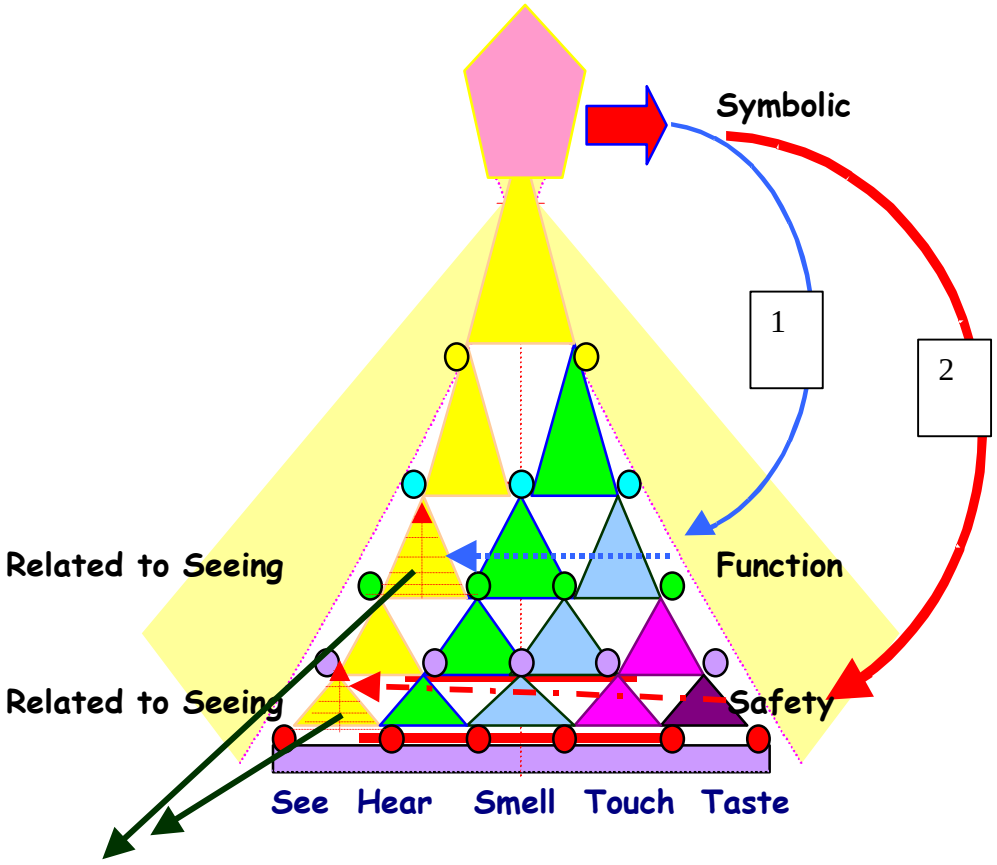
Step 9: Specify the concepts that need to be developed for the project at hand by mapping the results of the previous processes. Do this by connecting *what* to find (Values association), to *how* to find (Sensing modality), and to *where* to find (Interaction levels or the Environment) for each Architectural design Unit: Work Place (Wp), Building section (Bs), Building (B), City (C), Continent (Co), Globe (G) and represent it as an order.

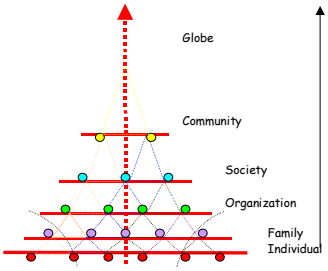
For people who prefer to work with abbreviations, digits or numbers, such an underlying structure of a concept could be further symbolized by using the numbers or abbreviations attributed to each element of the Self-Graph, and also to each architectural unit as shown in Table 1.

Table 1: abbreviations and numbers attributed to each element of the Self-Graph and also to each Architectural design Unit.

Values	Sensing modalities	Interaction levels or the Environment	Architectural Unit
1- Symbol (Sym)	1- Mind Intuitive Deco. (M.I.D)	1- Globe (G)	1- Globe (G)
2- Aesthetics (A)	2- Seeing (Se)	2- Community (C)	2- Continent (CO)
3- Recognition (R)	3- Hearing (H)	3- Society (S)	3- City (C)
4- Function (F)	4- Smelling (S)	4- Organization (O)	4- Building (B)
5- Comfort (C)	5- Touching (TO)	5- Family (F)	5- Building section (Bs)
6- Safety (S)	6- Tasting (T)	6- Individual body (I b)	6- Space (Work place) (Wp)

For example, [(R+F) * Se*G] _B means: value Recognition is Synthesized to the value Function, and the result of this synthesis is Synergized to sensing modality Seeing and to the Globe as an interaction level with the environment. The total is related to the whole Building level. In digits we can express this as [(3+1) * 2 * 1] _ 4, which means value marked as number 3 (Recognition) is Synthesized to the value marked as number 4 (Function), and the result of this synthesis is Synergized to sensing modality marked as number 2 (Seeing) and to the level of interaction with the environment marked as number 1 (Globe). The total is related to the Architectural Unit marked as number 4 (whole Building level). For people who prefer to work with visuals, such an underlying structure of concepts like 1- Symbolic Function related to Seeing relevant to a certain Society, or 2- Symbolic Safety related to Seeing relevant to a certain Community, could be symbolized as shown below.





This is relevant to one of the interaction levels with the environment that are arranged from higher to lower as follows: Globe, Community, Society, Organization, Family, and Individual.

Finally, relating the pervious result to a certain Architectural Unit: Work Place (Wp), Building section (Bs), Building (B), City (C), Continent (Co), Globe (G).

To practice, try to develop the following concepts:

- Symbolic Function related to Seeing relevant to an Organization (cars factory: Mercedes). The design problem is on the whole Building level.

- Symbolic Safety related to Seeing relevant to the whole Globe. The design problem is on the whole Building level of the Ministry of Defense.

- Aesthetic Recognition related to Seeing relevant to a certain Society (the Greeks). The design problem is on the Building section level: the Greek wing in an international exhibition.

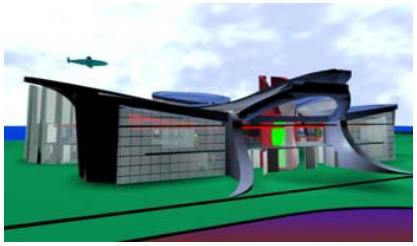
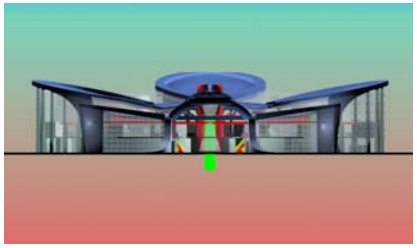
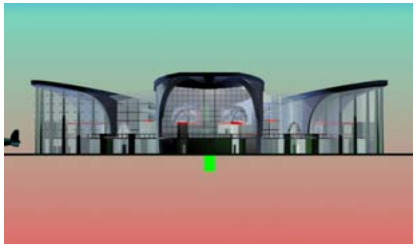
- Recognized Function related to Smelling relevant to an Organization (Bakery or Flavour shop). The design problem is on the Building section level: the entrance to the produce section.

- Functional Safety related to Touching at an Individual level. The design problem is on the Work place car wash, e.g. using anti-slip materials.

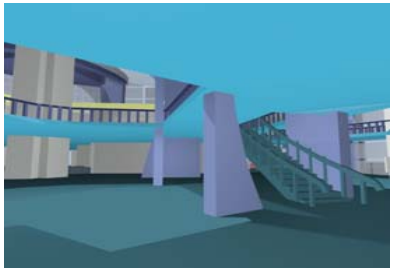
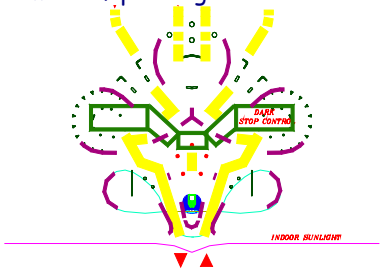
- Functional Comfort related to Hearing at an organizational level. The design problem is on a Building section level: sleeping area for babies in a hospital.

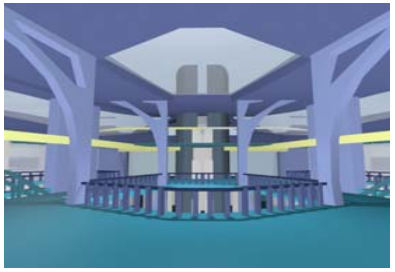
Examples:

1-Symbolic Function related to the Mind intuitive decoding, relevant to the Globe. The design problem is on the whole Building level. (When approaching the building everybody has the impression that the building is flying. This means that the function of the building is perceived intuitively).

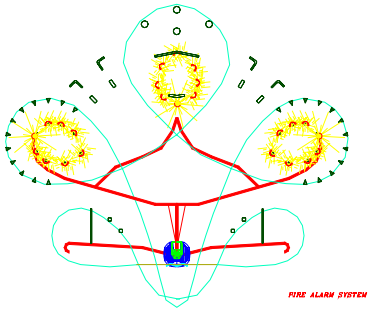




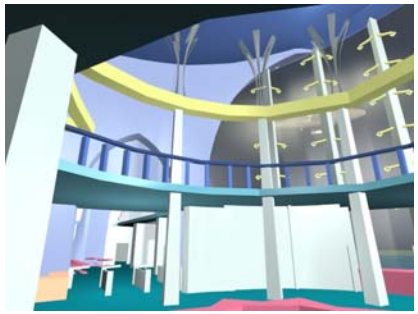
2-Functional Comfort related to Seeing at an Organizational level. This Corresponds to a departure hall in an airport building complex. (Natural orientation by using daylight to direct the movement of passengers to their various destinations)



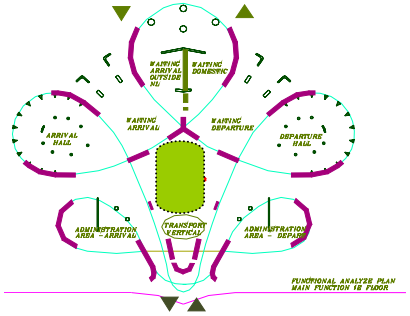
3-Aesthetical Function, related to Seeing on Organizational level for the check-in desk as a Work place in the departure hall. (Decorative elements that have a distribution function for the sounds, the light and the fire alarm sensors)





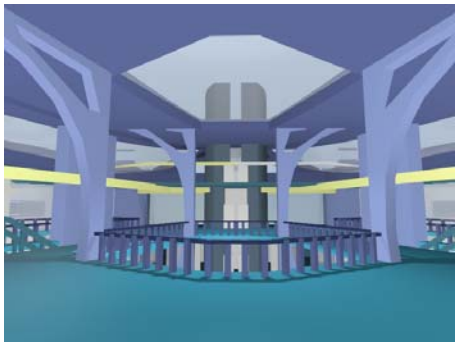
The main line for the distribution of sounds, lights and the fire alarm sensors are within a visible viaduct. This is seen as a decorative element from inside the building.

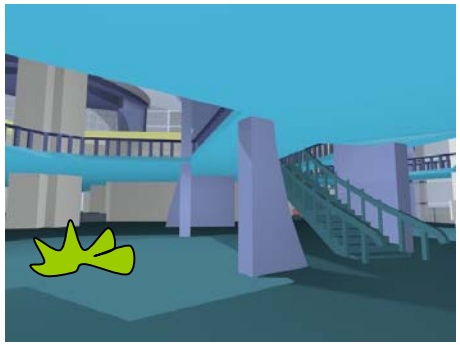
4-Recognized Function, related to the intuitive Mind decoding, relevant to the whole Globe. The design problem is on the whole Building level (The layout of the building's main units): the Departure and the Arrival units, the Common area, the Administration unit, and the Technical unit.



The Departure unit is on the right. The Arrival unit on the left. The in-between area is the Common area.
The main function (Transport) is on the ground floor; the secondary functions, which are an occasional watching of Air show, a Restaurant, and a Technical unit, on other floors.

5-Functionl Comfort, related to Seeing, relevant to the Globe, on a Building section level: the Common area. (Using sunlight coming from openings in the roof, in combination with green plants, and fountains of water to create a feeling of comfortable).





Sunlight falls on fountains and trees, in the central hall, creating a feeling of a comfortable short stay. People feel they have room to look around and make choices.

6-Symbolic Comfort, related to Hearing, relevant to the Globe, on a Building section level: the Common area. (Using the sound of a waterfall or a fountain to create a feeling of comfort).

Chapter 4 The Tool

This chapter discusses an elaboration on the theoretical basis as described in Chapter 2 and the application protocol as described in Chapter 3. It includes the Tool elements and the principles of working according to it. This chapter introduces the Tool as a practical instrument, which can assist in guiding the strategic briefing process.

The three taxonomies of the Self-Graph as defined in Section 2.5: a) A taxonomy of values, b) A taxonomy of sensing modalities and c) A taxonomy of interactions with the environment, will be represented in Boxes 2, 3 and 4 of Table 2.

Table 2: The five boxes of the Tool

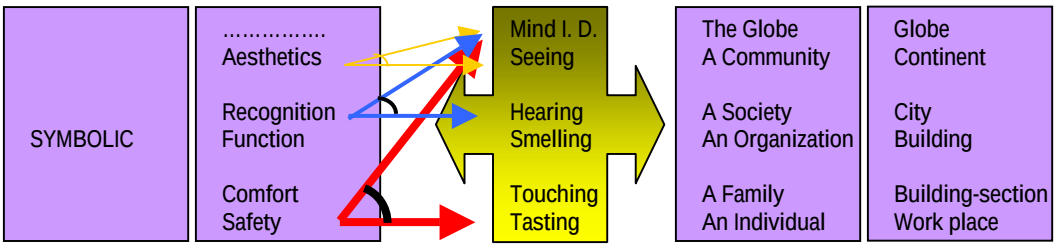
Box 1	**Box 2**	**Box 3**	**Box 4**	**Box 5**
The prioritized Values of the Self-graph	**Values** (Ordered the same as in the Self-Graph)	**Sensing modalities**	**Interaction levels with the Environment**	**Architectural Unit**
To be filled in with some or all values from box 2. The order is to be determined according to the client's wishes.	Symbol Aesthetics Recognition Function Comfort Safety	Mind Intuitive Deco. Seeing Hearing Smelling Touching Tasting	Globe Community Society Organization Family Individual body	Globe Continent City Building Building section Space (Work place)

The fifth box, in the same table represents the architectural units. This refers to the levels of the problem we are trying to solve.

Adding Box 1 to the previous Table 1 will replace the process of generating underlying structures for the concepts in scarcity (Section 2.6). In other words, it replaces the mechanism of manipulating underlying structures for concepts because of scarcity on the highest level.

As we will see later, adding this box gives the client the chance to define the order of achieving the main values, which means that he automatically can get the whole tree of possible underlying structures for the concepts.

To make the interface with this tool friendlier, we will elaborate Table 2 in six matrices. Each matrix will have only one value in box 1. Boxes 2, 3, 4 and 5 will stay the same (See examples: Tool Matrix 1).



Example, Tool Matrix 1 (the prioritized value put in box 1 is Symbol)

As we have explained, the prioritizing[5] that has to be discussed with the client results in defining different value profiles of buildings (Figure 11).

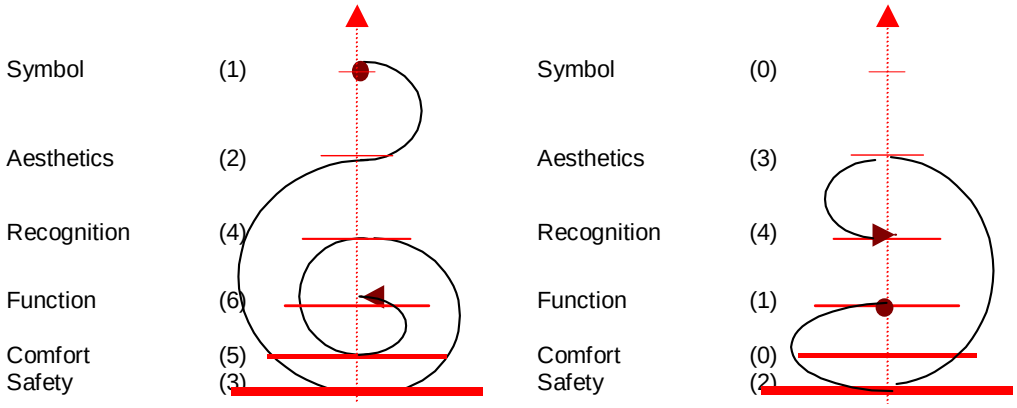


Figure 11: Different value profiles of different clients define different buildings

Thus, the client's value profile will provide the necessary information to fill-in the first boxes of all matrices.

