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Synchronization of Mental Abilities

Abstract

I think it is better to summarize some cognitive issues in relation to this subject; how we learn, how we should organize learning (instructions), knowledge, etc. before treating creativity and rationality.

Is it, really, possible to consider creativity without any kind of involvement of the ability of problem solving? Do designers not solve a kind of problem while they 'create' an (conceptual) artifact? What kind of mental process is creativity? Is it a mental ability of physical nature only, or is it also a kind of constructed form what we might have built up through our lives because of our tendencies ever since our childhood? Have not we built up our present knowledge by experience, by intuition and by many other learning instructions?

Do we use our rationality only to solve algorithmic problems or is creativity also, somehow, a quick, well constructed rationality? Maybe both are of the same the same type of intelligence but creativity is more mystical to explain and the other seems to be easier to clarify.

What is it to be creative or rational in terms of mental process? What do a creative and a rational mental behavior look like? Do not we use (creative) methods that are rational as well as creative behavior? What might a creative method mean to us?

I would like to give some examples from my teaching experience by hoping that it gives some hint about this issue.

When I ask my students to make some analysis or design for a given task, actually, they use declarative, procedural and tacit knowledge as well as their intuition while trying to reach their creative design solutions. Every semester they produce mostly similar results in many ways but also somehow different from each other. Each student has a different background in some ways as well as similar ones since the media gives them the chance of immediate communication besides that of local experience. I would like to present some examples of my students' work during the conference, which will reflect some of their rational and intuitive thinking within the global and regional effect.

One of the human cognitive faculties is intuition, as we all know. Students are more successful when we set them free to use their

intuition besides using declarative, procedural and tacit knowledge. In all fruitful creative design process, teachers should rationally, motivate them to activate all their mental abilities to employ but then by helping them to find out the constraints of the issues at hand, since otherwise students can be lost in the sea of chaotic trivial and indirect relevant variables.

Finally, education should be rational enough to stimulate students to get trained in using mental leaps, which goes with the analogical reasoning, for a creative learning process in the widest sense including how to achieve creative design solutions. They should learn to use all their abilities simultaneously to enjoy the synchronic effect of it.

Key words: Intuitive, thinking, rationality, creativity, problem solving

It might be useful to expose some ideas about conditions of learning before going in depth with rationality and creativity. Rationality, in the sense of reasoning, is easier to explain more explicitly than creativity.

We all understand that teaching can not satisfy the entire learning process since it is only one of the teaching instructions named learning by being taught". There are more of learning instructions other than "learning by being taught; learning by discovery, by experience, by trial and error, by being told, by repetition, by analogy, etc.

We are not able to control the whole process of what students have already learnt and will learn. What we need is, first of all, motivated students who can learn. "The only thing that must be assumed is the existence of a student who is capable of learning. This is the starting point" (Gagne, 1985, p 19). Motivation and capability of learning are only the internal conditions of learning. There are also external conditions of it that teachers and managers of education should take into account. There must be a plan for teaching before teachers begin to teach. In particular, we need a plan concerning students' capabilities before beginning to teach and after; what are the standard knowledge and abilities to begin and to what end, what they should learn in each phase are all should be taken in to account to instruct effectively (Gagne,1985. p 20).

Besides, we should manage learning, too. Teaching staff should have a strategy to let students keep their motivation, guide them in their efforts.

Teachers have the one of the main tasks to motivate the students to learn, keep learning and guide them in the direction of their efforts, evaluate their the product of what they have learnt to achieve an effective learning system (Gagne, 1985, p 20).

Nevertheless, in my opinion, students need an environment of learning that teachers are dominant elements of it during lessons besides all other elements like learning equipments, libraries, and many others, so that they have a chance to observe and chose what they want to learn under the guidance of teachers to explore also

their curiosities and abilities. Students and teaching environment can adopt themselves to each other.

We can make an analogy between the two-way process of learning/teaching and observer/his or (her) environment. “Environmental images are the result of a two-way process between the observer and his environment. The environment suggests distinctions and relations, and the observer-with great adaptability and in the light of his own purposes-selects, organizes, and endows with meaning what he sees” (Lynch, 1984, p 6).

This is, of course, only an analogy in relation to their roles of both the target and the source analogies: learners/ teachers as source analogy and observer/ environment as target analogy (Holyoak and Thagart, 1996).

Another factor that is also external to students is instructing. Teaching staff should provide well-organized conditions of learning for learners so that they can keep learning phase by phase and discover realms fit in their curiosities. “Instruction means arranging the conditions of learning that are external to the learner” (Gagne, 1985, p 20).

