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On The Nature of The Conceptual Schemata Development of Architecture Students

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Abstract

Embedded within the theoretical and conceptual frameworks implied by the schemata theory and studies on architectural precedent knowledge, the present study is based on a research that investigates and evaluates two major issues within the context of architectural education. First is the level and characteristics of the conceptual schema of the students of architecture have had just before their education in architecture starts, and second, the nature, and the characteristic of that precise conceptual schema's development and transformation throughout their formal education. This study, on the other hand, reports a comparative analysis and evaluation of two particular stages: 1st year, before their formal education starts, and 3rd year, as it was assumed by the study, as the stage when their disciplinary schemata is already roughly "formed." Findings showed that students not only developed their conceptual schemata and their existing schemata is transformed into a more specialized and field-specific one, but also they have developed a set of skills which might be called "designerly seeing," and "designerly thinking."

Keywords: *Education, architecture, conceptual schema, architectural precedent*

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PREAMBLE

Being its origins in Gestalt Psychology, schema theory was known to be principally conceived in the works of Frederic Bartlett, and Jean Piaget who is often recognized as the scholar who first coined the term "schema" in 1923. In general, schema theory deals with how knowledge was organized in one's mind, how it was processed, and how one's schema affects and conditions the acquisition of knowledge. In this conception schema refers to mental structures of chunks or units of knowledge stored in mind. In Rumerhart's words "Schemata can represent knowledge at all levels-from ideologies and cultural truths to knowledge about the meaning of a particular word, to knowledge about what patterns of excitations are associated with what letters of the alphabet. We have schemata to represent all levels of our experience, at all levels of abstraction." In this sense one's schemata is one's knowledge. (Rumelhart 1980).

As it was put by Paul DiMaggio (1997), perception, observation and cognition, are all dependent upon, and highly conditioned by one's pre-conceptions, namely her or his schemata. Schemata, indicates representations of knowledge, but also it is a means of one's faculty to process information. It works in various ways. For example, one's pre-conceptions might automatize her or his perceptions, make them easy, which in turn will make the phenomena disappear from her or his perception (one remembers Russian Formalists' duality of habitual and estrangement). One's schemata also condition the perceptions so that perception is almost always selective, and consequently understanding is non-objective; as once Goethe brilliantly put it "one only sees what one looks for. One only looks for what one knows." Even categories such as "attention," and "motivation," depend upon the preexistence of these structures, and so does "failure" (DiMaggio 1997). Without a pre-existing relevant basis, no new knowledge could register into one's mind, or it would be misrepresented.

Schema theory's application to the field of design and architecture is a well-known endeavor, as expected, it is particularly popular within the research concerning design knowing and learning (Webster 2008; Devlin 1990; Jacob, 1993; Minsky, 1997; Craig 2001; Akin 2001; Akin and Akin 1996; Lawson 2004; Kohls and Scheiter 2008; Oxman 2005; Oxman 1994). These applications might be interpreted as adaptation of the theory to the specificities of a domain that particularly deals with ill-defined problems and tacit knowledge, in this sense must be seen as an advance on the theory.

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THE CONTEXT OF THE STUDY

Within such a framework, (formal) education in any field could be interpreted as involving much of a development of a schema in students' minds, as well as transforming the existing one(s) to fit the needs and the specificities of the addressed field. This could be of course done in various and differing means and ways, with reference to the concerned field's epistemology and the nature of the involved knowledge, as well as the employed pedagogy since there might be competing or alternative, but equally effective and relevant pedagogical paradigms prevailing side by side in a field.

Schematic structures might be thought of as one of the primary indicators of education and cultivation of a student; in turn studying schemata of the students (its initial stage, its transformation, and change during their education) on the other hand might shed light on the nature and characteristics of the concerned development. Within this context, for example, studying freshmen's pre-conceived schemata would be particularly essential before any attempt to start their formal education, since everything would be developed starting from these existing structures of knowledge, namely the foundations upon which the education would be established, and everything would be pre-conditioned by these (Bartlett 1995; Piaget 1952; Piaget and Inhelder 1969). Particularly, understanding these would be essential since while educational models and their proposed schemata, is more situational, owing to the relatively isolated/controlled context of the educational environment. On the other hand students' pre-conceived schemata on the one hand is unpredictable and variable, influenced by many means, on the other ever changing, nowadays often with a fast pace owing to the influences of digital age and the social media.