[5] *Please have a look at the application protocol (steps 1, 2, and 3) on how to perform the process of prioritizing.*

4.1. Tool elements

The tool, which assists in guiding the strategic briefing process, therefore contains five boxes (Table 2):

- Box 1 holds the prioritized values from the Self-Graph, set according to the client's needs and wishes (Steps 1,2, and 3 according the application protocol). Values in this box take the adjective states.
- Box 2 holds the same values as the Self-Graph, in the same order: *Symbol, Aesthetics, Recognition, Function, Comfort, and Safety.* Values in this box take the noun states.
- Box 3 holds the sensing modalities *(Mind Intuitive Decoding, Seeing, Hearing, Smelling, Touching, Tasting).*
- Box 4 holds levels of interaction with the environment *(Globe, Community, Society, Organization, Family, and Individual).*
- Box 5 holds architectural units (*Globe, Continent, City, Building, Building section, and Space or Work place),* which refer to the levels of the problem we are trying to solve.

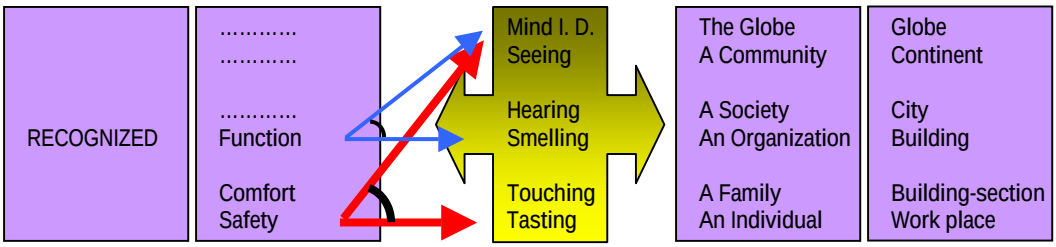
4.2. Principles of working with the Tool

To construct the strategic brief, we need to work as follows with the tool elements according to the tool principles:

1- Each underlying structure for an architectural concept has five elements: values prioritized according to the client's wishes, as number 1, or 2, or 3, etc. in box 1; Synthesized to other values that are beneath it (according to the Self-Graph), as in box 2; Synergized to a sensing modality from box 3, and to a certain level of interaction with the environment from box 4. These four elements are related to a particular level of the problem that we are trying to solve: an architectural unit from box 5.

2- The prioritized values (in box 1) take an adjective state, while the rest of values (in box 2) take noun states (See examples Tool Matrix 1 & Tool Matrix 3).

3- Recall that sensing systems are related to the values in box 2 or to the values in the nouns states (Section 2.4). For example Safety can be experinced by all senses, while Aesthetics can only be perceived by Mind-intuitive decoding and by Seeing; getting Recognition can be acheived by Hearing, Seeing and by Mind-intuitive decoding, while the Function (of a house for example) can be judged by Smelling, Hearing, Seeing and by Mind-intuitive decoding (See examples Tool Matrix 1 & Tool Matrix 3).



Example, Tool Matrix 3 (the values in box 2 in relation to sensing modalities)

4- If we choose to put a certain value in box 1, then we have to omit it from box 2. In addition, we omit all values that stand above it. In Matrix 1, for example, if we choose the value Symbol to be put in box 1, we give it an adjective state Symbolic, and we omit it from box 2. In Matrix 3 for example, if we choose the value Recognition to be put in box 1, we give it an adjective state Recognized and we omit it from box 2. In addition we omit all values that stand above it (see example Tool Matrix 3).

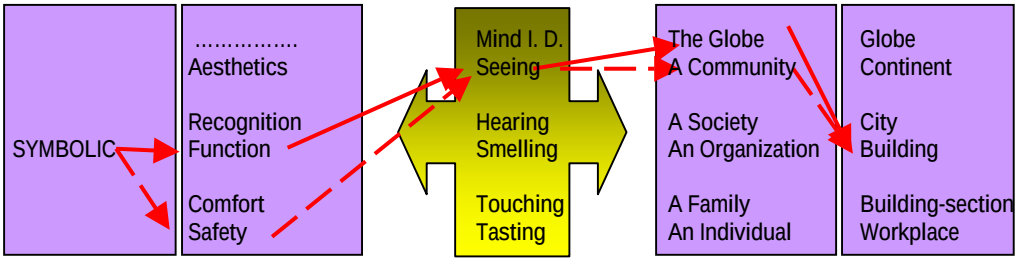
5- The building of a strategic brief assumes a connection between the five categories of elements in the five boxes from higher to lower (see previous table).

6- Note that if a concept is relevant to the whole Globe, then it also is relevant to all Individuals, to all members of an Organization, etc.

Thus, working with the tool elements according to the tool principles to construct the strategic brief can be elaborated in the following six matrices as explained in the following section.

4.3. The Tool Matrices

The Tool Matrix 1: The prioritized value (in box 1) is Symbol.



These underlying structures for concepts can be encoded as follows:

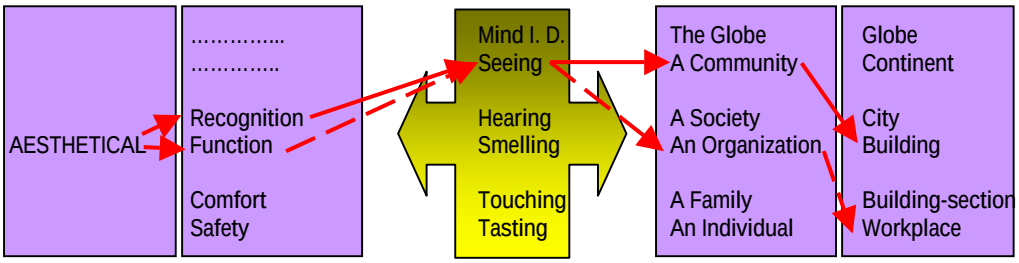
1- Develop a concept like: **Symbolic Function,** related to **Seeing,** relevant to the whole **Globe.** The design problem is on the whole **Building** level (e.g. when seeing my building, everybody on this globe gets the impression that this building is an airport building). To develop such a concept, all forms that create the sense of flying maybe suitable.

2- Develop a concept like: **Symbolic Safety,** related to **Seeing,** relevant to a certain **Community.** The design problem is on the whole **Building** level (e.g. when seeing my building, everybody who belongs to a certain community gets the impression that this is a safe building. To develop such a concept, all steady, stable, and well-balanced forms that have a symbolic meaning in a certain community may maybe suitable [6]).

3- Develop a concept: etc… (it could be any combination of elements from the five boxes of the Matrix 1).

[6] *Text in parentheses is the author's personal interpretation, to be used as a hint or example. You may think in other directions.*

Tool Matrix 2: The prioritized value (in box 1) is Aesthetics.

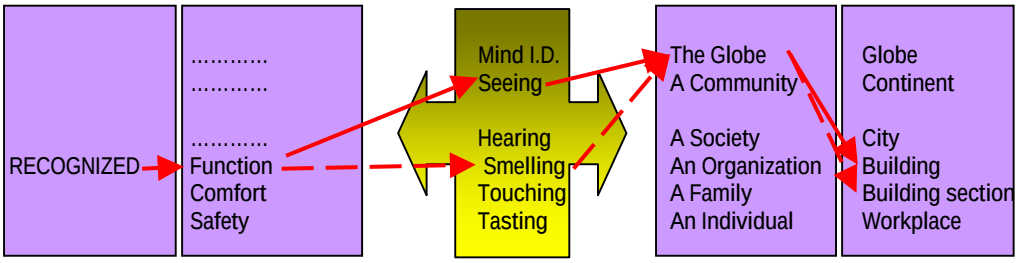


These underlying structures for concepts can be encoded as follows:

4- Develop a concept like: **Aesthetical Recognition,** related to **Seeing,** relevant to a certain Community. The design problem is on the whole **Building** level (Take for example the Chinese Community and the building of the Chinese Culture Center in Amsterdam).

5- Develop a concept: etc… (it could be any combination of elements from the five boxes of Matrix 2).

The Tool Matrix 3: The prioritized value (in box 1) is Recognition.



These underlying structures for concepts can be encoded as follows:

6- Develop a concept like: **Recognized Function,** related to **Seeing,** relevant to the whole **Globe.** The design problem is on the whole **Building** level (Take for example a building like an airport building complex)[7].

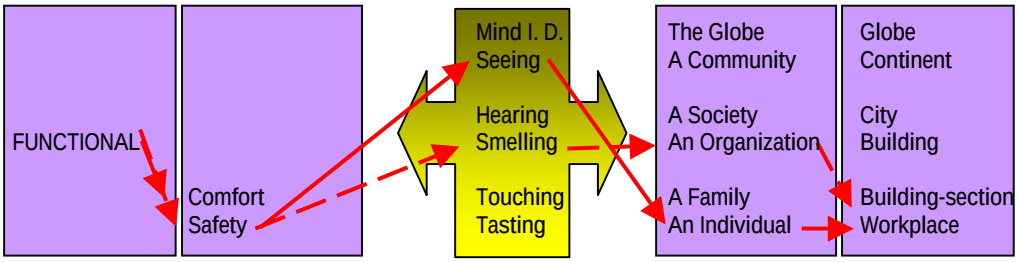
[7] *Please close your eyes and try to envision a concept by embodying this underlying structure to experience how these sets of words help you to create concepts.*

7- Develop a concept such as: **Recognized Function,** related to **Smelling,** relevant to the whole **Globe.** The design problem is on a **Building section** level (Take for example a building like a bakery and the section is the entrance to the produce section).

8- Develop a concept: etc. (it could be any combination of elements from the five boxes of the Matrix 3).

Note that when a concept is relevant to the whole Globe, it is also relevant to all individuals, to all members of an organization, etc.

The Tool Matrix 4: The prioritized value (in box 1) is Function.



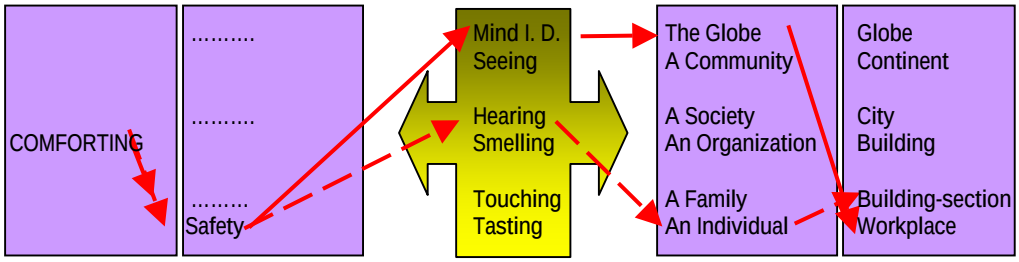
These underlying structures for concepts can be encoded as follows:

9- Develop a concept such as: **Functional Safety,** related to **Seeing,** relevant to an **Individual.** The design problem is on a **Workplace** level (Take for example a building like a hospital, and the work place is the x-ray room).

10- Develop a concept like: **Functional Safety,** related to **Smelling,** relevant to an **Organization.** The design problem is on a **Building section** level (Take for example a building, like the Faculty of Chemistry, and the section is the laboratory).

11- Develop a concept: etc. (it could be any combination of elements from the five boxes of the Matrix 4).

The Tool Matrix 5 The prioritized value (in box 1) is Comfort.

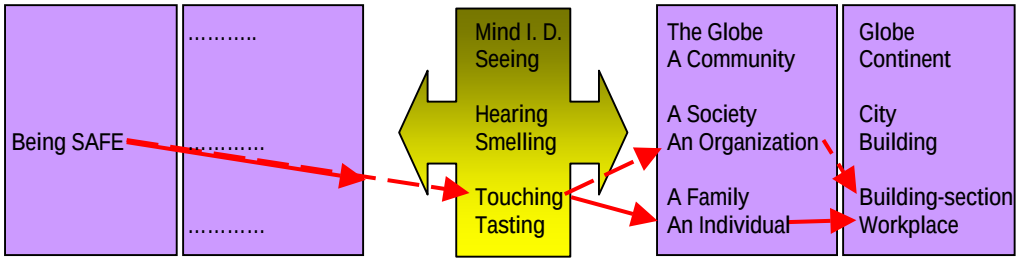


These underlying structures for concepts can be encoded as follows:

12- Develop a concept like: **Comforting Safety,** related to **Hearing,** relevant to an **Individual.** The design problem is on a **Workplace** level (Take for example a building like a psychiatric ward and the **Workplace** is the relaxing room where patients are examined).

13- Develop a concept like: etc… (it could be any combination of elements from the five boxes of the Matrix 5).

The Tool Matrix 6: The prioritized value (in box 1) is Safety.



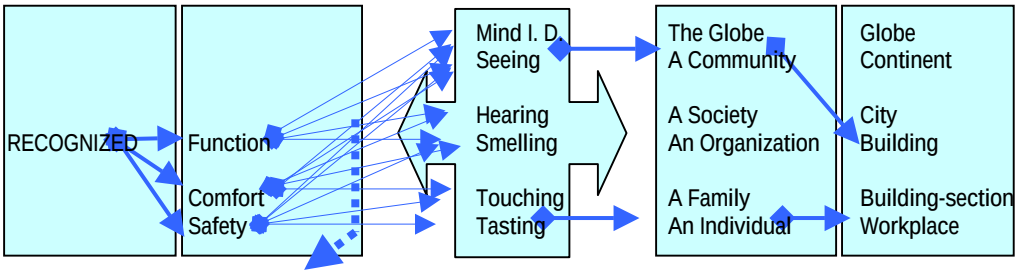
Although Safety has to be addressed in all buildings, because it is at the biological and physiological levels of interaction, and it therefore is instinctively embedded in the brain, it does not need any association to be understood. However, it is sometimes necessary to stress it in a particular situation. In such cases we need to use this matrix.
These underlying structures for concepts can be encoded as follows:

14- Develop a concept such as: being **Safe,** related to **Touching (**The pain as a result of undesired mechanical interactions**)**, relevant to an **Organization.** The design problem is on a **Building section** level (Take for example a multi-functional space that can be used to store or receive a great number of visitors on rare occasions).

15- Develop a concept like: being **Safe,** related to **Touching (**The pain as a result of undesired mechanical interactions), relevant to an **Individual.** The design problem is on a **Workplace** level (Take for example a building like a kindergarten and the work-place as the playing hall as a safe play area for children (no sharp edges)).

4.4. Notes

Before starting to use the tool we need to note that the first two boxes (values prioritized according to the client's wishes in box 1, and the values ordered according to the Self-Graph as in box 2) are always different, while the other three boxes (sensing modalities, interaction levels with the environment, and architectural units) are always the same in all matrixes. You can also see that the content of box 2 (values of the Self-graph) is always related to the content of box 1 (the prioritized values of the Self-graph), and the content of box 3 (sensing modalities) is in turn related to the values in box 2. Thus, by defining the values in box 1 and their orders, we automatically have the whole tree of possible underlying structures for the concepts that can be developed, such as for example Matrix 3 shown below.



Note that the whole tree of possible concepts is related to the value in Box 1**.** Thus all that clients need to do is to prioritize between the values. The most interesting thing about this tool is that if a value like Recognition, for example, is irrelevant or unimportant as far as the client in concerned, then the whole tree of possible concepts

related to it is irrelevant to the design problem. Moreover, if a concept is relevant to the whole globe, then it also is relevant to all individuals, to all members of an organization. For example, the concept that needs to be embodied depends on the following underlying structures: Recognized Function, related to Seeing, relevant to the whole Globe. The design problem is on the whole Building level, which means that the building function has to be visually represented and means the same on the global level. This implies that it also is relevant to all individuals, to all members of an organization, and for all society members, etc. This means that it is enough to develop a concept on a global level to include all members on all lower levels of the classification.