I think instructions are a set of external arrangements by teaching staff to give way learners to use their mental abilities to process the given information to learn. “In the most general sense, instruction is intended to promote learning. This means that the external situation needs to be arranged to activate, support, and maintain the internal processing that constitutes each learning event” (Gagne, 1985, p 20).

We should also take into account the fact that selective perception is also a constraint which influences our learning that involves also the context (Gagne, 1985, p 81).

It is plausible, in accordance with the belief today, to understand learning as ‘information-processing’ which involves long-term memory, short-term memory (working memory) and retrieval systems, transformation and the like. (Gagne, 1985, pp 13-14).
Read further: “In order to enter and be stored in the long-term memory, the material of learning must be encoded. That is, it has

to be transformed into a form that is semantic, or meaningful...Encoding, however, is the critical process by which incoming information is transformed into learned and memorable capabilities” (Gagne, 1985, pp 81-82).

Thus, what does the processed information become when it is learnt? This brings us to the concept “knowledge” which means to me: justified true belief that implies also many suppositions because its ultimate convincing concept is belief.

What can we say about sorts of knowledge? What kind of knowledge can we have? According to some sources there are 3 sorts of knowledge: 1-Declarative knowledge (knowing what which also has two sub sorts: a-language like representations, b-image like representations), 2-Procedural Knowledge (knowing how), 3-Tacit knowledge (some thing like implicit knowledge), and 4-Linguistic Knowledge (which is also a kind of Tacit knowledge since even if we can not explain all rules of our native language, we still can use it and can be understood by people who use the same language as his own native one (Stillings et al, 1998).

Mean while, intuition is a different matter from tacit knowledge, although it might be seen like that. I think intuition is a kind of built in form in our mind; we get it by our birth. It is a kind of mental ability that forms our first reaction to the external data so that then we can test this experience later to make it become tacit as well as explicit knowledge. Many theories are written about it, I am not going to in depth with it; it is too a deep issue to explain it within a paragraph of a paper.

Nevertheless, there are discussions about the theory of knowledge. Psychologists and traditional epistemologists have different ideas about the distinction between declarative and procedural knowledge since, in their opinion, the two are very closely related. (Stillings et al, 1998, p 369). I think the difference between the two is imaginable, because we can never imagine anything without its functional relations. Some thing can only mean anything to us if we can relate it to some function that is also very closely related to procedural knowledge. Yet, I think we have declarative knowledge with some static properties (beside relational ones) like dimensions etc. which are activated during procedural processes. “Much of our

knowledge-that is probably encoded declaratively, since much of it is mobilized in controlled processes” (Stillings et al, 1998, p 369).

and about tacit knowledge: “There is a classical intellectualist suggestion: if an agent regularly employs rules in the integration of behavior, then if the agent is unable to report these rules, then it is necessarily true that the agent has tacit knowledge of them” (Fodor 1981, 73-74; reprint of Fodor 1968 in Stillings et al, 1998, p 371).

After exploring some ideas about learning and teaching in general, it might be useful to summarize it by a schema (Figure 1). I try to explain here the representational, a Kantian approach I believe in. It shows that human mind constructs two kinds of knowledge in terms of objectivity (which is common to all human beings) and that of subjectivity (which is mostly individual). This leads us to another concept, namely “knowledge representation”. It is a kind of representation relates data structures to each other. “...a representation is a set of conventions about how to describe a class of things” (Winston, 1993, p 16).

A knowledge representation has four parts: a lexical, a structural, a procedural and a semantic (Winston, 1993, p 19).

Semantic net is one of the representation techniques in which there are lexical, structural and semantic parts besides other ones which are: associational, structured object, formal logic based, procedural, common sense knowledge representations and other approaches (Brachman and Levesque, 1985).

Nevertheless, representations should include many facets and they should be done systematically like theories, thus not fragmentary. “Theories, not individual sentences, are representations” (Hacking, 1993, p 133).