In addition, comparative studies that focus various stages of schemata development might be used as a means of evaluation of the change and development in students' schemata, which in turn would shed light on the nature of the given education itself. That is to say, investigating these structures might give insights about not only the effect, potentialities and the characteristics of the employed model, but also about its possible flaws and shortcomings.

There exists a specific lineage of the application of schema theory to fields of design in general and architecture, that takes the theory with relation to studying past or existing works, namely precedents (Alan Colquhoun 1969; Hancock, 1986; Gero, 1990; Fabg, 1993; Caragonne, 1995; Zarzar 2003; Lawson 2004; Zarzar

& Guney 2008). This is no surprise, since design precedents (i.e. works of architecture) are the carriers or containers of knowledge, infused with all-types of (objective) knowledge, and analysis of these would help one to distill a special type of knowledge directly gained from its specific context. One could guess, this is an important way of learning and developing schemata, especially as far as ill-defined problems, and tacit knowledge is concerned this might sometimes be the best way to do so, one could evaluate it as a pedagogical device. However, reading, and a consequent understanding and evaluation, not only requires sufficient techniques or methodologies but also presupposes already existing schemata, developed to a certain level and also developed to "fit" the specificities of the examined phenomena. It is a clash of schema(s); the reader's versus the schema provided by the examined work itself, which in turn is an essentially creative act itself that would (expected to) yield (new) knowledge.

Viewed from another perspective, this framework also implies that one's ability to read a work is an indicator of state of the development of one's schemata and the level of "fitness" and overlap between her/his schemata and the schemata provided by the works of architecture under investigation. In design literature, there exists a number of similar studies investigating designers' or students' schemata using the schemata theory and content analysis (Craig 2001; Akin and Akin 1996; Akin 2001).

While the present study might be embedded within the abovementioned wider universal contexts, since it is an outcome of the tradition(s) of architectural education and related research lineages in Turkish context, and since the investigated material was actually a part of the this context it could also be embedded within this "local" research framework where various aspects of architectural design education were investigated (Aydınlı 2015; Ciravoglu 2003; Uluoglu 1990; Yurekli & Yurekli 2004; Özkar 2011; Bala and Arat 2013; Gür & Yüncü 2010; Önür 2004; Önür 2006).

PROBLEM AND AIM

This paper is an outcome of a larger research project that aims to investigate and evaluate two major issues within the context of architectural education. First is the level and characteristics of the conceptual schema of the students of architecture have had just before their education in architecture starts, and second, the nature, and the characteristic of that precise conceptual schema's development and transformation throughout their formal

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education. The concerned development is thought not to be merely about gaining a disciplinary conceptual vocabulary (i.e. a stack of concepts), but a whole mindset; a holistic organization also incorporating "designerly" (ways of) seeing and "designerly" (ways of) thinking (a la Nigel Cross') (Cross, 1982).

Embedded within the abovementioned theoretical/conceptual framework, and conceived as a part of this larger research, the present study, reports an individual assessment and a comparative analysis of two particular stages in the architecture students' formal education: the first year, and the third year (See *Table 1*)

The motivation behind such an undertaking is based on the assumption that these stages represent two important phases of their education, those have their own characteristics. First year, is above all a reference point, an departure point of any attempt to understand the nature of the education process, and also represents one side of a binary opposition, namely the "states" of "formal education not taken" and "formal education taken (after the graduation)". Second, focusing on this stage would give insights about the nature and state of the pre-existing schemata of students; "the material," that is to be processed and transformed by the formal education. Third year, on the other hand, is assumed to represent another essential stage, this time within students' formal education. It is assumed that now students formed a rough sketch of their schemata, to be expanded and advanced upon in their remaining years. At this stage, it has been two years since they were introduced to architecture culture, and embedded within the tradition of architecture. More important, it is a halfway along their formal education, a point when students were already introduced "all" of their introductory level courses, including theory, history, building science tracks, and they have already completed a number of architectural design courses as well. In turn, they were expected to be familiar with the basic notions and concepts of the field, and established a premature, but firm schema concerning architecture. The findings would indicate the effect of all the (f)actors, whether determinate or indeterminate, upon the cultivation of the student.