We have to add here that if the client is not aware of what these values could mean, then we need to explain them by comparing with other well-known buildings or show some examples. When these steps are performed and the client decides some or all values are important, then we can further discuss the whole tree of possible solutions, by discussing the relation to the other possible elements of other boxes.

4.5. What we need before starting to use the tool

Before you start using the tool it is recommended to restructure the available raw information you obtain from the client that you are going to design for. The restructuring has to recognize the design problem levels as explained in box 5 of the tool. This will make this information directly available for the filling of box 5 (Architectural Units).

Architectural Units: On which level are we going to start solving the design problem?	
	Globe
	Continent
	City
	Building
	Building section
	Space (work place)

If this raw information is not given, then we can get it from a reference book like *Architects` Data* (Neufert, *et al.*, 2000). This book covers user requirements, basic dimensions, and considerations of functions organized largely by building type (from airports to zoos).

4.6. The benefits of the Strategic Briefing

As described before, the tool was made to help explicate the core of the design, which is a whole of interrelated underlying structures of concepts. The order in which these concepts are generated is the conceptual process design. These underlying structures of concepts are encoded into a set of words that symbolize *why, what, how and where* to search. They can therefore be translated into patterns of orders. Each underlying structure in this symbolic format works as a mental map with all the components necessary for searching a concept.

This section discusses the benefit of abstracting and manipulating knowledge, like in our case the encoding of the design problem for the specific purpose of intuitive decoding, and for increasing the designers' ability to create novel concepts. Furthermore, it will discuss how this whole of underlying structures of concepts and the conceptual process design can be comprehended in an early phase of the design by the design team members, forming a common background or a shared memory that is necessary for directing their focus, especially when working collaboratively.

4.6.1. Benefits of selective and focused search

The encoding of the most characteristic feature of a concept makes the outlines of this searched concept sharper with other information fading into the background. Searching for a concept then is similar to searching for a coin on a beach, which we do by defining its most typical features. Harth (1995) calls this phenomenon the selective positive feedback "*Suppose you are looking for a coin you dropped on a beach. Assume that, to aid you in the search, the cortex suppresses the images of pebbles, leaves, shells, and so on, and to enhance anything small, round, flat, and metallic, in short, anything that looks like a coin. In this selective positive feedback, a mere suggestion of a coin would be made to look even more coin like to call attention to itself, until closer scrutiny reveals that the search has been successful or that what you were looking at was not a coin after all"*.

4.6.2. Benefits of intuitive decoding

The second benefit of encoding the design brief in such a structure is that the designers can intuitively decode it and solve the problem at the most abstract level. This means formulating the strategy, which is in fact the core of the design solution. The strategy as the core of the design solution indicates what and how to achieve 1) which part of the problem (which underlying structure for a concept) we have to start solving, and 2) the order of achieving them or the conceptual process design. The conception of both allows the mind to estimate the quality, the time and the costs of the concept that needs to be developed, and the skills of participants needed to participate in the design process. For example, if the design has to deal with values in a sequence like symbol, aesthetics, function, comfort and safety, then the estimated quality, time and costs will be higher than if the work starts with the values of function, comfort and safety. In other words, the structure of a concept underlying structure indicates the quality, the time and the costs of the concept that needs to be developed (Figure 12).

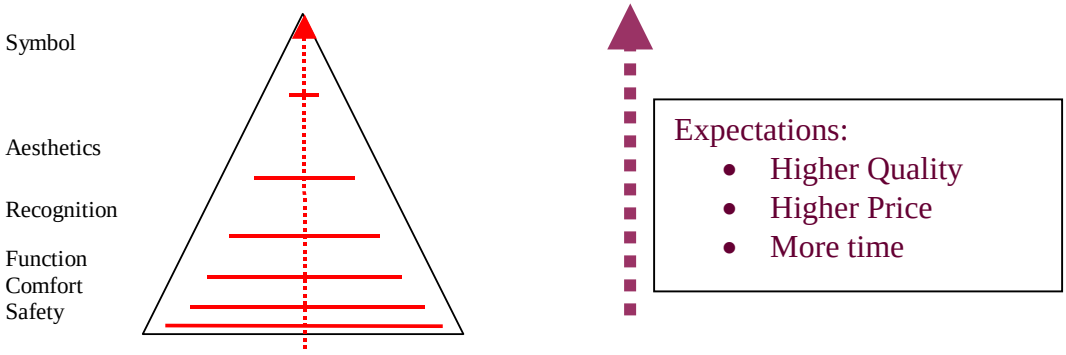


Figure 12: The structure of a concept underlying structure as an indication of the quality, the time and the costs of the concept that needs to be developed

Furthermore, by synergizing the client can define and redefine the desired interaction level with the environment, which means defining and redefining the quality of the concepts that belong to the final product. For example, if he/she reduces the ambition to develop a concept from a global level to an individual or organization level, then the invoked concepts will be lower qualitatively. In general, when the encoding aims to realize values that are on higher levels according to the Self-Graph, and thus related to a higher sensing with higher levels of interaction with the environment, then the

encoded pattern will be intuitively decoded as a high-quality product's concept. This implies performing on a higher level because the envisioned underlying structures require highly capable designers. This in turn indicates more costs and time needed to realise the design.

Reaching this climax by encoding the essentials of the design problem and representing it in a symbolic format will encourage designers to decode this problem intuitively (Al Hassan, *et al.*, 2005). This means solving the problem first by decoding the symbolic representation into a strategy, which indicates the following: The conceptual process design, i.e. which part of the problem (underlying structures for a concept) we have to start solving; the concepts that need to be developed; the product's expected quality; the means needed to arrive at this quality; an estimation of the time needed; the capabilities of the designers who can translate these underlying structures for concepts into actual concepts. This increases our ability to estimate the costs (Figure 13).

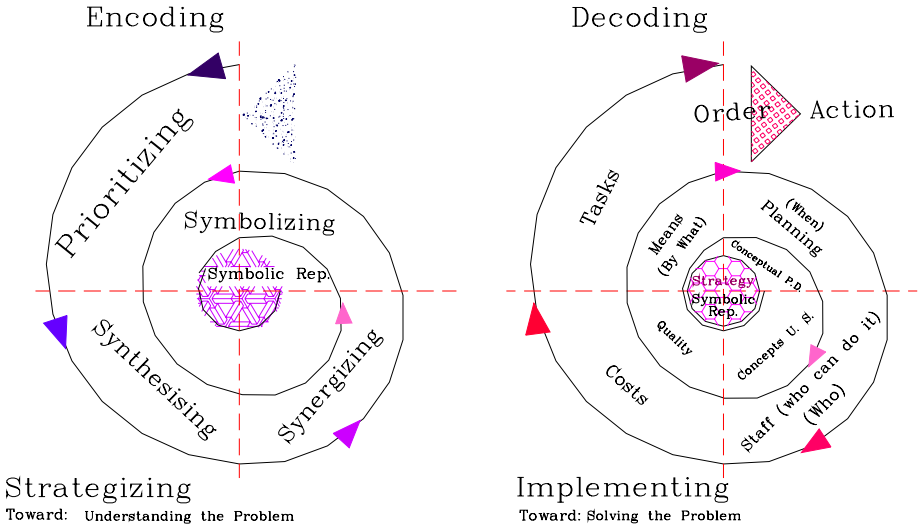


Figure 13: The intuition between the symbolically encoded design problem and the decoded strategy

Thus, depending on this very limited information in a certain structure in the very beginning, the client and the designers can be well informed about the quality of the product, and the quality of the designers, as well gaining an idea of the costs and time

needed. This may increase the possibility to choose the economically most profitable quality regarding the costs and time needed to realize the work. Dorst (2003, p. 117) therefore argues that the strategy that seems to work the best is to pose or identify priorities, solve the high-priority problem and adapt all the other solutions to this '*core design'*.

In conclusion we argue that the comprehension of the design problem on the highest level encourages designers to decode it intuitively. This means conceiving the design solution on the highest level. The creativity then lies in formulating the question more than in answering it, and thus, in what Glegg (1969) describes as "*the secret of inventiveness is to fill the mind and the imagination with the context of the problem"*. This is what we mean by the encoding of the design problem in an abstract symbolic format. *Relaxation* means giving intuition a break to decode the problem by transforming the symbolic representation into a strategy, which in our view is the same thing but opposite in direction (Figure 13). Newell, Shaw, and Simon (1957) assume that people's continuous creative achievements in fact depend on this creative process of problem formulation, and that a creative activity simply appears to be a special class of problem-solving activity characterized by novelty in problem formulation.

4.7. Summary

What we have discussed until now was how to model the mental process which occurs when the Master builder of the past communicated with the client, asking him some questions that are related to his future property (building). Depending on the clients' answers, the Master builder intertwined underlying structures for the concepts that he needed to be developed.

For a better explanation of this idea, we would like you to go through the same experience and to take the position of the client.

Now if you were asked the same question, which is:
How would you like your future building (house, company…) to be[8]?
It is imaginable that your mind is now invited to create some mental shortcuts of images, pictures or what we articulate in general as concepts.

[8] *Please try to answer these questions in order to be in closer interaction.*

If you were asked to try to hold one of these concepts for a while in your short-term memory, and try to analyze it, then what could the basic aspect of this concept be?

We argued in this thesis that a concept has to have a basic value, like aesthetics, comfort, function, safety, symbol, or recognition. These values are related to one or more of our sensing systems. Otherwise we could not perceive them. They are also related to a certain group of people who are interested in the building. Those groups we refer to as the desired interaction levels with the environment. Furthermore, each concept is related to the context of the building, the building as whole, a part of the building, or a certain space in this whole building. These basic aspects characterize the most important features of each concept.

Now if you were asked to try to order the same shortcuts that you have created before, but this time considering your priorities, the result you get is a series of shortcuts of mental images, in a certain order. Each of them characterizes the most important features of your future property. The sum of these mental images given your priority order is what we call the strategic brief.

Reaching the climax by encoding the essentials of the design problem and representing it in a symbolic format encourages designers to decode this problem intuitively. This means solving the problem first by translating the symbolic representation into a strategy, which indicates the following: the conceptual process design, the concepts that need to be developed, the product's expected quality, an estimation of the time needed, the capability of the designers who can translate these underlying structures for concepts into actual concepts, and finally an estimation of costs. This means a comprehension of the core of the design solution at the highest level.

Designing this tool, which can help us produce the strategic brief, as the core of the design therefore adds a significant contribution to the debate on how to access the designers' creative minds. It also provides a mechanism for forming a problem scope, a shared memory, and a reference for collaboration. Every participant will understand his/her position in the context of the whole by deciding which of these concepts is more related to his/her specialization. Chiu (2002) emphasizes the importance of developing such a tool by saying: "*We need a process model of collaborative design to describe the context of the design tasks, which is important for all participants to understand his/her position in design collaboration*".

The following chapter will illustrate the applicability of the tool in practice by showing that the tool can be used by the parties it was intended to support, and is capable of fulfilling the purpose for which it was designed.

Chapter 5 Testing the tool for its applicability in practice

Testing the tool for its applicability means illustrating whether the tool can be used by its intended users and is capable of fulfilling the purpose for which it was designed. In other words, illustrating whether the predetermined objectives, which are behind the design of the tool as articulated in Section 1.3 were met, and examining whether the users in the three main positions (the client's position, the designers' position, and the architectural design managers' position), as explained in Section 1.5 were helped to achieve these objectives.

The main objective behind the tool is to trigger a shift in briefing, which can help us manage the complexity caused by the information overload in the early phase of design by assisting the reproduction of the design challenges as a cognitive artifact. This is supposed to replicate the stage of conceiving the design problem in an integrated manner, which can facilitate the very beginning of the design process by achieving the following objectives:

- Simplifying the transformation of information between the client and the design participants on the one hand, between the design participants themselves, and between the working memory and the long-term memory of each participant on the other.
- Providing a mechanism that enables us to repeatedly attain a unique common design problem representation, and form a shared vision.
- Allowing for the possibility to make very important decisions at the earliest phase when starting a project.
- Leading to a more effective use of design team capabilities.
- Providing a framework that is important for all participants to understand their main tasks in addition to their positions in the collaborative design team, which can harmonize their collaborative search for a common solution.
- Providing some clarity as to how proposed solutions should be judged.

In this chapter, the criteria will be explained, a case study will be defined, and the results of application will be illustrated, discussed and evaluated.

5.1. Criteria for evaluating the applicability of the tool

In this Section, we will discuss how to formulate the criteria that aim at illustrating whether the users in the three main positions were helped to achieve the predetermined objectives behind designing the tool. This is elaborated as follows:

1- Whether the tool helps participants (taking the position of the client) to articulate the project's objectives and to form the Strategic Brief as an abstract mental representation of the design (challenges).
2- Whether the Strategic Brief, which is produced with the help of the tool, allows participants (taking the position of the designers) to form a shared vision, which can provide a framework that helps participants to understand their main tasks in addition to their positions in collaborative design, and can lead to a more effective use of design team capabilities.
3- Whether the tool, which can assist in the production the Strategic Brief, seen from the designer managers' points of view, helps to effectively regulate an important complex information hinge between the client and the mono-disciplinary design team members.
4- Whether the participants in the three main positions find the tool a practical instrument for supporting the systematic explication of the brief, and the probability of making it their own, ready to be used in other cases.

The first three criteria test whether the predetermined objectives behind the tool are met considering the three test positions. The fourth tests whether the tool is a practical instrument for supporting the systematic explication of the brief. It also tests the probability that the end users will embed the tool to make it their own.

Each of these basic criteria is elaborated in a set of questions that can be used by participants as main points of attention for evaluating the tool as follows:

The first criterion, which tests whether the tool had helped participants (taking the position of the client) to articulate the project's objectives and to form the Strategic Brief as an abstract mental representation of the design (challenges) can be elaborated as follows:

1- The effectiveness of the tool to discriminate between what is relevant, less relevant and what is totally irrelevant in forming an abstract mental representation of the design problem.
2- The efficiency of the tool for making an abstract mental representation of the design problem.
3- Whether the tool helps participants to systematize, and structure the project information effectively.
4- Whether the Strategic Brief helps participants to attain a clear vision over the end product, and a better control over the total process from the very beginning.
5- The sense of time needed and the financial requirements before and during the design when dealing with the project at hand.

The second criterion, which tests whether the Strategic Brief, which is produced by means of the tool, helps participants (taking the position of the designers) to form a common ground for team collaboration based on the common understanding of the core design (challenges) can be elaborated as follows:

6- Whether the Strategic Brief provides a framework for all participants to understand their tasks in addition to their positions in the mono-disciplinary design context.
7- Whether the Strategic Brief increases participants' abilities of locating the responsibilities by decision-making when developing different concepts.
8- The harmony between the design team members as a result of their common understanding of the design core, which is supposed to support the team collaboration.
9- Whether the Strategic Brief helps the design team members to focus their attention by embodying certain underlying structures for concepts.
10- Whether the Strategic Brief helps the design team members to generate novel concepts when embodying certain underlying structures.

A point of attention like whether the Strategic Brief had an access to the designers' creative minds was further elaborated by evaluating the following:

a. The originality of the concepts behind the design.
b. The identity and style of the designed building as a whole.

c. The unity of the design as a multi-disciplinary whole.
d. The internationality of the resulting design.

The third criterion, which tests whether the Tool (as seen from the designer managers' point of view) helps to regulate an important complex information hinge between the client and the mono-disciplinary design team members by enhancing the systematical explication of the brief, can be elaborated as follows:

11- Whether the Tool helps to establish a shared vision, and a common reference for the client as well as the design team members, by viewing the end product mentally before the start.
12- Whether the Tool helps forming an adequate design team organization, and locating the responsibilities when developing different concepts.
13- Whether the Tool helps participants in both positions to harmonize their efforts in order to reach their common goal.

The fourth criterion, which tests whether the participants in the three positions find the tool a practical instrument for supporting the systematic explication of the brief, and the probability of embedding the tool in their minds and making it their own, ready to be used in other cases, can be elaborated as follows:

14- The probability of embedding the tool in minds and adopting it ready to be used in other cases.