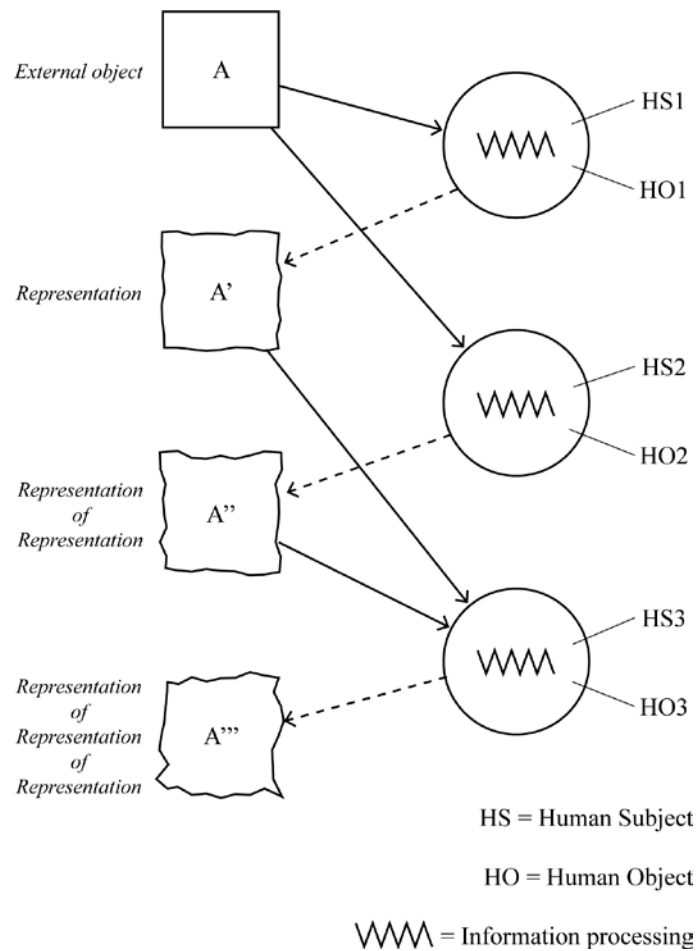


Figure 1. A schematic representation of representational mind

After having discussed about learning, knowing, and knowledge representation, I want to attempt to present some ideas about how to use all kinds of knowledge during ‘creative’ design process and then how we should train students. If we study it properly, we can get to know better what and how to teach through some methods since our cognitive device is limited to solve complicated problems with many variables to take in to account. We need some models to understand complicated issues at hand under the pressure of time.

We must use models to manage complex problems. Some talented persons can use metaphors to produce new models, but they need time to be tested and ready to use (Lynch, 1960, pp 288-289).

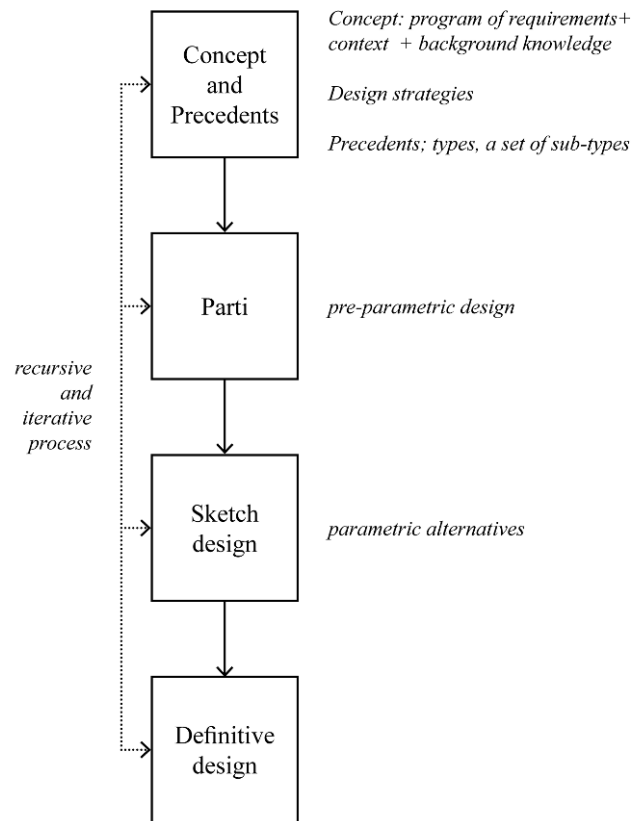
What can we say about talent, then? I believe it is a kind of intelligent mental ability by birth that employs analogy which occurs by mental leaps, metaphor, circumscribing (finding the relevant information and eliminating the irrelevant.), quick recognition, relations between issues at hand in the widest sense (thus analysis), has quick perception of some aspects in relation to the problem at hand. Thus, a talented person seems to have nearly all mental abilities. Yes, I think he/she does have these but only in some issues.