Table 1. Research on Characteristics and Development of Conceptual Schemata of Architecture Students. (Stages concerning the present study are highlighted)

ARCHITECTURAL EDUCATION: STAGES, VARIABLES, CONDITIONS, ASSUMPTIONS		
STAGE	**Description, variables and conditions.**	**Basic Assumptions**
1st year	**Formal education is about to start.** This Stage represents one side of the binary opposition (Formal education taken/Formal education not taken)	This stage represents the beginning phase of students' schemata prior to their formal education. It is a datum, a reference which could be used to measure and evaluate the development of their schemata throughout their formal edeucation. Conceptual schemata affacted by their informal previous experience i.e. Travel, their living environment, mass media, etc.
2nd year	It has been **one year since students were introduced to architectural culture and tradition**: basic design and introduction to architecture courses were taken. Two architecture culture courses and a number of introductory level building science courses were taken. No architecturl design, no history, no theory courses were yet taken.	Now, students are expected to **have developed a basic knowledge of architecture, and a set of concepts.** This is the first stage of their conceptual schemata development during their formal education. They were expected to utilize a number of basic architectural concepts to describe, interpret and evaluate works, but their schemata is assumed to be not yet formed since not all essentials were introduced to them.
3rd year	**It has been two years since they were introduced to architectural culture and tradition:** In addition to their first year experience in the academy, they now have copleted two architectural design courses, two art and architectural history courses, two theory and architectural culture courses, architectural representation and building science courses (all introductory level).	This stage is another datum, a reference point since students were now **completed all introductory level courses,** therefore almost every aspect concerning architecture, were introduced to them as a part of the formal education. Therefore it is assumed that **students' schemata is now more or less formed.** From now on they would be widening and deepening their knowledge and skills, departing from this "roughly" formed schemata, reshaping it or transforming it.
4th year	Graduation year. It has been **three years since students were introduced to architectural culture and tradition.** In addition to their previous experience, at this stage they have completed 2 more design courses, and all the common courses were already taken. Now the students are about to take various elective courses to orient their own path.	Since **all the common courses (both the introductory and the advanced level) were completed,** at this stage, **students are expected to have developed almost a "complete" and "advanced" architectural schemata,.** They were expected to show a more holistic and rigorous performance in describing, interpreting and evaluating works of architecture.
Graduation	**Formal education ends.** This Stage represents the other side of the binary opposition (Formal education taken/Formal education not taken)	**All the requirements of the formal education were fulfilled.** This is the final stage of students' scehmata development that could be developed by the formal education. This final stage could be be interpreted as the product and making of the formal education.

SCOPE AND METHODOLOGY

The data of the present study involves 1st year, and 3rd year architecture students' descriptions of visuals concerning works of architecture and built environment.

In total 141 students were voluntarily participated in the study where 89 of them were 1st year, and 52 of them were 3rd year. The data collection was conducted in a number of separate sessions, and students were shown visuals and asked to "describe" what they "saw" in the slide and write their report verbally down onto the provided sheet. Time was limited to 3 minutes for each slide and a limited space on the paper was provided for writing down their descriptions, to ensure the reports to be as concise as possible.

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In total, 20 visuals were presented (See Note). The selected examples were all well-known examples of well-known architects, from early 1900s (Modern Architecture) towards the present age (representing contemporary). The examples were selected to represent/carry differing aspects concerning issues such as formal and organizational aspects, style, scale, typology, usage, and the work's relation with the context, its symbolic meaning, etc. On the other hand, none of these categories was mentioned/given or imposed to students beforehand. It was all between students' schemata and the visuals.