The users' satisfactions are estimated by giving a mark between very high and very low. In between, there are three other possibilities. For example, the participant's opinions for estimating whether the tool helps participants to systematize, and structure the project information effectively, could be registered as follows:

Very effective				Not effective
5	2	-	-	1

The numbers (5, 2 and 1) indicate how many participants in the test group experienced working with this tool as very effective to not effective at all.

5.2. Case study

The following aspects played a role in a case study:

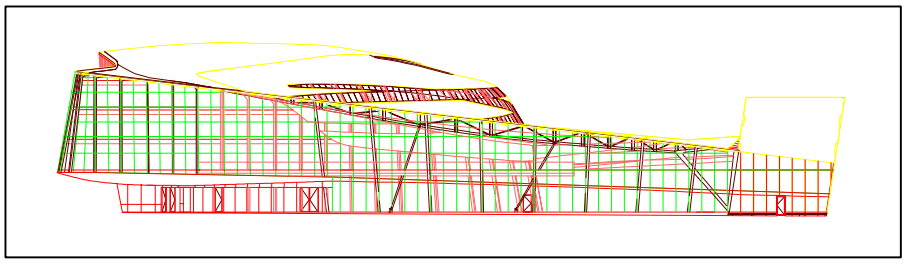
a. The possibility to test multi-disciplinary design team interactions.
b. The possibility to deal with the three main positions.
c. The possibility to evaluate the satisfaction of users at all stages.

For these purposes and to examine the basic criteria (mentioned in section 5.1), a multidisciplinary group of students in the Master phase (seven students), from almost all departments of the Faculty of Architecture Building and Planning: Architecture Design, Structural Design, Building Technology, Construction Management, Physics of the Built Environment, and Construction Technology had to work on a multidisciplinary design project.

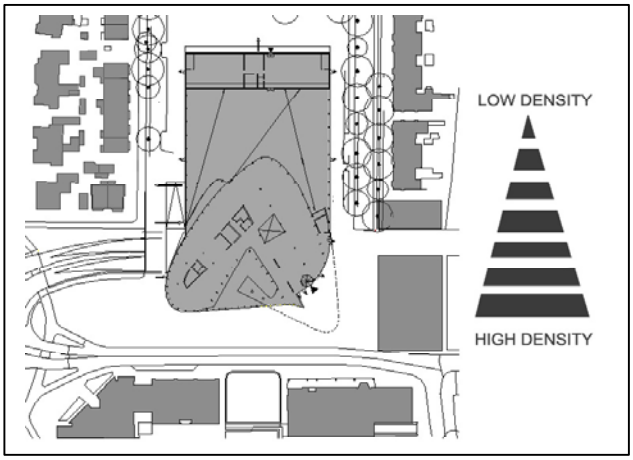
The multidisciplinary design project was to integrate a theatre into the existing city hall of `*Alphen aan de Rijn*`. This special case therefore also tests the ability of the tool to deal with rehabilitating existing buildings.

The available raw information as received from the client, and as given to the participants in the test group can be summarized as follows:

1- The original building of the city hall is a new building of a certain architectural style (Blob Architecture). It has a complex, and a complete shape. The interference with such buildings with the aim of adding a new function is very difficult (see the image below, which reflects this conception).



2- The situation is very limited and the city hall building is surrounded by dense building structures (see the image below).



3- The realization of the new theatre may only cause minor damage to the city hall and the rest of the city plan.

5.3. Sessions

Because participants were not familiar with our suggested tool, we arranged a set of sessions that corresponded to each of the three positions. During seven meetings, participants were asked to perform their tasks by successively adapting the three main positions in three stages as follows:

- During the first stage of two sessions, participants took the position of the client to generate the strategic brief as a set of underlying structures of concepts.
- During the second stage of four sessions, participants took the position of the designers to generate the concepts according to the result of the first stage.
- During the third stage of one session, participants took the position of the design manager to evaluate their experience after working with the tool. In other words, participants were asked to reflect on their experience, considering the whole process using the given points of attention (mentioned in Section 5.1).

5.4. The process of application

The effectiveness of working with such a tool can only be realized after practicing. This is because during the first two stages, participants have to be practically involved. This means that they focus on following the instructions, which leads them to formulate the Strategic Brief as a set of underlying structures for concepts, and then to translate it into the design's main concepts. After practicing, participants can reflect on their experiences and provide feedback to the whole process by recalling what they did, and how. The application process therefore was planned and performed as follows:

A- During the first two sessions and for adapting to the client's role, the author helped the participants to perform this role by doing the following:

1- Explaining the tool matrices and the principles of working with them (Section 4.1 - 4.3).
2- Showing how the tool works, e.g. how different combinations of the tool's elements from different boxes end with different underlying structures for concepts, and how the contribution of each participant relates to the order of the underlying structures for concepts.
3- Giving some examples *(from the authors' design of Eindhoven Airport Building).*
4- Asking the participants to conceptualize an optimal situation of the new city hall with the theatre by generating some underlying structures for concepts.
5- Asking the participants to analyze the existing city hall: how they perceive it according to the conceptualized optimal situation.
6- Asking the participants to determine what has to be changed. This defines the design as a whole, as a set of underlying structures for concepts.

B- During the second stage of four sessions and by adapting to the designer's role, the author helped the participants to perform this role by doing the following:

7- Asking the participants to decide who has to contribute to the development of each of these ordered underlying structures for concepts.

8- Asking the participants to design by embodying the defined underlying structures for the concepts.
9- Asking the participants to present their common final design as a series of concepts on paper.

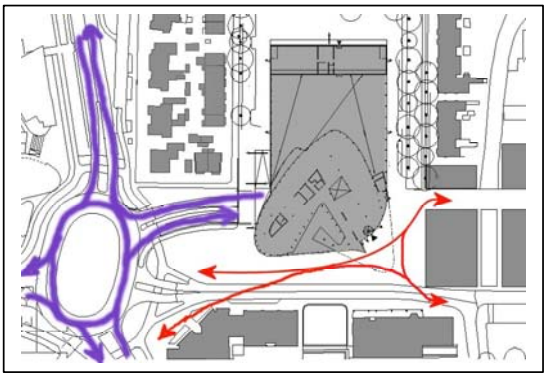
C- During the third stage of one session and for adapting to the design manager's role, the author helped the participants to perform this role by doing the following:

10- Asking the participants to reflect on their experiences and give feedback about the whole process by using the points of attention (mentioned in Section 5.1).

5.5. Results

Before starting, participants were asked to gather and restructure the available raw information, which they received from the client to define an adequate background to start using the Tool. If some necessary information was not given, participants were asked to consult a book like *Architects` Data* (Neufert, *et al.*, 2000) as is explained in Section 4.5. The result was as follows:

On the City level: the test group members decided to restrict themselves to the design problem as given. This was the realization of the new theatre with minor damage to the city structure (all roads and buildings around the new theatre as a part of the city structure had to stay in tact as they were). The structure, the density and the heights of the neighboring buildings had to stay as given in the city plan (see the image below).



On the Building level: the city hall of *Alphen aan de Rijn* had to be preserved, as much as possible. The main axis for circulation from the city to the city hall, and all circulations inside the building of the city hall had to be preserved as they were. The architectural style (Blob Architecture) of the city hall had to be respected. The interference with the existing building, to which the theatre had to be added as a new function had to enrich the aesthetic value of the original building.

On the Building section level (The theatre): The necessary raw information, which was not given, was taken from Neufert *Architects` Data* book, section on theatres and cinemas, pp. 476-488 (Neufert, *et al.*, 2000).

The result of restructuring of the available raw information, which participants received from the client, and also of consulting the Neufert considering the requirements of theatre building was as follows:

1- The main functions unit:

b- The theatre hall and tower.
c- The stage.
d- Actors' dressing rooms.

2- The support functions unit:

e- Entrance and foyer.
f- Waiting hall with WC and telephone cells.
g- Information and tickets.
h- Café.

3- The technical unit:

i- Drinking water, gas, electrical, sewerage.
j- Elevator for the theatre equipment.
k- Fire protection water supply.
l- Central heating room.
m- Lighting, Communication, Media, and Control rooms.

5.5.1 The results of taking the client's role

The results of taking the client's position were the following:

- The value profile.
- The Strategic Brief as a set of underlying structures.

5.5.1.1 The value profile of the new theatre

The value profile of the theatre as defined by the participants taking the client's position is illustrated in Figure 14.

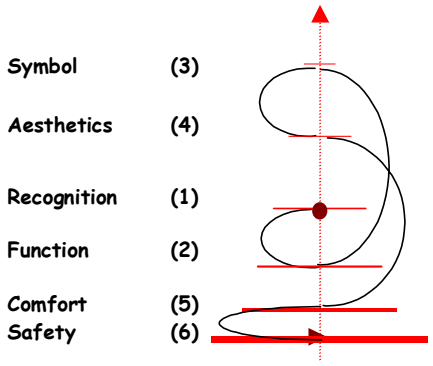


Figure 14: Value profile of the theatre in the city hall of Alphen aan de Rijn as defined by the participants taking the client's position.

This value profile reflects the priorities by designing the theater as a new function in the city hall of *Alphen aan de Rijn.*

5.5.1.2 The Strategic Brief of the new integrated theatre to the city hall of 'Alphen aan de Rijn'

According to this value profile of the theatre building (Figure 14), participants had to start from the value Recognition, which is related to Matrix 3, then Function (Matrix 4) and then Symbol (Matrix 1), etc. Recall that a matrix is connected to each value. For example, in order to start with the value of Recognition, we need to activate and elaborate Matrix 3 (see Section 4.3 the tool Matrices). The result is as follows:

From Matrix 3 participants chose to develop the following underlying structures of concepts:

1- *Recognized function* related to *intuitive mind decoding*, relevant to the city hall *organization.* The design problem is on the *whole building* level.

2- *Recognized function* related to s*eeing* relevant to the whole *globe*. The design problem is on the *building section* level (the theatre).

3- *Recognized safety* related to *seeing* and *hearing* relevant to the theatre *organization*. The design problem is on the *building sections* level: the main theatre hall till the exit (the fire alarm systems and other building services have to be recognized by seeing and hearing for both blind and deaf people).

From Matrix 4 participants chose to develop the following underlying structures of concepts:

4- *Functional comfort* related to *seeing*, relevant to the theatre *organization*. The design problem is on the *building section* level: the stage and the theatre hall for optimal viewing.

5- *Functional comfort* related to *hearing*, relevant to the theatre *organization*. The design problem is on the *building-sections* level: the stage and the theatre hall for optimal hearing (all seats have to be facilitated with good acoustics).

6- *Functional comfort* related to *seeing, smelling, touching and mechanically interacting* between visitors of the city hall and the new theatre during the realization of the building, relevant to the theatre *organization*, on a *building section* level (the entrance of the city hall).

7- *Functional comfort* related to *hearing, smelling and touching,* relevant to the theatre *organization.* The design problem is on the *work-place* level: Technical unit (all dirty and noisy or wet spaces, like drinking-water supplies, sewerage, central heating room and water supply fire protection have to take the shortest route to their destination and have to have a separate supply installation and separate control rooms in the common basement).

8 - *Functional comfort* related to *seeing* and *touching* or mechanically interacting**,** relevant to the theatre *organization.* The design problem is on the *building section* level: the theatre Hall (all electrical and communicational installations have to be visible, and have to be operated upon with minor mechanical interaction with the building constructions when necessary for easy maintenance).

9- *Functional safety* related to *smelling* and *touching* relevant to the theatre *organization.* The design problem is on the *work-place* level: escape routes (all escape routes and exit gates have to be well protected against fire and smoke).

From Matrix 1 participants chose to develop the following underlying structures of concepts:

10- *Symbolic function* related to the *intuitive mind decoding,* relevant to the *globe*. The design problem is on the *whole building* level (when approaching the building, everybody on this globe should get the impression that the building is a theatre, i.e., everybody should intuitively decode the building function as a theatre).

11- *Symbolic comfort* related to *hearing,* relevant to the *globe*. The design problem is on the *building section* level: the Café. (Using the sound of a waterfall or a fountain to create a feeling of comfort).

12- *Symbolic safety* related to *seeing,* relevant to the whole *globe*. The design problem is on the *whole building* level (globally perceiving the building as safe: using steady, stable, and well-balanced forms on large pillars, etc.).

From Matrix 2 participants chose to develop the following underlying structures of concepts:

13- *Aesthetical recognition* related to *seeing,* relevant to the *European community*. The design problem is on the *whole building* level (Using the Blob architectural style, popular in Europe).

14- *Aesthetical function* related to *seeing,* relevant to the theatre *organization*. The design problem is on the *building sections* level: the theatre main Hall (the distribution

main line and elements that facilitate the function for the sounds, the light and the fire alarm sensors also are decorative in the ceiling).

15- *Aesthetical recognition* related to *seeing*, relevant to the city hall *organization*. The design problem is on the *building sections* level: the relation between the work offices of the city hall and the theatre (using different light intensity, color, etc. in such a way that people naturally recognize the boundary line between both functions).

16- *Aesthetical comfort* related to *seeing*, relevant to the *globe*. The design problem is on the *work-place* level: the Café (using certain colors, materials or textures can invoke impressions to the aesthetical comfort).

17- *Aesthetical safety* related to *seeing*, relevant to the *globe*. The design problem is on the *whole building* level (using certain forms like symmetric well-balanced forms can invoke such an impression of aesthetical safety. Also colors, materials or textures can invoke similar impressions).

From Matrix 5 participants chose to develop the following underlying structures of concepts:

18- *Comforting safety* related to *touching*, relevant to the *individuals*. The design problem is on the *work-place* level: theater seats (heating the individual places where people are to be seated and using a kind of materials like wood that can reflect the feeling of warmth, which can invoke the impression of comforting safety).

Although safety does not need any association to be understood and has to be guaranteed in all buildings, it is sometimes necessary to stress it, to take care of a certain situation. **From Matrix 6,** Participants chose to develop the necessary concepts by embodying the following underlying structures:

19- *Being Safe* related to avoiding pain caused by *mechanical interaction*, relevant to an *individual*. The design problem is on a *work-place* level: entrance and the exit gate, up to the chair elevator for individuals with heart complaints or handicaps.

20- *Being safe* related to avoiding pain caused by *mechanical interaction*, relevant to an *individual*. The design problem is on a *work-place* level: the theatre decor requirements' elevator (no physical interaction with people).

These twenty underlying structures for concepts form the Strategic Brief as a core of the design, which can direct the search for solutions. By taking the designers' role, participants can develop these underlying structures of concepts for the design's main concepts.

5.5.2 The result of taking the designers' role

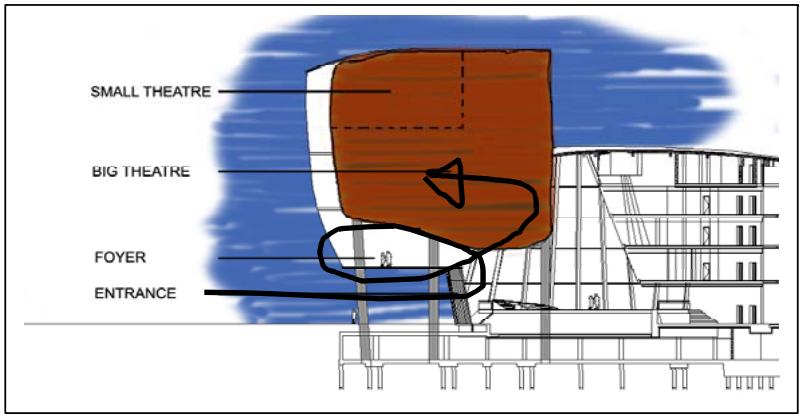
As soon as the Strategic Brief, which contains the underlying structures of concepts, was articulated, the participants were asked to take the designers' role, and to start designing. They were free to determine who was to develop which concept, in which form of collaboration, and with whom. The results of this first application of a Strategic Brief were as follows:

Concept: *1- Recognized Function, related to the intuitive Mind decoding, relevant to the city hall Organization. The design problem is on the whole Building level (the layout of the building's main units).*

It is well known that unless the spaces in a building are arranged with respect to each other, corresponding to their degree of privateness, visitors can intuitively become badly oriented. Participants in the test group therefore suggested that the building's main units should be situated according to the intimacy gradient, which is necessary for the intuitive mind decoding. The new building design recognized a gradient of settings with different degree of intimacy, which is reflected in the layout of the spaces, representing the following sequence:

- The city hall as a main function of the building: it stays on the ground floor. Students added the theater entrance, telephone cells, information and tickets desk to the ground floor.
- The entrance (the most public parts) to the slightly more private areas like the café on the second flour and finally to the most private domains, being the theatre hall.