Let us consider a talented architect who is said to be an idiot in economics. Is this person born with all skills and knowledge in architecture and without any kind of ability in economics? There is probably a fact that people can be born with gifted hardware and I guess this leads them to have tendency to explore what match with their interests. In my opinion, this talent occurs in the same way as the above- mentioned intelligent mental ability does. These mental activities are in essence rational.

Let us suppose all these cognitive activities were possible to teach to 'untalented' persons. Would it be possible for them to be able to act like talented ones? I suppose not since the quickness and tendencies would differ.

In spite of this pessimist but clear sounding idea, we can still teach and train students. We can make them explore their capabilities.

What do we need to begin with designing if we follow these ideas about mental activities of having talent? The schema (Figure 2) shows what the possible design phases are, and what we need to begin with design.



This is, of course, not a linear process; only a sketch of it and architects break the rules sometimes. Besides, it includes recursive and iterative processes.

Figure 2. Some possible design phases

All these phases include different scales and a bit different kind of information. Yet, the cognitive process in each one remains unchanged. The schema (Figure 3) shows the original approach to design and analysis process but I modified it to other two ones (Figure 4 and 5).

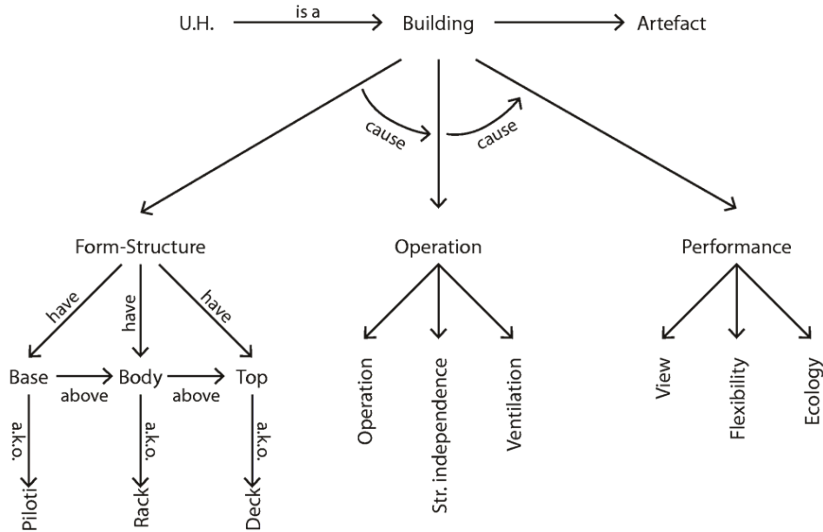


Figure 3, “The design frame, graphically expressed, looks like this:”, after Tzonis, 1992

In figure 4, it is shown how we analyze a precedent through its form- operation-performance. This is, of course, one of the methods for precedent analysis. We use precedent analysis to learn about solutions that are on the surface look different but in some ways similar so that designers use it during design process. “To create concepts one needs to be able to detect similarities between situations despite their differences” (Holyoak and Thagart,1996, p 22).

One of the most important task of precedent analysis is finding out what hidden (morphological) relations and principles are that underlie the form of the artifact at issue. It can be first seen as some thing different from its real morphological structure because of its immediately accessible properties, if we study it properly we can understand correct properties of that artifact.

Here this state of art is explained with a very good example: “For example, on the basis of readily accessible properties that can be seen, people presumably will not judge whales to be very similar to other mammals not fish, they will probably acknowledge that with respect to some important, although less accessible property or properties whales are similar to other mammals. This

observation suggests that restricting oneself to relatively accessible properties may make it difficult to account for the perceived similarity of whales to other mammals. If one can not appeal to “hidden” properties, it is difficult to explain the fact that people might recognize such similarities” (Vosniadou, 2003, pp 179-180).

All these ideas imply that we should analyse the artefacts to gain proper knowledge of it. I mean by analysis in its general sense: it is a kind of representation of breaking up a whole into its components on such a way that the elements do not have to be broken down into more ‘unnecessary’ (due to some criteria) details; besides, the structural and semantic relations between components must be preserved and exposed. This “... unnecessary details...” will lead us to the term ‘morpheme’ in morphological analysis of architectural design. By morpheme I mean: the smallest meaningful unit of an artifact and morphology is the science of morphemes (Tzonis, 1992).