As it was expressed in the introductory section, the collected reports were thought as the externalizations and written projections of student' schemata, formulated verbally, and as such became to be objective contents of thought (a la Popper) so that they could be investigated and analyzed.

The evaluation of students' written responses were subjected to so-called content analysis, which is widely used for analysis of visual (i.e. still images such as sketches, pictures, paintings, drawings, and video), verbal (i.e. recordings, sounds), as well as textual material of all types (Krippendorff 2004; Danilson 1977; Berelson 1952). As an extension of the method the present study employs "qualitative" analysis of "textual" material.

In total 1780 reports were individually assessed by two independent researchers, and subjected to quantitative and qualitative investigation to report down the observed patterns and motives. These reports were later evaluated as a whole and turned into a schemata map of each individual group (1st and 3rd year) representing overall portrait of their schemata. After the evaluation of each group, a comparative study is conducted between the reports of the individual groups.

FINDINGS AND DISCUSSION

Expressions Related to Spatial Aspects of the Observed Buildings/Built Environment

Although external views of the buildings were given, spatial aspects of the built environment and the buildings were expected to be referenced in many cases as a part of their architecture. The findings show that 1st year students were rarely referenced spatial aspects (0.36 references by student), if referenced these were attributed to notions such as "streets," or "squares." On the other hand, 3rd year students not only tend to emphasize spatial aspects of the buildings and built environment (3.17 references per student), their concepts were more "architectural." They used

Note:
Presented buildings/environments were, Burj al Arab in Dubai-aerial in context (Tom Wright), Residental and Office building in Ciani, Switzerland (Mario Botta), Fallingwater, Pennysylvania (Frank Lloyd Wright), Farnsworth House in Plano, Illinoi (Mies Van der Rohe), aerial photo of Habitat 67 in Montreal (Moshe Safdie), Berlin Free University -aerial (Candilis, Josic, Woods and Schiedhelm), Solomon R. Guggenheim Museum in New York City (Frank Lloyd Wright), CCTV Building in Beijing-aerial in urban context (Rem Koolhaas), Cube Design Museum in Kerkrade (Shift Architecture Urbanism), Port House in Antwerp (Zaha Hadid), La Sagrada Familia in Barcelona-aerial photo in urban context (Antoni Gaudi), Sydney Opera House (Jørn Utzon), Parc de la Villette in Paris (Bernard Tschumi), Allmannajuvet Zinc Mine Museum in (Peter Zumthor), Chichu Art Museum in Naoshima – aerial photo (Tadao Ando), Centre Georges Pompidouin Paris – aerial photo with urban context (Renzo Piano, Richard Rogers, Gianfranco Franchini, Peter Rice, Ove Arup, Mike Davies, Su Rogers), Guggenheim Museum in Bilbao – aerial phptp with urban context (Frank Gehry), The Jubilee Churchin Rome (Richard Meier), Beijing National Stadium (Ai Weiwei, Pierre de Meuron, Jacques Herzog, Li Xinggang)

concepts such as “space,” “interior space” “open space”, “semi-open space,” “closed space,” “square” and “courtyard.”

Description of Contextual Relations

Observed examples were given in context, with varying relations. Therefore, expressions concerning contextual relations were expected. Two groups differed radically from each other not only quantitatively but also qualitatively in this topic. 3rd year students used contextual references 2 times more than the 1st year students (7.4 to 3.5 references per student). However, when examined qualitatively, 1st year students’ contextual references were more of setting basic relations or locating the building (beside the…, in the middle of…) or context was used as a reference for the examined buildings (higher than…, different from.) In some cases context is described as something that is “around” the building. The term “context” was never used. On the other hand, 3rd year students’ expression of the context, with relation to building is quite complex and richer. First, the term context is widely used (1.1 per student), urban fabric and cities were cited as contexts, the building’s relation to the earth, and ground seemed to be an important contextual relation. Background of a building is sometimes referred to as a “context.”