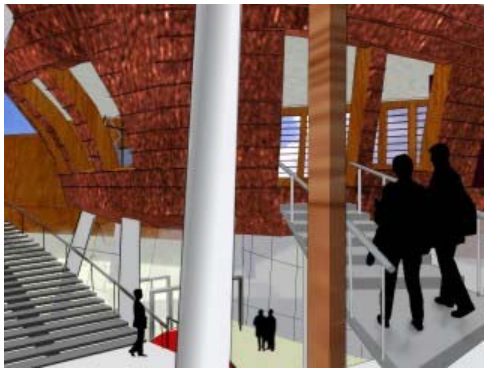
In other words, the layout of the building's main units places targets at natural points of interest to lead the theatre visitors to their different goals (see the image below).



The participants chose a path that is gently curved between the targets and situated according to the intimacy gradient, so that the visitors see the next target clearly and directly after reaching the first one (see also the three below images, which reflect this conception):

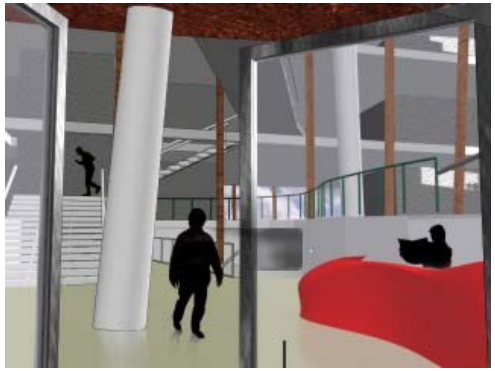
1- Entrance and foyer (the least private).
2- Information and tickets desk (more private than the entrance).
3- Café (more private than the entrance, and the information and tickets desk).
4- The theatre main hall, which is the most private domain.

A- Ground floor
Entrance
Information and tickets desk
(the least private)



B- Second floor
Café, Foyer

(more private than entrance)



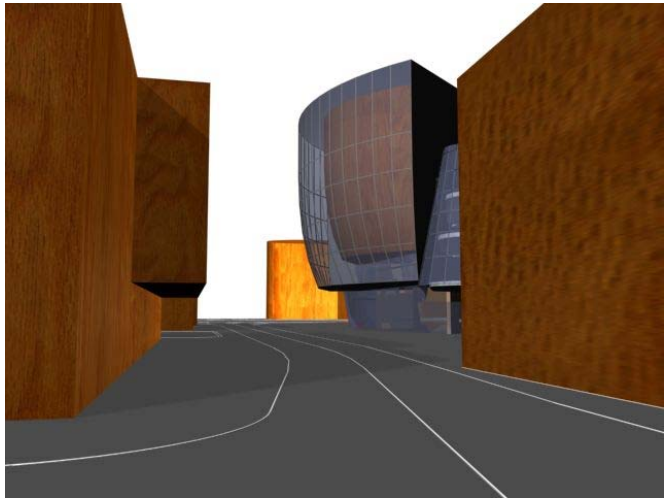
C- Third floor
toward the theatre hall,

(the most private domain)

(While developing this concept, students were engaged from Architectural design, Physics of the Built Environment, Construction Management and Building Technology, while other students were observing and giving feedback).

Concept: *2- Recognized Function, related to Seeing, relevant to the whole Globe. The design problem is on the Building-section level: the theatre.*

Students discuss the possibility of making the mass of the theatre like a television.

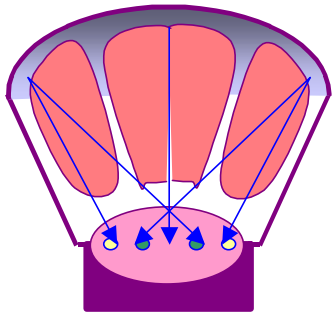


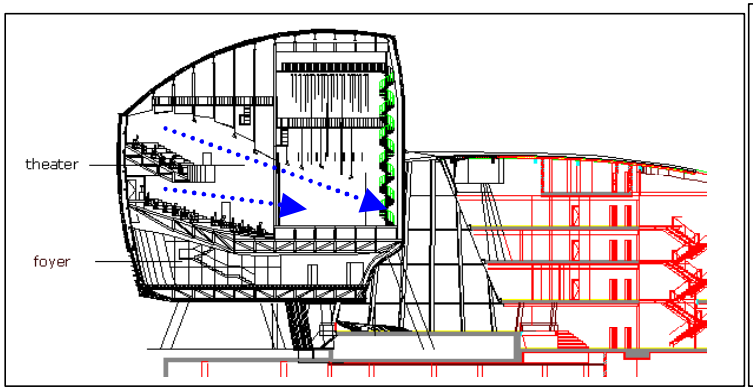
(While developing this concept, students were engaged from Architectural design, Structural Design and Building Technology, while other students were observing and giving feedback).

Concept: *3- Recognized Safety, related to Seeing, and Hearing relevant to the theatre Organization. The design problem is on the Building-sections level: the main theatre hall to the exit. The fire alarm systems and building service systems have to be recognizable for both blind and deaf people through auditive or visual cues.*

(Students from Physics of the Built Environment and Architectural design were engaged, while other students observed and gave feedback).

Concept: *4- Functional Comfort, related to Seeing, relevant to the theatre Organization. The design problem is on the Building section level: the stage and the theatre hall for optimal viewing.*

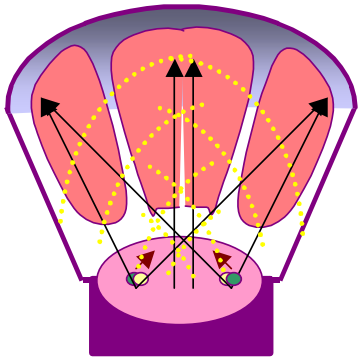


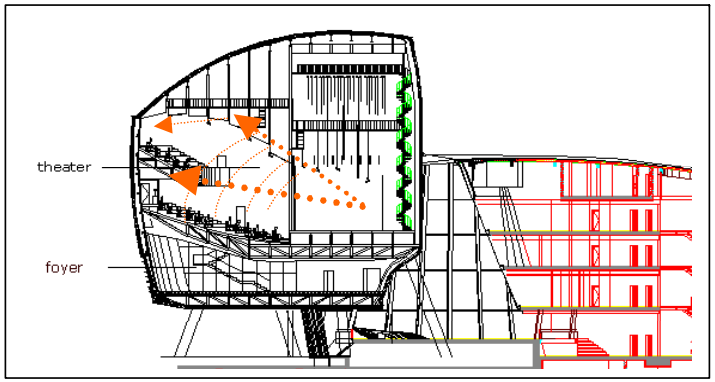


Students chose the following form by defining a certain angle between the stage and the show hall both vertically and horizontally. Both fit the very strict situation of the original city hall building.

(Students form Physics of the Built Environment and Architectural design were engaged, while other students were observed and gave feedback).

Concept: *5- Functional Comfort, related to Hearing, relevant to the theatre Organization. The design problem is on the Building-sections level: the stage and the theatre hall for optimal hearing. All seats have to be facilitated with good acoustics, (i.e. defining a certain angle between the stage and the show hall vertically and horizontally).*

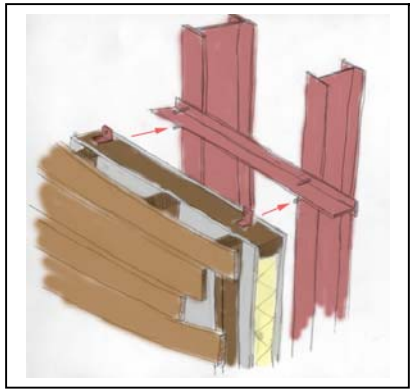




Students chose the following form, defining a certain angle between the stage and the show hall both vertically and horizontally.
Both fit the very strict situation of the city hall original building.

(Students from Physics of the Built Environment and Architectural design were engaged, while other students observed and gave feedback).

Concept: *6- Functional Comfort, related to Seeing, Smelling, Touching, and mechanically interacting between visitors of the city hall and the new theatre during the realization, relevant to the theatre Organization, on a Building-sections level: the entrance.*



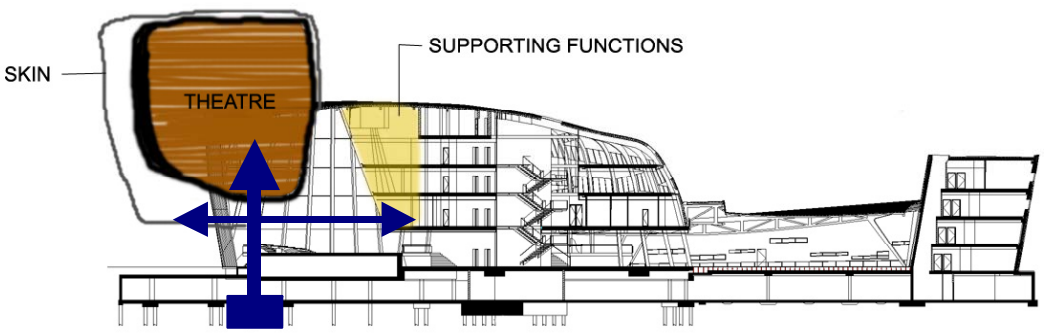
During the construction phase it had to be possible to completely divide the building plot and the working area of the city hall. By using prefabricated elements, the construction time could be reduced to a minimum.

(Students from Building Technology and Construction Management were engaged, while other students observed and gave feedback).

Concept: *7- Functional Comfort, related to Hearing, Smelling, and Touching, relevant to the theatre Organization. The design problem is on the Work-place level: Technical unit. All dirty and noisy or wet spaces, like drink water supplies, sewerage, central heating room and water supply for fire protection have to take the shortest way to their destination and have to have a separate supply installation and separate control rooms in the common basement.*

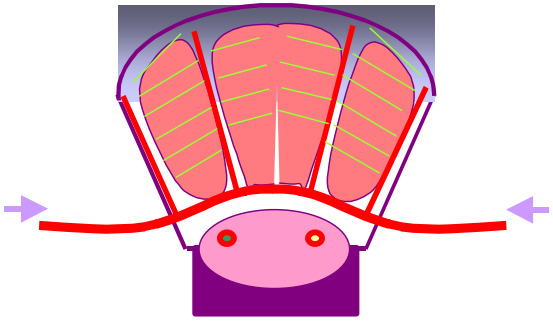
(The distribution centers and technical services are located in the basement. The existing shafts are used to carry the installation load vertically. The layout of all wet places vertically and horizontally takes the shortest routes to the discharge points).

To facilitate the new function, the participants found that it is possible to expand the existing technical unit under the ground to cover the new load that supports the new function: the theatre.



(Students from Architectural design and Physics of the Built Environment were engaged, while other students observed and gave feedback).

Concept: *8 - Functional Comfort, related to Seeing, and Touching or mechanically interacting**,** relevant to the theatre Organization. The design problem is on the Building section level: the theatre Hall. All electrical and Communicational installations have to be visible. They have to be operated upon with minor mechanical interaction with the building constructions for easy maintenance.*

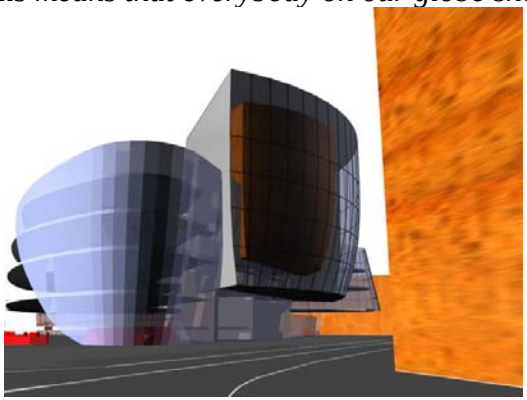


Locating the distribution lines of the heating installation between the rows directly under the floor.

(Students from Architectural design, Physics of the Built Environment and Structural Design were engaged, while other students observed and gave feedback).

Concept: *9- Functional Safety, related to Smelling, Touching relevant to the theatre Organization. The design problem is on the Work-place level: escape routes (all escape routes and exit gates have to be well protected against fire, and smoke).*
(Students from Building Technology and Structural Design were engaged, while other students observed and gave feedback).

Concept: *10- Symbolic Function related to the intuitive Mind decoding, relevant to the Globe. The design problem is on the whole Building level (when approaching the building everybody on this globe should have the impression that the building is a theatre. This means that everybody on our globe should intuitively decode that the building function is a theatre).*



Students start, for example, by designing a double façade where people can walk in-between, pausing on different floor levels like ants roads reflecting the movement of actors on the stage.

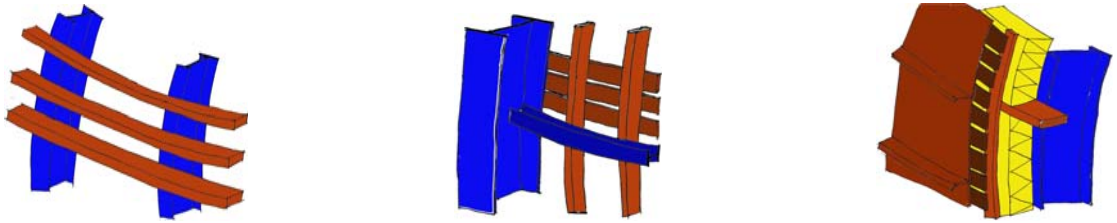
(Students from Architectural design and Structural Design were engaged, while other students observed and gave feedback).

Concept: *11- Symbolic Comfort, related to Hearing, relevant to the Globe. The design problem is on the Building section level: the Café. (Using the sound of a waterfall or a fountain to create a feeling of comfort).*

(Students from Physics of the Built Environment and Architectural design were engaged, while other students observed and gave feedback).

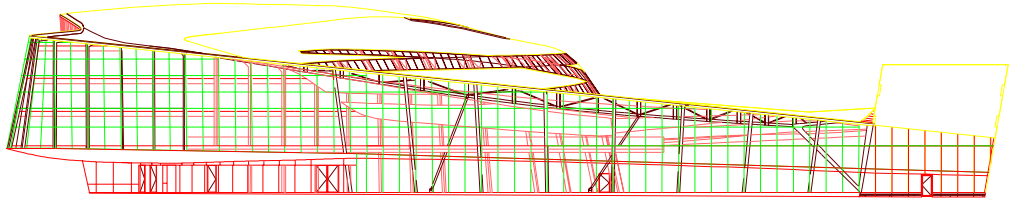
Concept: *12- Symbolic Safety, related to Seeing, relevant to the whole Globe. The design problem is on the whole*

Building level (globally perceiving the building as safe: using steady, stable, and well-balanced forms like pyramids, large pillars, etc.).



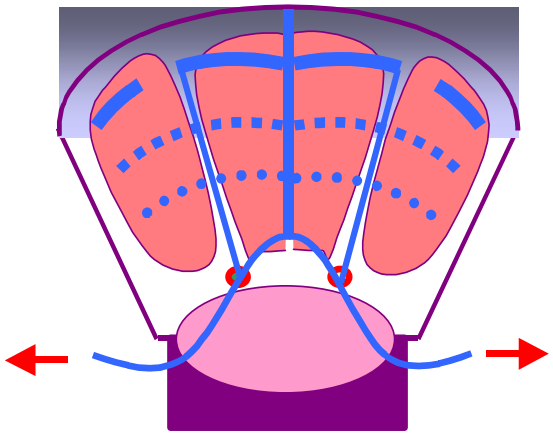
(Students from Structural design, Building technology and Architectural design were engaged, while other students observed and gave feedback).

Concept: *13- Aesthetical Recognition, related to Seeing, relevant to the European Community. The design problem is on the whole Building level (using the Blob architectural style, popular in Europe).*



(Students from Architectural design, Structural Design and Building technology were engaged, while other students observed and gave feedback).