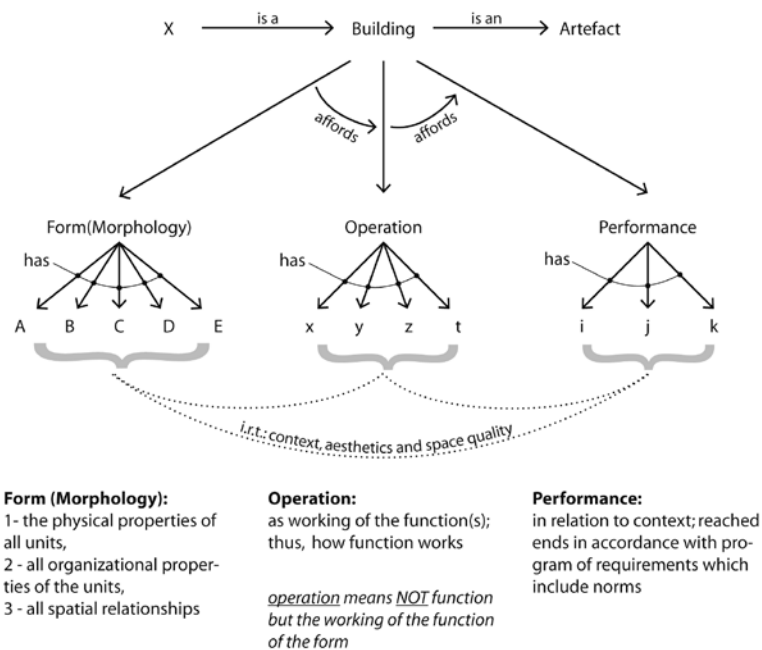


Figure 4. A possible cognitive structure of (architectural) precedent analysis, compare with figure 7

Thus, in this schema (figure 4) we can see how the form is related to operation and performance. The form of an artifact is further

analyzed into its major units, sub units and finally sub divisions. Spatial relations (figure 5, 6) are recognized and represented as a semantic net work. There are of course many aspects of its form, but I think it is useful, first of all, to find out its basic units and their relations beside organizational sorts of it since otherwise we would have been lost within unnecessary details. We would not see the hidden principles of precedent at hand to be analyzed. Objects are mostly not the same as they are seen. “Our sense of direct understanding is an illusion, because the apparent simplicity of everyday comprehension arises from the subtlety and complexity of the human mind” (Holyoak and Thagart, 1996, p 22).