Material and Construction System Mentions

Two groups’ references to material of the building only differ marginally (2.79 references versus 3.5 references per student) in terms of quantity. However, qualitatively they were quite different. First year students preferred to state “steel” possibly since it is an unfamiliar material, but referred generally as “iron.” Glass, if referenced, is generally interpreted as “cladding,” sometimes concrete and brick is referred as “cladding” showing that these materials were not seen as structural elements. The most important finding is that in 1st year students’ descriptions material is never expressed as a part of some type of construction system, but an isolated observation it itself. This is quite different from 3rd year students’ descriptions. In 3rd year students’ descriptions almost in every case, if a material is to be referenced, it is done with relation to the structure or construction system of the observed building. Another difference is 3rd year students’ interpretation of glass. Besides cladding, it was conveyed as a part of expressions such as “glass building,” “glass façade” “glass plane,” and “glass wall.”

Both groups radically differ in their references to construction system or structure of the buildings both quantitatively and qualitatively. For 1st year students, references to structure or construction system is almost non-existent (0.28 per student). If

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done, descriptions are quite naïve. On the other hand, structure and construction system seems to be an important part of 3rd year students' descriptions of the buildings (3.03 per student).

Descriptions through Unfamiliarity and by Contrasting with A Priori "Norm"

As the data was being investigated, a peculiar pattern was discovered in 1st year students' descriptions (1.43 references per student). Since such patterns were never seen in 3rd year students' descriptions the observation seemed unique therefore particularly important for the research. In this category of descriptions, students tried to describe the buildings and the build environment either by unfamiliarity or by contrasting with some a priori norm. In most obvious examples students directly stated that the buildings were "unfamiliar," "not normal," or even "weird" (For example, see *Figure 1* and *Figure 2*)

Figure 1. Fred and Ginger. Vlado Milunić and Frank Gehry Source: Wikipedia (Lena Sevcikova)

Figure 2. Notre Dame du Haut. Le Corbusier. Source: Wikipedia (Wladyslaw)

This seemed not to be due to a direct referential difference (which is actually a requirement by definition) but rather due to students assuming something a priori, which is supposed to be known to all, and accepted anonymously as a "norm." There are examples where the "norm" is stated such as "different from an apartment," "glass instead of walls," where for example, glass is actually is both conceptually and literally "is" a wall but apparently "wall" in students' conception seems to be too narrow to "see" the element as a wall. Interpretations such as "has no roof," "has no walls," "has no windows," did not point to an observation based on facts since actually observed buildings had such elements, showing that for example, "flat roof," "glass walls," or "openings" did not register in students' minds at all. For example stating that a building does not have a roof is characteristically different from same building described as "having a flat" roof. In is not that they did not have the concept "roof" but rather students' conception of roof referred to something too specific, too hardcoded that they could not be able to adapt or modify it to the newly observed phenomena.

Typological References in Descriptions

Similar to the previous category references to typologies were highly utilized in 1st year students' descriptions (3.06 per student) as compared to 3rd year students' descriptions which were virtually almost non-existent (0.8 per student). First year students used concepts such as "mass housing," "gated community," "apartment," "house," "stadium," "business center" and "luxurious house" or "palace." Among all, "shopping center" seemed to be a special typology that was often referenced. Almost none of the references except "stadium" were exact. Possibly, at least in some cases, typologies were used to describe the "size" or the "form" of the buildings rather than expressing their function. From another point of view, these might be seen as strong paradigmatic concepts gained from daily life and were projected onto the observed phenomena to "explain" it. It was notable not to see

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typologies or functional references such as "museum," or "art/cultural center." On the other hand, 3rd year students' reference to typologies seemed to be rather related with their "knowledge" of the observed building. For example, Sydney Opera house is referred to as "performing arts center," and La Sagrada Familia is referred to as "cathedral" as expected.