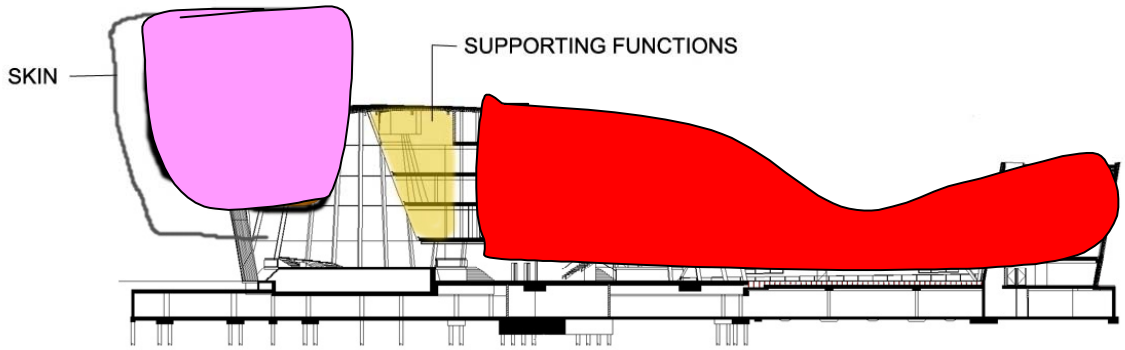
Concept: *14- Aesthetical Function, related to Seeing, relevant to the theatre Organization. The design problem is on the Building-sections level: The theatre main Hall* (the distribution main line and elements that facilitate the function for the sounds, the light and the fire alarm sensors also are decorative in the ceiling).



The main line of installations for the distribution of sounds, lights and the fire alarm sensors are within a visible viaduct, seen from inside the building as a decorative element.

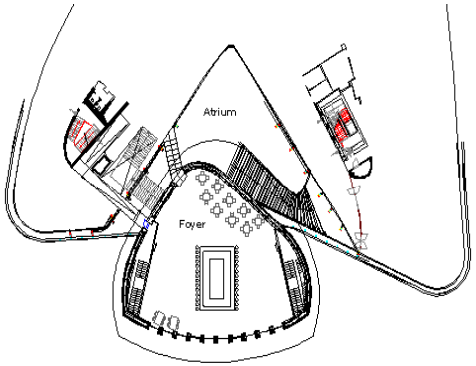
(Students from Architectural design, Physics of the Built Environment and Structural Design were engaged, while other students observed and gave feedback).

Concept: *15- Aesthetical Recognition, related to Seeing, relevant to the city hall Organization. The design problem is about the relation between the work offices of the city hall and the theatre level (using different light intensity, color, etc. in such a way that people naturally recognize the boundary line between both functions).*



(Students from Architectural design, Physics of the Built Environment and Structural design were engaged, while other students observed and gave feedback).

Concept: *16- Aesthetical Comfort, related to Seeing, relevant to the Globe. The design problem is on the Work-place level: the Café. (Using certain lights, colors, materials or textures can invoke impressions to the visual comfort).*



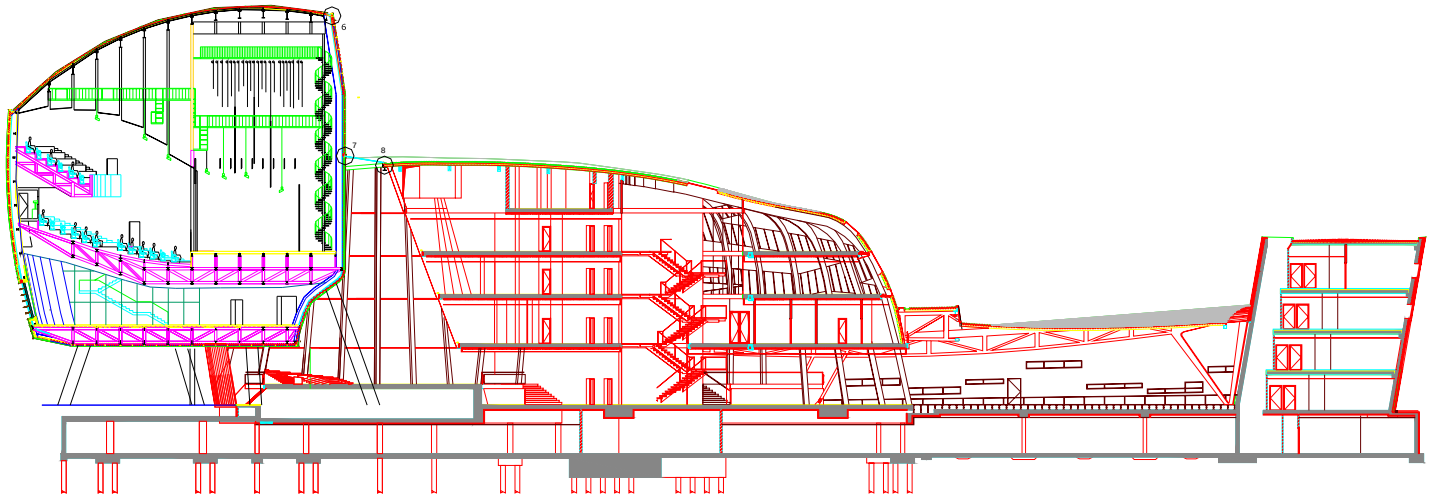
Using certain lights, colors and materials to create a calm ambience.

(Students from Architectural design were engaged, while other students observed and gave feedback).

Concept: *17- Aesthetical Safety, related to Seeing, relevant to the Globe. The design problem is on the whole Building level (using certain forms, like symmetric well-balanced forms, may invoke such an impression of Aesthetical Safety. Moreover, using certain lights, colors, materials or textures of wood for example may invoke similar impressions).*

(Students from Architectural design, Structural design and Building technology were engaged, while other students observed and gave feedback).

Concept: *18- Comforting Safety, related to Touching, relevant to the Individuals. The design problem is on the Work-place level: theater seats (heating the individual places where people are to be seated and using a kind of materials like wood that may reflect the feeling of warmth, which can invoke the impression of comforting safety).*



(Students from Physics of the Built Environment, Building Technology and Architectural design were engaged, while other students observed and gave feedback).

Safety does not need any association in order to be understood. It has to be guaranteed in all buildings, however sometimes it is necessary to stress it, to take care of a certain situation. For this participants chose to develop the following underlying structures:

Concept: *19- Being Safe, related to avoiding pain caused by mechanical interaction, relevant to an Individual. The design problem is on the Work-place level: entrance and the exit gate, up to the chair elevator for individuals with heart complaints or handicaps (adjusting to their special needs).*

(Students from Architectural design, Structural Design and Building Technology were engaged, while other students observed and gave feedback).

Concept: *20- Being Safe, related to avoiding pain caused by mechanical interaction, relevant to an Individual. The design problem is on a Work-place level: the theatre decor elevator (no physical interaction with people).*

(Students from Construction Management, Structural Design and Building Technology were engaged, while other students observed and gave feedback).

This was the stage of transforming the Strategic Brief as an input represented by a set of underlying structures to an output represented by a set of concepts. By analyzing the result of this stage, we can conclude that the tool provided the possibility to define certain concept underlying structures in a certain order. This helped participants to attain a clear vision of the final product, and better control of the total process from the very beginning. This brief can be sent, received and discussed by all participants in the early phase of the design processes. In other words, working with abstract knowledge or dealing with concepts instead of data in the early phase of design, helps to simplify the transformation of information between the client and the design team members, and between the designers themselves. Everyone can see, agree or disagree with the envisioned end product. This has a great impact on harmonizing efforts to reach a shared common goal.

Defining underlying structures of concepts by their most characteristic features makes the outlines of these searched concept sharper with other information fading into the background. This helps designers to focus their attention and greatly increased their particular levels of information. From the concepts they develop it is easy to recognize that the Strategic Brief helps them to focus their attention by embodying

certain underlying structures for concepts. Moreover, some concepts are very novel, considering the difficult and very constrained project situation at hand, which means that the Brief has an access to the designers' creative minds.

After performing this stage, participants took the design manager's role and looked at the whole process for evaluating their experiences by working with the tool.

5.5.3 The result of taking the design managers' role

The effectiveness of working with such a tool, can only being realized after practising. Therefore, by reflecting on their experiences, participants gave feedback on the whole process by recalling what they had done, and how. In this stage, participants took the design manager's role and looked at the whole process. For evaluation, participants were asked to reflect on their experience, considering the whole process using the given points of attention (mentioned in Section 5.1). This helped them to formulate their arguments by comparing their experience of working with the tool with their normal practice, and also by comparing themselves to the other groups working on the same project. The results are summarized as follows:

1- The effectiveness of the tool for discriminating between what is relevant, less relevant and what is totally irrelevant for forming an abstract mental representation of the design problem:

Very effective	-	-	-	Not effective
4	1	1	1	

By prioritizing, for example, participants took the client's role and defined the value profile of the building. This value profile provides the necessary information about what is relevant, less relevant and what is totally irrelevant to fill-in the first boxes of all matrixes. When a value like Aesthetics for example, is irrelevant or unimportant as far as the client is concerned, then the whole tree of possible concepts related to it is irrelevant for the design problem. This mechanism of discriminating between what is relevant, less relevant and what is totally irrelevant information therefore helps us to filter the project information, and to effectively form an abstract mental representation of the design problem as a whole.

2- The efficiency of the tool for making an abstract mental representation of the design problem:

Very efficient	-	-	-	Not efficient
4	1	1	1	-

Comparing the design activities practiced by the test group with other groups, participants in the test group made significant progress (especially in the first period during the two voluntary presentations, before the intermediate evaluation). Most other groups were waiting till somebody came up with a concept, and then they discussed it. Moreover, participants in the test group solved the design problem in its context as given, while most of the other groups failed to stick to in the given problem context. Most of the groups changed the given situation by demolishing the surrounding environment totally or partly, and/or changed the design problem as given. In other words they solved self-created problems (Figure 15).

3- Whether the tool had helped participants to systematize, and structure the project information effectively:

Very helpful	-	-	-	Not helpful
5	2			-

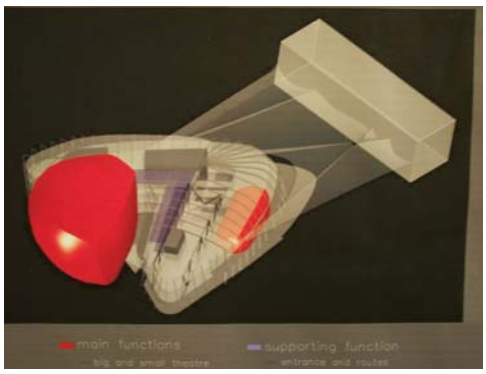
The processes of restructuring the available raw information, which they received from the client, defining the main values relevant to the project at hand, and strategizing according to the tool, helped participants to systematize, and structure the project information effectively.

4- Whether the Strategic Brief had helped participants to attain a clear vision of the end product, and a better control of the total process from the very beginning:

Very helpful	-	-	-	Not helpful
5	2			-

By providing a mean to define which concept underlying structures need to be developed first, in which order these concepts need to be developed and by whom, this Strategic Brief helped participants to attain a clear vision of the final product, and a better control of the total

process from the very beginning. In most other groups there was chaos, especially at this stage.



1-

2-

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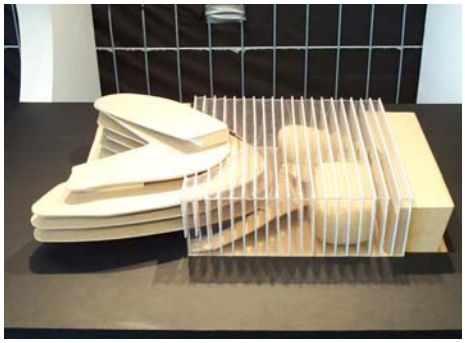

4-

Figure 15: The presented solutions **(1)-** the solution as presented by the test group. **(2, 3 and 4):** the solutions presented by three other groups, as an example of almost all other groups. You may recognize that the whole situation is changed. Moreover, a large part of the original building was demolished.

5- The sense of time needed and the financial requirements before and during the design when dealing with the project at hand:

High Sense	-	-	-	No Sense
5	2	-	-	-

Students for example could solve the problem by adding the theatre under the ground. This would have cost less time and money, but because of the importance of the recognition value of the building as seen from outside, they did not choose for that solution. However, by preserving the city hall, as much as possible, they reduced the costs and the time tremendously. Comparing this with the results of other groups they were very realistic. Most of the other groups totally neglected the finance element. As we have seen in Figure 15, their design did not recognize the existing building nor the surrounding city structure.

6- Whether the Strategic Brief provided a framework for all participants to understand their tasks in addition to their positions in the mono-disciplinary design context:

Very clear	-	-	-	No clear
5	1	1	-	-

For example, by developing Concept 2, which is: Recognized Function, related to Seeing, relevant to the whole Globe. The design problem is on the building section level: the theatre. Students discussed the possibility of making the mass of the theatre like a television. To develop this concept, students were engaged from Architectural design, Structural Design and Building Technology, while others observed and gave feedback. This illustrates how the Strategic Brief can help us indicate the tasks in addition to the positions in a mono-disciplinary design context. The two students who did not follow the instructions fully experienced more difficulties in understanding their tasks in addition to their positions in the mono-disciplinary design context.

7- Whether the Strategic Brief increased participants' abilities to allocate the responsibilities during decision-making while developing different concepts.

High	-	-	-	Low
5	1	1	-	-

By indicating a framework for the participants to understand their tasks in addition to their positions in the mono-disciplinary design context, participants increased their abilities to allocate the responsibilities while developing different concepts. The two students who did not follow the complete instructions experienced more difficulties in deciding what was expected of them.

8- The harmony between the design team members as a result of their common understanding of the design core, which is supposed to support team collaboration:

High	-	-	-	Low
5	1	1	-	-

By making the decision to be the first group to present the work voluntarily (two times) before the intermediate evaluation, the participants in the test group reflected the group coherence, which is a sign of harmony and enthusiasm.

9- Whether the Strategic Brief had helped the design team members to focus their attention by embodying certain underlying structures for concepts.

High	-	-	-	Low
6	1	-	-	-

Clarifying the problem as a whole by defining certain underlying structures for concepts that need to be developed before the start helps us to envision what we are looking for, which enhances what Harth (1995) called the selective positive feedback of the mind, and activates relevant information that once was saved in our long-term memories. The strategic brief, which incorporates this mechanism, helped participants to focus their attention and greatly increased their particular levels of information.

10- Whether the Strategic Brief had helped the design team members to generate novel concepts when embodying certain underlying structures:

Very much	-	-	-	Not at all
6	1	-	-	-

With the background of understanding the design problem as a whole (as a set of underlying structures of concepts), which were generated with the help of the tool, the participants were able to find solutions that clearly discriminated them from the rest: realistic, within the constraints proposed by the project supervisors, and still with a high quality. Some concepts

were very novel considering the difficult and very constrained project situation at hand, which means that the Brief accessed to the designers' creative minds.

A point of attention like `accessing the designers' creative minds` was further elaborated by evaluating the following[9]:

a. The Originality of the concepts behind the design.

Very Original	-	-	-	Not Original
6	1	-	-	-

Concerning the difficult and very constrained project situation at hand.

b. The Identity and Style of the designed building as a whole.

Very Clear	-	-	-	Not Clear
6	1	-	-	-

c. The Unity of the design as a multi-disciplinary whole.

Very Clear	-	-	-	Not Clear
6	1	-	-	-

d. The Internationality of the resulting design.

Very International	-	-	-	Not International
6	1	-	-	-

Very international as concepts and less as a representation

11- Whether the Tool had helped to establish a shared vision, and a common reference for the client as well as the design team members, by viewing the end product mentally before the start.

Very much	-	-	-	Not at all
5	1	1	-	-

[9] *By evaluating this item, the evaluating committee as well as author had almost the same understanding.*

The strategic brief in this symbolic format can be held in memory and can be sent and received between all participants. This can facilitate the information exchange between clients and design team members. It forms a shared memory, a common background and a reference for collaboration.

12- Whether the Tool had helped with an adequate design team organization, and allocating the responsibilities when developing different concepts:

Very much	-	-	-	Not at all
5	1	1	-	-

The establishment of an optimum function structure or the core of the design, as we call it, constitutes one of the most important steps of the conceptual design phase, because once the core of the problem has been clarified to some extent, it becomes much easier to formulate the overall task in terms of the essential sub-problems as they emerge. This helps us allocating the individual responsibilities, which are related to each of these sub-problems.