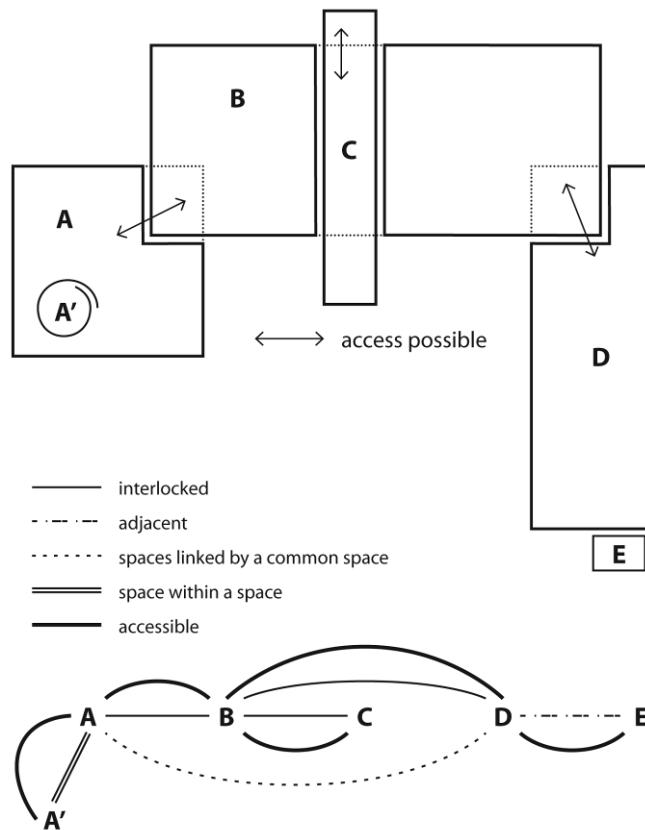


Figure 5. A schematic representation of the major units

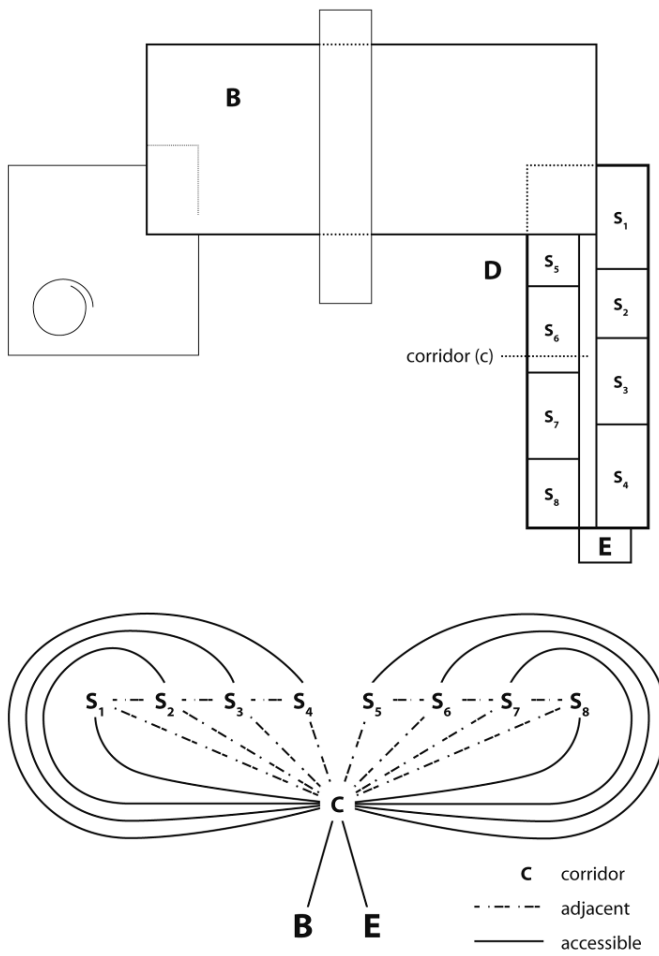


Figure 6. A schematic representation of the major units

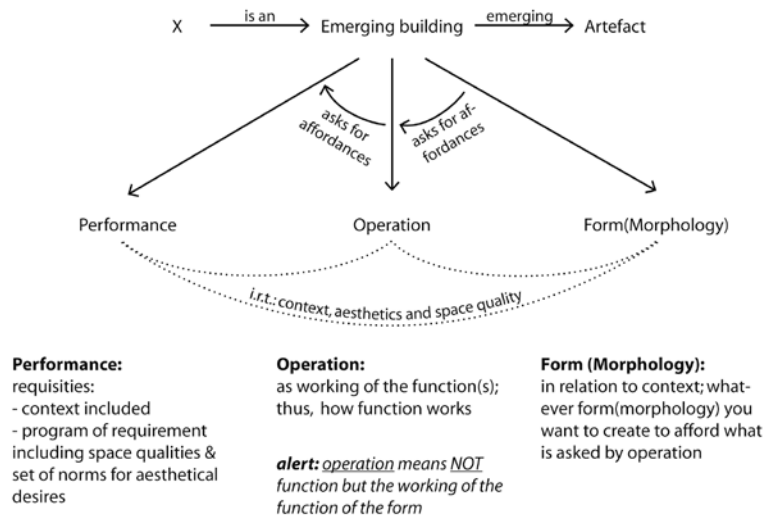


Figure 7. A possible cognitive structure of (architectural) design mechanism, compare with figure 4

This schema above represents a way of modeling design process, a kind of synthetic one. This process is applied to all phases which is shown in figure 2.

Synthesis is bringing the ‘undividable’ (in accordance with some criteria- morpheme) components into a possible whole(s) within their mutual structural and semantic relationships. This is, of course, a very short explanation of synthesis in general. Later on I will, further, explain what possible combinable mutual structure and semantic are in (architectural) compositions through their components or morphemes /and or: combination of morphemes (objects).

During every design process, designers analyze what relevant is. They use precedent knowledge which is from all over the world. They learn from each other; they build their semantic networks through entire environment they act in, globally. Each of them learns from other designer’s semantic networks to become more capable of creating better design solutions. They should keep doing it-without losing attention on the importance of regionalism-because: “Although the individual concepts in a person’s semantic networks are important for thought, the full power of human

thinking depends on its capacity to combine concepts to create more complex structure” (Holyoak and Thagart,1996, p 22).

Finally, this study implies that design teaching staff should provide relevant knowledge, implicit/tacit and explicit, and also learning environment so that students freely can explore and develop their abilities by being guided by teaching staff. It is thus useful to use all kinds of knowledge since they have then a synchronic positive effect on teaching and learning.

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