Expressions Concerning The "Bigness," "Size," and "Dimension"

It was interesting to observe none of the 1st year students used metric system to describe the size of the buildings or any other dimension such as level. Their expression of size or dimension is generally expressed in terms of some subjective expression such as "big," "small," or with some type of reference such as "higher than," "smaller than," etc. Stating the "Number of Floors" seemed to be frequently utilized (1.96 per student) possibly as an indicator of size even to the buildings that virtually have no floors at all ("it is 5 floors high"). On the other hand, while that barely referenced number of floors, 3rd year students' expressions concerning size and dimensions varied considerably. They used metric system frequently. The notion of scale is known (as compared to 1st year students where it is non-existent), other buildings are used for comparison, and perhaps most important in some cases "human scale" is referenced. The term "skyscraper" was generally used by the first year students to refer to vertical "highness," curiously the term "monumentality" have never been referenced while it was frequently used by the third year students.

Description of "Unknown" in Terms of "Known"

Similar to "typologies," first year students highly tended to describe buildings and built environment with reference to "resemblance" or "similarity" with some object (3.5 per student) as compared to 3rd year students (1.0 per student). This was interpreted first due to lack of conceptual vocabulary, second lacking skills to "describe" a building's form. Consequently they tend to describe or express their observations through presumably a universally "known" object, pointing to a universally "known" form (a ship, a melon, a cocoon, a shell, a cake, etc.), namely a shortcut to represent the observed phenomena. Complex forms were tried to be expressed in similarly organized "things," such as puzzle, tetris, lego etc.

Relative, Subjective Expressions, Evaluations

This category is also unique to 1st year students (2.28 per student) since 3rd year students never used any subjective, relative expressions to describe the buildings or the built environment. 1st year students, on the other hand, seemed to "evaluate" buildings

using expressions such as “nice,” “good,” “beautiful,” “boring” “ugly,” “weird,” or use subjective expressions such as “handsome,” “attractive,” “expressive” “artistic,” or “luxurious.” Relative references such as “not so big,” “not so high,” “quite rich,” are also widely observed.

Descriptions Providing General Information about The Buildings

Few of the students from both groups stated the name of the building or the environment they observe (0.23 for first year, 0.67 for third year students). For the first year, this was possibly due to lack of knowledge, for the third, due to the fact that stating the building’s name and its architect would not make any contribution to the building’s description. Similarly the period of the buildings were never attributed by the third year students in any way, while the term “modern” and “modernist” is frequently used by the first year students. However, qualitatively evaluated, they seemed to use these terms to denote “unfamiliarity,” a deviation from the “norm” or to state that the building is “new,” rather than to some era or style. Issues such as symbolic references, cultural motives, and meaning have never been addressed by the both groups.

Formal References in Description of the Buildings/Built Environment

Being at the core of the task, as expected, this category occupied an important place in overall descriptions. First observation was the use of basic geometrical references, such as basic shapes, to describe forms of the buildings. These were either three dimensional such as cylinder, cone, cube, or two dimensional such as square, rectangular, circular. First year students’ and third year students’ references to basic geometrical shapes did not differ much, being 9.83 and 9.96 respectively. Since basic geometry is not fully satisfactory to describe the buildings and the built environment completely and in detail, students used concepts those could be interpreted as “geometrical modifiers” or “transformative operations.” Such concepts might be expressing location and state transformation such as rotated, tilted, reversed, or raised, or some formal transformation of the initial geometry, such as divided, cut, sliced, carved, subtracted, separated, etc. As far as the geometrical modifiers or transformative operations are concerned, there is a noticeable difference between the two groups both quantitatively and qualitatively. First year students used such concepts far more less than third year students (1.49 per student versus 5.19 per student). In addition, the conceptual vocabulary of the third year students were not only more convenient but also richer. They used approximately three times more (2.96) number of different concepts regarding this category,

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and they used more "architectural" terms to describe modifications. In this category, terms such as plane, mass, solid, void, and modifiers such as chamfer, offset, dislocation, displacement, rupture, slot, opening, erosion, and such were never observed in the first group showing a deep difference.

Color information is widely given, especially if color is one of the dominant visual aspect of the observed building (3.85 per student for the first year students, and 2.6 per student for the third).

Beside the three dimensional morphology, third year students also tend to examine the "façades" of the buildings specifically, and they frequently seem to be using the term "architectural language" where in first year students' interpretations these two issues do not exist at all.