13- Whether the Tool had helped participants in both positions to harmonize their efforts to reach their common goal:

Very much	-	-	-	Not at all
5	1	1	-	

Working with abstract knowledge or dealing with concepts instead of data in the early phase of design, helps us to simplify the transfer of information between the client and the design participants. Both can see, agree or disagree about the envisioned end product that is represented by the concepts' underlying structures of the strategic brief. This can have a great impact on harmonizing efforts to reach the shared common goal.

14- The probability of embedding the tool in participant's minds and adopting it ready to be use in other cases:

High	-	-	-	Low
5	1	1	-	-

Because of the limited number of tool elements (five sets of categories) and the limited operations of the processes of structuring (strategizing processes), participants could memorize both by heart. This makes the tool easy to be mind-adapted and therefore to be used in other cases, especially for students who really worked enough. The two students who did not follow the instructions fully, experienced lower benefits.

5.7. Evaluation of the resulting design by the evaluation committee

In the final evaluation that was done by the faculty's evaluation committee (the author was not a member of it), the students' work was appreciated. The experimental group got the third highest mark in rank: 7.5 as a team (Table 3).

Table 3: The results of all groups of the final evaluation done by the committee.

Groups results	Numbers of groups with their respective marks rewarded											Total
	2	3	1	4	3	4	2	3	3	2	1	28
Mark awarded	8	7.5	7+	7	7-	6.5	6+	6	5.5	5	4	

This means that only two groups got an 8, three groups got a 7.5, one group got a 7+, etc.

The distribution of results within the experimental group was as in Table 4.

Table 4: The individual results of the experimental group members, in the final evaluation done by the committee.

	Students' results in the test group						
	8	8	8	7.5	7.5	6	7
Average	**7.5**						

The individual results of the experimental group members were representative of their personal efforts and their commitment to work with tool. The five students who worked with the suggested tool got the highest marks: 8, 8, 8, 7.5, and 7.5. The two other students got a 6 and a 7. Mark 8 was the highest mark that was given by the evaluation committee to individuals in any of the groups.

5.8. Reflection

Our suggested approach was a new way of conceiving and solving design problems. It suggests that the design process should be performed as follows:

1- First, conceive the whole of the design problem as a set of underlying structures of concepts, solve this problem at this level, and then go on to lower levels and find details.
2- Second, develop these underlying structures of concepts into the design main concepts and present them as a complete result, although the design process is still in an early phase.

This way of practicing design is unusual compared to the traditional manner, which indicates ``*analyze, keep collecting data and working with parts till you see the whole*``. It is in fact opposite to our proposed understanding of ``*define basic values, prioritize, synthesize and work with this whole till you see parts*``. This is because designers are solution-focused, not problem-focused (Cross, 2004). A successful design behaviour therefore is based not on extensive problem analysis, but on adequate 'problem scoping' and on a focused or directed approach to gathering problem information and prioritising criteria (Cross, 2004). This way of practicing design was unfamiliar to the evaluation committee. Because of that, their feedback on the intermediate evaluation was disapproving, and had a negative effect on the project development as perceived by the students in the experimental group. The test result could therefore have been very much better if the intermediate evaluation had been more constructive.

The participants (1) experienced the effectiveness of practicing design with the suggested tool, and were (2) the first group to present their work voluntarily (3) they were almost the only group that restricted itself to the constraints of the situation as given, and were therefore (4) the most realistic. However, facing the committee's disapproving reaction made them worried that their work would not be appreciated. At this stage participants were advised to continue. Two students did not take the advice seriously, but fortunately the five other students decided to go on it. With the background of the understanding of the design problem as a whole and the underlying structures of concepts generated with the help of the tool, these students were able to

find solutions that clearly distinguish them from the rest: their solution was realistic, within the constraints as proposed by project supervisors, and still of a high quality.

Based on analysis of the results of evaluations, made by the participants in the test group, we conclude that the tool provides a mechanism that enables us to repeatedly attain a unique common design problem representation, which can be articulated as a synthesis of underlying structures for concepts in a certain sequence. The content and the sequence of these underlying structures define how and when each design team member has to contribute to the whole design process. This leads to a more effective use of design team capabilities, and forms an essential basis for organizing efforts, and directing and harmonizing the search for collaborative solutions. Moreover, the test showed that working with abstract knowledge by dealing with concepts instead of data can help us avoid an information overload in the early phase of design by means of the following:

- It can simplify the transfer of information between the client and the participants on the one hand and between the participants' themselves on the other.
- It provides a mechanism that enables us to repeatedly attain a unique common design problem representation, and to form a shared vision.
- It allows for the possibility to make very important decisions at the earliest phase when starting a project.
- It forms an essential basis for organizing efforts toward collaborative solutions.
- It also provides some clarity on how proposed solutions should be judged.

In general, we can conclude that the tool seems to be applicable, can be used by its intended users and is capable of fulfilling the purpose for which it was designed.

Chapter 6 Conclusions and future avenues of research

The aim of this PhD project was to design a tool that helps to explicate the core of the design as a set of underlying structures of concepts representing *what* to achieve and *how* to achieve it on the highest level. These interrelated underlying structures of concepts can be intuitively decoded into mental images and these can be translated into the design main concepts. Designing such a tool helps us to replicate an early design stage, which has almost been lost in today's common practice. This stage involves the conception of the design problem as a whole and depends on forming a strategy, which indicates the main directions of possible solutions. In the past the master builder implicitly performed this task. Nowadays, it is hardly anyone's specific responsibility in a multidisciplinary design context. This is an omission of one of the most important stages of the conceptual design phase. The reproduction of this stage therefore is especially important when working collaboratively in a multi-disciplinary design context.

The core of the design in such abstract form can be represented in the internal sketchpad of the client and designers' working memories and can therefore be comprehended at the start of the design process. At this point all participants form a common reference and a shared memory. However, for the core of the design, to be represented in an effective form, it has to be in a certain format, which is not the thousands of pages of the traditional brief because our working memory cannot deal with this large amount of necessary and unnecessary information at the start of the project. Only a few chunks can be simultaneously activated in the working memory in a way that can represent the whole design problem, and the strategy reflected as a set of underlying structures for concepts that need to be developed in a certain order.

Designing a tool that can help to explicate the core of the design, to be represented in such an effective form (chunks), implied finding a theoretical basis first. In the literature, there were no direct available means, theories, or methods, although several authors recognized this central PhD-project problem. Oxman (1995) mentioned that in recent decades two dominant research directions have been developed. One of them is involved with how to explicate the cognitive processes, which can lead to the conception of the design as a cognitive artifact, including all related research areas like symbolic representations, intuition, the process of design cognition and the

manipulation of representation as a cognitive capability in design. Hamel (1995, p. 53) argued that describing the development of the design problem conception is a question for future research. Simon (1996, pp. 133-136) launched an open question that also still needs to be answered about finding a way in which the theory of design may be viewed in relation to other knowledge, like psychology -man's relation to his inner environment or man's relation to the complex outer environment in which he seeks to survive and to achieve. However, until now there has only been limited success. The reason is that staying in only one field of science will not help us attain this aim (Al Hassan, *et al.*, 2005). Beheshti (2000) mentioned at least ten areas that define the agents of design, and describes the study of creativity and cognitive activities of design in various fields: philosophy, psychology, logic, epistemology, ontology, aesthetics, etc. This means that significant results in these research areas are needed to stimulate a discussion on fundamental principles of design thinking, and to allow us to gain insight into the nature of design as an innate human faculty. Acquiring knowledge by designing therefore is the only way to achieve this objective of explicating the cognitive processes, which can lead to the conception of the design as a cognitive artifact (Al Hassan, *et al.*, 2005).

Designing in general, and the designing of this tool in particular, implies accessing the inner environment using well-known information and axioms and trying to synthesize. This is a totally different approach from the standard scientific research, which starts with making measurements, and collecting and analyzing data to conclude a formula.

While designing the tool, several challenges needed to be overcome. First, understanding the phenomena of generating concepts. Second, explicating the process of generating underlying structures for concepts. Third, explicating how external constraints influence this process of generating underlying structures for concepts. Finding answers to these challenges resulted in formulating a theoretical basis for the tool design. To lead the future users step by step from their first acquaintance with the design problem to the creation of design main concepts, this theoretical basis was elaborated in an application protocol and a tool.

To illustrate the applicability of the tool in practice, a multidisciplinary group of students in the Master's phase worked on a project. The group's design was evaluated according to many points of attention and criteria, during the process as well as afterwards, including the resulting building design. The test aimed in fact at illustrating whether the tool can be used by the people it was intended to support, and whether it is capable of fulfilling the purpose for which it was designed.

Based on the analysis of the results of evaluations made by the participants in the test group, by observing their work and by comparing the practice of the experimental group with that or other groups working on this project, we came to the following conclusions:

1- The tool helped participants to take the position of the client, to restructure the available raw information, define the main values relevant to the project at hand and strategize according to the tool to formulate the Strategic Brief effectively. By providing the option to define which underlying structures need to be developed first, and in which order these concepts need to be developed and by whom, this Strategic Brief helped participants to attain a clear vision of the final product, and a better control of the total process from the very beginning. The envisioning of the final product provided some early indications of the quality of the eventual product. For example, when the participants started the encoding to realize values, which are on higher levels according to the Self-Graph (being related to a higher sensing with higher levels of interaction with the environment), they intuitively anticipated that these patterns should deliver high-quality product concepts. This required highly capable designers, and indicated more costs and time needed to realise the design. This allowed participants to choose the most profitable solutions regarding costs and time. Participants, for example, could have solved the problem by placing the theatre under the ground. This would have cost less time and money, but because of the importance of the recognition value of the building as seen from outside, they did not choose for that solution. However, by preserving the city hall as much as possible, they could reduce the costs and time tremendously. Compared to the results of other groups they were very realistic. Most of the other groups totally neglected the financial element, and the time needed to rebuild. As can be seen in Figure 15, the other groups' designs did not recognize the existing building or the surrounding city structure. They changed the given situation by demolishing the surrounding environment totally or partly, and/or changed the design problem as given. In other words, the students of other groups solved another self-created problem. Because of that, the evaluation committee accepted these exaggerations as inevitable.

Thus, despite the very limited information about a certain structure in the very beginning, the client can be well informed about the quality of the product, and the quality of the designer, as well as gain an idea of the costs and time needed.

2- The Strategic Brief, which is produced with the help of the tool, helped participants to take the position of the designers to form a common ground for team collaboration based on a common understanding of the core design (challenges).

By providing the possibility to define which underlying structures for concepts need to be developed first, and in which order these concepts need to be developed and by whom, this Strategic Brief offered a framework for the participants to understand their tasks in addition to their positions in the multi-disciplinary design context. This increased their abilities to allocate responsibilities when developing different concepts. The two students who did not follow all the instructions experienced more difficulties in understanding their tasks in addition to their positions in the design context. Furthermore, they experienced more difficulties in deciding what was expected from them. Most of the other groups were also waiting until somebody came up with a concept, and then they discussed it. In other words, there was no allocation of responsibilities in the early phase.

Defining underlying structures of concepts by their most characteristic features makes the outlines of the desired concept sharper, with other information fading into the background. This helped designers to focus their attention and greatly increased their particular levels of information. From the concepts they had developed it was easy to recognize that the Strategic Brief helped them to focus their attention by embodying certain underlying structures for concepts. Moreover, some concepts were very novel considering the difficult and very constrained project situation in question, which means that the Brief accesses the designers' creative minds. Furthermore, making a decision to be the first group to present their work voluntarily two times before the intermediate evaluation, participants in the test group reflected the group coherence, which is a sign of harmony and enthusiasm.

3- The Tool, which helped to produce the Strategic Brief as a set of underlying structures of concepts seen from the designer managers' point of view, helps to regulate important complex information like between the client and the mono-disciplinary design team members.

By viewing the end product mentally before the start, the participants were helped in forming a shared vision and a common reference, which was necessary to allocate responsibilities and to form adequate design team organizations. This also helped to harmonize the multi-disciplinary design team efforts contributing to their common goal.

4- Participants especially, those who really worked enough, made a good use of the tool, and probably will be able to use it in other cases.

Because of the limited number of tool elements, and the small number of principles that define how to use these elements, participants could memorize them by heart. Moreover, they learned to combine them to easily create underlying structures for concepts.

In conclusion we can say that the tool seems applicable and is capable of fulfilling the purpose for which it was designed. This replicates the stage of conceiving the design problem in an integrated manner and proposing a solution conjecture, thus facilitating the very beginning of the collaborative design process. However, we would like to add that our approach, which suggests moving quickly to identify a problem frame, proposing a solution conjecture and then going into more details, is a new way of conceiving and solving design problems. It is unknown in the standard tradition, which indicates we should ``*analyze and keep working with parts till we see the whole*``. In fact it is in opposition to our proposed understanding of ``*define basic values, prioritize, synthesize, synergized and direct working with this whole till you see the parts*``. Engaging the evaluation committee at the beginning of the process therefore is recommendable to prevent misunderstanding, and possible disappointment on the part of the participants.

Future research and recommendations

This PhD project provides insight, which is an important step forward in explicating the design as an innate human faculty. It also introduces a different way in which design problems can be developed and represented. This is urgently needed for the effective transferring of knowledge, especially for collaborative work in a multi-disciplinary design context. This insight is especially important because we still only have sketchy and incomplete knowledge for explicating the design as an innate human faculty and much less knowledge about the different ways in which design problems can be represented. The step that has been made with respect to the symbolic design problem representation, adds a fundamental and significant contribution to the field of design theory and research, design management, design education, and to the education systems in general. Continuation of this research could therefore take place in many fields, and especially those related to the previously mentioned research fields.

For design theory and management, this work provides a vision and a necessary step toward understanding and explicating the cognitive process, which can lead to design as a cognitive artifact. However, there is still work to do to scientifically prove and improve the two hypotheses that we used to underpin designing the tool: the Self-Graph and the Strategizing Process. This is a field of science in which researchers with competences in both cognitive psychology and design need to do more work. Strategic management studies can also benefit from it, because making decisions on a strategic level implies seeing the whole picture, while "*western culture has progressed so rapidly in science and technology and it has become very good at breaking problems into pieces. Unfortunately, it wasn't very good at putting it back together*" (Carnmer, 2000). Putting it back together is only possible by learning how to abstract knowledge, filter and encode information. This can be supported via training using visuals. Seeing the whole picture, helps us to allocating responsibilities, discriminating between what is necessary / unnecessary, or relevant / irrelevant within the overload information concerning a certain problem. It also facilitates the underestimated intuitive encoding and decoding of information. The step that we made by explicating how a design can be comprehended as a whole, and also solved as a whole, is very important for development in this direction.

In practice, especially designers can use the concept of encoding and decoding knowledge to improve their creative thinking. This is because creativity implies accessing the inner environment, which is only possible if learners are trained to encode and decode knowledge, and are also trained to use visuals. Elaborating this concept in practical training therefore is a good proposal for a further research and application. Moreover, this work is very important for the development of artificial intelligent design help instruments. McFazean in Segers (2004) indicates: *"the future direction for CAAD research lies in the understanding of the mapping between designers' cognitive thoughts and their external representation"*.

For design education, this tool would be a good instrument to use in design teaching, because it helps teachers to create openings for different possible solutions, especially in the early phase of design where students usually struggle to make a start. Furthermore, starting the design to realize the client's key values in the final building (being on higher levels of the self-graph and related to higher sensing systems, like the mind's intuitive decoding) would probably provide higher quality buildings. Application in design education might therefore even result in qualitatively better designers. This work also encourages speculations about the tool's appropriateness for being generalized and applied in a wider field, not only for building design, but also in

different contexts like industrial design, or the design of vehicles. Applicability in other design fields would be possible if in further studies in different domains (apart from the design of buildings) Box number 5 (the Architectural Unit) were to be changed into another domain-related category (cf. Tool, Section 4.1, Table 2). The other boxes (i.e., the Values, the Sensing centers, the interaction levels with the Environment) already seem to be known and shared in all kinds of design problems in various design fields.

Training to use visuals would be a good preparation in basic education systems, which can support the ability to encode and decode knowledge in higher education levels. The encoding and decoding of knowledge enhances creativity because using our minds' highest competences is only possible when we deal with abstracts, symbols, or pictures. Caviglioli, (2002) argued "*Accessing the inside is only possible when learners are trained to use visuals. Using visuals as I experienced as well in the basic education as in the higher education system is underestimated till it becomes visual illiteracy*". This training requires developing an adequate approach, which can also be an avenue for future research.

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Summary

The problem

The rapid change towards breaking down the design problem into partial discipline-related sub-problems without any conception of the whole, the increasing number and variety of participants, and the difficulty involved in defining the design tasks are main reasons behind the growing complexity and the information overload in the early phase of design. Managing this complexity necessitates the development of knowledge, which can provide a general overview of the complete design task as well as its sub-tasks, so that we can deploy specialists in early design decisions, in which irreversible design directions are decided on.

Conceiving the design problem as a whole, which depends on forming a strategy for solving the interrelated sub-problems, has almost been lost in today's common practice. This is because producing this knowledge is hardly anyone's specific responsibility in a design team. Working on sub-problems design team members can no longer see the consequences of their actions, because they lose their intrinsic sense of connection to the larger whole. In the past the master builder implicitly performed this task of conceiving the whole of the design problem first, and depending on the result he formed a strategy to solve interrelated sub-problems.

This unrecognized loss of seeing the whole of the design problem and transforming this whole into a strategy, which indicates the main directions of the possible solutions, therefore is an omission of one of the most important stages of the conceptual design phase. The reproduction of this stage therefore is especially important when working collaboratively in a mono-disciplinary design context.

Vision toward a solution

Further, explicating this conceptual design phase means starting the building design process with a minimum of relevant information, which can then be accrued into mental images representing the core of the design. This approach in fact suggests a return to the natural intuitive way of thinking by designing. For instance, if you were asked as a client how would you like your future building (house, company…) to be, your mind would be invited to create some shortcuts of mental images, pictures or what we articulate in general as concepts. If you were asked to try to order the same

shortcuts that you had created before, but this time considering your priorities, the result you would get is a series of shortcuts of mental images, in a certain order. The underlying structures of these mental images in a particular order, which reflects priorities, is simply what we call the Strategic Brief.

Explicating the drivers and the mechanism of producing these underlying structures of these mental images as a core of the design provides a tool, which can assist in leading the production of the strategic brief. This can form a common background, a shared memory, and a reference for collaboration. By holding it in their memory, participants are able to understand their positions in the context of the whole, and also are able to decide which of these mental images are more related to each of their specializations.

Approach

Designing this tool implies first finding a theoretical basis. In the literature, there were no directly available means, theories, or methods, although several authors recognized this central project problem. The reason is that staying in only one field of science does not help us attain this aim. Acquiring new knowledge by designing may therefore be the only way to achieve this objective of explicating cognitive processes, which can lead to the conception of the design as a cognitive artifact. This means a combination of an integral, holistic, intuitive understanding based on axioms and well-known information, and also on existing knowledge in the realm of design studies, cognitive (psychology) science, complexity theory, and the theory of dynamic systems. This is a totally different approach from standard scientific research, which starts with making measurements, and collecting and analyzing data to conclude a formula that can explain and explicate design thinking.

Designing the tool

Designing the tool to assist strategic briefing involved several challenges that needed to be overcome:

- The first is understanding the phenomena of generating concepts.
- The second is explicating the process of generating underlying structures for concepts.
- The third is explicating how constraints influence the process of generating underlying structures for concepts or the strategizing process.

By understanding the phenomena of generating concepts, and by explicating the process of generating underlying structures for concepts and how constraints influence this process, we provided a theoretical basis for designing the tool. This theoretical basis is translated into an application protocol and a tool to lead future users step by step from their first acquaintance with the design problem to the creation of building concepts.

Testing

To illustrate the applicability of the tool in practice, a multidisciplinary group of students in the Master's phase worked on a project. The group's design was evaluated according to many points of attention and criteria.

Based on the analysis of the results of evaluations made by the participants in the test group and by the evaluation committee, we can conclude that the tool provides a shift in briefing, which can help to regulate a complex information hinge between the client and the mono-disciplinary design team members, and also a mechanism for managing the complexity caused by the information overload at this information hinge. Moreover, the test showed that working with abstract knowledge by dealing with concepts instead of data can help the following:

- It simplifies the transfer of information between the client and the design team members on the one hand and between the design team members' themselves on the other.
- It provides a mechanism that enables us to repeatedly attain a unique common design problem representation, and to form a shared vision.
- It allows for the possibility to make very important decisions at the earliest phase when starting a project.
- It leads to a more effective use of design team capabilities.
- It forms an essential basis for organizing efforts toward collaborative solutions.
- It also provides some clarity on how proposed solutions should be judged.

Thus, depending on this still very limited information in a certain structure in the very beginning, the client and the designers can be well informed about the quality of the product, and the quality of the designer, as well as gain an idea of the costs and time needed. This illustrates that this tool seems applicable, and is capable of fulfilling the purpose for which it was designed.

Conclusion

In conclusion we may say that human beings' and especially designers' highest creative acts are more than finding a good solution to a problem. It is more about formulating the right problem in the right format, which has the potential to access the inner, and to direct the thinking to certain search areas where novel solutions can be created.

The Strategic Brief as a set of underlying structures for concepts can support the focus and the effective searching of the designers, and allows us to free the path to creativity and to enhance intuitive creative thinking. Holding an underlying structure for a concept as an outline for a desired concept in memory activates the mechanism of selective positive feedback, which allows this outline to become sharper with other information fading into the background. This means filtering the overload of project information selectively. Designers become better focused, and their search for concepts becomes easier and more effective.

Designing a tool, which can help explicate the design as a cognitive artifact delivers a shift from a data centric approach towards a concept centric approach, which is urgently needed nowadays for the effective transfer of knowledge. It can help us to replicate the stage of conceiving the design problem in an integrated manner and proposing a solution conjecture to facilitate the very beginning of the collaborative design process. This adds a significant contribution to the field of design theory and research and also to the debate on how to form a shared vision, and how to access the designers' creative minds.

Samenvatting

‘Strategic Briefing’ is een van de belangrijkste activiteiten aan het begin van het strategisch ontwerp. Het betreft de integrale multidisciplinaire ontwerpprocessen van gebouwen. ‘Strategic Briefing’ verschilt aanzienlijk van de traditionele praktijk. In plaats van een gedetailleerde briefing aan het begin van het proces, worden in de initiële strategische briefing sleutelwaarden bepaald die grotendeels vorm geven aan de algehele gebouwontwerp concepten.

De ‘Strategic Briefing’ die we beschrijven in deze dissertatie is het resultaat van twee opeenvolgende mentale processen: het eerste is gericht op het verduidelijken van de behoeften van de klant in volgorde van prioriteit. Hierbij wordt of de probleemruimte gedefinieerd of wat er gevonden moet worden. Het tweede richt zich op het aansturen en harmoniseren van het zoekproces door de ontwerpers. Dit kan door het zoeken te definiëren of de volgorde van de zoekresultaten te bepalen. Beide processen helpen de mentale beelden te vormen en te transformeren binnen de gedachten van de cliënten. Ze vertegenwoordigen hun behoeften als een mentaal beeld dat door de ontwerpers gebruikt kan worden als gemeenschappelijke basis zodat er richting gegeven kan worden aan mogelijk oplossingen.

Het in model brengen van deze cumulatieve mentale processen geeft ons een idee van deze mentale beelden zodat we de kern van de ontwerpuitdagingen kunnen produceren als een cognitief artefact. De noodzaak voor een dergelijk model is gerelateerd aan de snelle veranderingen die optreden binnen het afbakenen van het ontwerpprobleem als verzameling deelproblemen binnen subdisciplines zonder een overzicht over het geheel. Daarnaast zijn er ook de toenemende aantallen participanten en hun verscheidenheid, en de groeiende complexiteit bij het definiëren van ontwerptaken. Dit alles maakt het ontwikkelen van zulke kennis noodzakelijk, zodat er een algemeen overzicht van de complete ontwerptaak is alsook een verdeling in subtaken. Dit maakt het mogelijk om specialisten vroeg te betrekken bij ontwerpbeslissingen, waarin onomkeerbare ontwerppaden gekozen worden.

Het mentale en impliciete proces van het bedenken van het ontwerpprobleem als een geheel, wat leidt tot het proces van het genereren van concepten die het ontwerpprobleem moeten oplossen als geheel, is in de huidige praktijk bijna geheel verloren gegaan. Dit is voornamelijk te wijten aan het feit dat bijna niemand hier

specifiek verantwoordelijk voor is binnen een ontwerpteam. Met andere woorden, elk teamlid bekijkt zijn subprobleem eerst, terwijl de traditionele en veelzijdige bouwmeester van vroeger het gehele probleem als zijn eerste probleem zag. Dit niet erkende verlies van het bekijken van het gehele probleem als kern van het ontwerpprobleem, en het transformeren van dit geheel naar de belangrijkste richting voor mogelijke oplossingen, is een omissie van een van de belangrijkste stadia in de conceptuele ontwerpfase, namelijk het eerste stadium. Deze verloren stadia leveren meestal een bijdrage aan het vaststellen van de onderliggende structuren voor de concepten die ontwikkeld moeten worden, alsook aan het conceptuele ontwerpproces, zoals bijvoorbeeld het oplossen van het ontwerpprobleem als geheel. Het doel van deze dissertatie is om de verloren informatietransformaties te verklaren en menselijke behoeften aan de kern van het ontwerpprobleem expliciet te maken, waarbij kennis, methodologieën, modellen, en gerelateerde instrumenten gegenereerd worden om het bouwontwerpproces te beginnen met een minimum aan informatie.

Aangezien iedereen intuïtief op dezelfde wijze mentale representaties maakt van het ontwerpprobleem, werd deze collectieve basis genomen als vertrekpunt. De onderliggende hypothese van deze dissertatie is dat een goed begrip van die collectieve basis de mogelijkheid biedt om een instrument te ontwikkelen om Strategic Briefing te sturen. Bij het verklaren en expliciteren van de verloren stadia, geven combinaties van bestaande kennis uit de cognitieve psychologie, systeemtheorie en ontwerpkunde ons het nodige inzicht in de wijze waarop mensen intuïtief ontwerpinformatie verwerken om tot bouwconcepten te komen en ook wat de psychologische hiërarchie van menselijke behoeften is (met betrekking tot behuizing). Het doel is om meer te weten te komen over hoe de binnenkomende ontwerpinformatie wordt verwerkt en aangepast, en hoe algemene bouwconcepten gevormd worden. We proberen de kern van het ontwerpprobleem te vangen zoals dat impliciet wordt voorgesteld door onze hersenen.

Deze dissertatie levert een theoretische achtergrond en een instrument op. De theoretische achtergrond geeft een verklaring en het instrument expliciteert de mentaal impliciete transformaties in informatie van behoeften naar onderliggende structuren ten behoeve van concepten en het conceptuele proces. Het ontwerpprobleem kan vervolgens als vanouds behandeld worden, zoals de bouwmeester het gehele probleem overzag en daarna delen van het probleem in een bepaalde volgorde ging oplossen afhankelijk van zijn concept van het geheel. Het instrument geeft ons een mechanisme ter verfijning van een algemene representatie van het ontwerpprobleem. Dit leidt tot een effectiever gebruik van de mogelijkheden van het ontwerpteam en vormt de basis

voor het organiseren van het werken aan gezamenlijke oplossingen. Daarnaast verschaft het ons enige duidelijkheid over hoe de voorgestelde oplossingen beoordeeld kunnen worden, en het geeft ruimte aan creatieve oplossingen binnen wat anders zeer strakke beperkingen lijken.

Nadat een eerste theoretisch basis gebouwd werd, werd vervolgens een zogenaamde Applicatie Protocol en een Tool ontworpen. Het resultaat is een instrument dat toekomstige gebruikers stap voor stap leidt van hun eerste blik op het ontwerpprobleem tot de uiteindelijke creatie van bouwconcepten.

Ter illustratie van het mogelijke gebruik van de Tool, werkte een multidisciplinaire groep van studenten in het Master fase aan een project volgens het Applicatie Protocol en de Tool. Hun werkwijze werd vergeleken met 28 andere groepen studenten, die op de gebruikelijke manier werkten. Het ontwerp van de groep werd op vele criteria beoordeeld, zowel voor het proces als daarna. Tevens werd het gebouwontwerp bekeken dat uiteindelijk resulteerde.

Op basis van analyse van de resultaten van evaluaties, uitgevoerd door de testgroepleden en door de evaluatiecommissie, kan worden geconcludeerd dat de Tool in de briefing veranderingen teweegbrengt, die:

- kunnen helpen om de complexe informatie-uitwisseling tussen de opdrachtgever en de monodisciplinaire leden van het ontwerpteam in goede banen te leiden,
- mogelijkheden bieden voor beheersing van de complexiteit die tijdens de briefing ontstaat door overmatige overdracht van informatie.

Bovendien toonde de test aan dat het werken met abstracte kennis in de vorm van concepten in plaats van met data (gegevens), kan helpen om het volgende te bereiken:

- Het vereenvoudigt de transformatie van informatie, enerzijds tussen de opdrachtgever en de leden van het ontwerpteam en anderzijds tussen de leden van het ontwerpteam onderling.
- Het verschaft een middel om steeds weer opnieuw te komen tot een unieke, gemeenschappelijke representatie van het ontwerpprobleem en tot de vorming van een gezamenlijke visie.
- Het biedt de mogelijkheid om essentiële besluiten te nemen in een vroeg stadium van het ontwerpproces.
- Het leidt tot een efficiënter gebruik van de competenties van het ontwerpteam.

- Het biedt de mogelijkheid tot effectieve samenwerking bij het zoeken naar gezamenlijke oplossingen.
- Het biedt de mogelijkheid tot het maken van gezamenlijke afspraken over beoordeling van voorgestelde oplossingen.

Zo kunnen, nog slechts gebaseerd op geringe - maar op speciale wijze gestructureerde – informatie, zowel opdrachtgever als ontwerpers zich al vroeg in het ontwerpproces een goed beeld vormen van de kwaliteit van het uiteindelijke product, van de kwaliteit van de ontwerpers en tevens een indruk krijgen van kosten en tijd die nodig zijn om het werk te realiseren. Dit resultaat illustreert de potentiële bruikbaarheid van het instrument om het doel te bereiken waarvoor het is ontworpen: de herintroductie van het ontwerp als cognitief artefact.

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Curriculum Vitae

Fayez Al Hassan was born on 11 March 1963 in Dmair, Damascus in Syria, where he completed his basic education. He gained a Bachelor's degree in Architecture and Town Planning from Damascus University in 1986. During his studies he followed two internships at Dresden and Hamburg universities in Germany. After his graduation in 1986 he spent six years working as an architect at MCE, a well-known design and construction company in Syria. Between 1993 and 1995 he worked in the Netherlands within the team of a Dutch building company (Bam), realizing the International Training Center (ITC) in Enschede.

Between 1996 and 1998 he worked for and was awarded his Master's degree of Architecture from Eindhoven University of Technology (TU/e). His final project was an integral design for Eindhoven Airport 2000.

Between 1998 and 2000 he joined the post-academic study, Architectural Design Management Systems (ADMS), at the TU/e's center of technological design, the Stan Ackermans Institute (SAI). The study was completed with a thesis entitled 'Guideline for a qualitative process design around briefing and bidding in the building industry'. This study was requested and sponsored by the TU/e's Real Estate Department, and concerned the implementation of the University Master Plan. The guideline was designed to support the Real Estate Department in its role as representative of the University Board, to make decisions about the management of the process of briefing and bidding for the university buildings at a strategic level.

After gaining his Professional Doctorate in Engineering (PDEng) title in September 2000, his ADMS final design project was extended to this PhD project. The Netherlands Organization for Applied Scientific Research (TNO) sponsored this PhD project. The extension aimed to design a tool for explicating the intuitive mechanism for encoding, the so-called Strategic Brief, and to base the intuitive practice on a scientific background, making it applicable and available for general use, and also to make it communicable in international circles.