References to Architectural Elements and Details

References to architectural elements such as windows, doors, stairs, roofs, etc. were also given as a part of the description, used almost in same frequency for the both groups (1.77 and 1.75 per student respectively), but qualitatively, in a differing way. Third year students give such expressions as a part of their expression of the overall morphology, as a means of further detailing and elaborating their descriptions. For example, some openings are interpreted as carved out of the mass (*Figure 7*), and in some cases glass surfaces are related with transparency both as an effect and as an attribute (*Figure 4*). Rhythm and solid void relations were also given as a part of the interpretations concerning openings on the "façade" of the buildings.

Figure 3. Villa Savoye. Le Corbusier. Source: Wikipedia

Figure 4. Farnsworth House. Ludwig Mies van der Rohe. Source: Wikipedia

However, for the first year students, architectural elements and details were either taken as an isolated "pieces" in themselves and expressions regarding them were merely used to indicate that they exist, or, references to architectural elements were employed to convey an absence of an expected element. For example, a flat roof is indicated as "there is no roof," (*Figure 3*) and a building with no openings or having different type of openings were emphasized as "has no windows" or "has no doors." First year students also lack sufficient conceptual vocabulary in this category. For example all type of openings were referred to as "windows," projections were always referred to as balconies, and elements such as canopies, flat roofs seem to be not mentioned at all.

Expressions Regarding The Conception, Composition, and The Organization of The Buildings/Built Environment

This is one of the major categories that point to radical differences between the two groups both quantitatively and qualitatively. As first observation, first year students used concepts regarding conception, composition, and organization of the building less frequently, as compared to third year students (1.88 per student and 9.61 per student). It seemed that in their observation first year students either lacked to identify this content, ignored them or failed to describe rigorously. Apparently this is due to their lack of conceptual vocabulary regarding this issue, the number of different concepts used by third year students is almost 4 times more (3.8) than the first year students, and third year students' concepts are not only more specialized but also more sophisticated and complex. Buildings' and build environments' dominant organizational principles were generally to be

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described in terms of listing their basic elements, without trying to state the relation between the components. For example the grid structure of the Barcelona city (**Figure 5**) is never referenced, the phenomena is either as "many boxes" "a lot of squares" without any relation between the units, or by setting naïve relations such as "one next to another," "series of buildings." Contrarily, particularly in this case, not only all of the students in third year identified the grid structure, but also they did this at first by putting a special emphasis on it (**Figure 5**).

Figure 5. La Sagrada Familia and Barcelona. Antoni Gaudi. Source: Wikipedia

If they could be able to find a precedent, first year students seem to be using the strategy of explaining the "unknown" in terms of the "known" or through similarity. For example, Safdie's Habitat in many cases is likened to "tetris," "lego," "puzzle," while in third year students' interpretation, same complex is interpreted in terms of concepts such as "superimposition," "articulation," "overlapping," and "stacking" (*Figure 6*).

Figure 6. Habitat 67. Moshe Safdie. Source: Wikipedia

Third year students, if applicable, tend to see complex organizations as "compositions," while this is almost rarely seen in first year students' descriptions (6.73 and 0.88 respectively.) If done, first year students refer to compositions by setting simple relations, such as "combined," "side by side," while third year students seem to be utilizing a rich gamut of concepts, some of which are already mentioned above. While both vertical and horizontal, centroidal and amorphous organizations were visible to the third year students and particularly emphasized as such, first year students only emphasized verticality, in case a building is a skyscraper, and this is done in a naïve way by only giving the number of floors, i.e. not referring to building's compositional aspects. In third year, horizontal organizations were described by referring to complex concepts such as fabric and weaving together, as well as concepts such as grid, fractal, network, and hierarchy.

In addition to the abovementioned ones, in third year students' descriptions a lot of concepts concerning organization or order, which do not exist in first year students' descriptions, such as being radial and axial, linearity, rhythm, and repetition, were used. Unity and order seemed to be important concepts those were frequently find place in third year students' descriptions, so does solid-void relations, while all these are virtually nonexistent in first year students' expressions.

CONCLUSION

As a part of their education, since they've gained new concepts, third year students used three times (2.8) more different set of concepts than the first year students. In some concerns such as expression of organization or order of the buildings this ratio gets as high as four. It is observed that quantitative development is

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paralleled with qualitative development or change, since advanced students tend to use more field-specific notions or specialized notions to describe the buildings. Their descriptions were also structured as compared to the first year where freshmen students' interpretations were rather piecemeal and disorganized. This is also true for two group's view of the buildings, where third year students saw the buildings as a unity, as a whole organization, and tried to describe them as such, first year students tend to see entities parts and components rather than the whole. Evaluated qualitatively, first year students' schemata seemed not only premature but in some aspects incompatible with the specificities of architecture. They seemed to be based on their lifetime experience of not-so-architectural built environment and the students did not seem to be gained any specialized conceptual structure before their formal education starts. It is suspected that in built environments with better and richer architectural qualities would be influential on the students' pre-development.

Students' descriptions of buildings might be categorized under two major headings, as they were structured as top-down descriptions and bottom-up descriptions. This is in a great sense related with the observed phenomena's nature, for example a building conceived as an ideal platonic solid (i.e. Botta's solid cylinder, *Figure 7*), differs from a "mat" organization (i.e. Berlin Free University, *Figure 8*) both in terms of the way they were conceived or designed and also in terms of the methods (or the way) to describe them. First year students seemed not to be aware of this difference. This is particularly important that if the suggestion is assumed as true then level of schemata and the ability to apply it to describe buildings and built environment might be considered as an indicator of ability to design or the level of education. This needs further investigation, but still the present study raises this question as a starting point of a follow-up research.

Figure 7. Basel BIS building. Mario Botta. Source: Wikipedia (Julian Mendez)

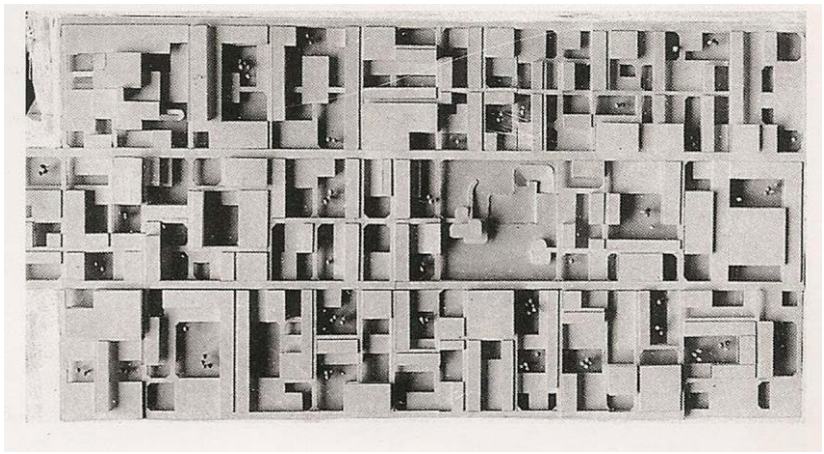

Figure 8. Berlin Free University. Candilis, Josic and Woods. Source: Tom Avermaete. Ed. NAi Publishers

Perhaps more important than the abovementioned issues, a notable change in students' way of thinking and their mindset. For example as they have reached third year, they tended to see all things in relation, in all their complexity: Building are usually considered as a part of their context, elements of the buildings were seen as a whole, with relation to each other, etc. The way first year students and third year students saw architectural works might be expressed as "things" versus "organizations," or "objects" versus "complexes," in respective order. In addition, third year students in a sense re-conceived the buildings, and tend to see and describe the processes and ways these were designed rather than trying to describe the buildings themselves. This might be interpreted as they have not only developed their conceptual schemata and their existing schemata is transformed into a more specialized and field-specific one, but also they have developed a set of skills which might be called "designerly seeing," and "designerly thinking."

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Resume

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