Ideograms as a tool for Constructive Sensemaking in Architecture Education

I. Vrouwe
ivo.vrouwe@kuleuven.be

LUCA / Association KU Leuven, Department of Architecture, Brussels, Belgium
Eindhoven University of Technology, Faculty of Architecture, Eindhoven, the Netherlands

ABSTRACT
Over the last twenty years, framing as a tool for sensemaking has become popular in social sciences, politics and media studies. However, the use of framing in design education is less frequent. Accordingly, framing architectural design practices and construction challenges holds great potential. This paper aims at the discussion of opportunities and challenges of using a framework in architecture education. In this context, a frame or a framework can be briefly defined as a collection of conventions that one relies on to understand a certain given concept.

In this research I intend to combine knowledge from three different fields, architecture education, communication design and framing research. A brief review of the three topics is made to describe their individual qualities, their relevance in contemporary education and their combined potential.

In order to be able to experiment with frames, I designed and developed a visual frame taxonomy by using ideograms for architecture education. The frame taxonomy joins the architecture education and contemporary learning styles. Focusing on ideogram illustrations as the core of the taxonomy, the research aims to contribute to the readjustment of architecture education to the learning styles of today’s generation of students. In this context I will discuss two educational case studies I performed at two different academies and one learning object. The workshops were based on the use of ideograms in workshop exercises. By the use of visual design briefs, students worked on form-study exercises and material research.

The use of ideograms in design briefs proved effective in communicating the content of the design exercise. By providing the student with visual topics to work on, the student showed a more efficient design process. In writing exercises, the icons contributed to a better understanding of the topics to discuss beforehand and structuring the research during the writing process.

KEYWORDS: Ideograms, Sensemaking, Framing, Construction, Pedagogy, Education.

1. INTRODUCTION
For several years, I have been involved in research and education in the field of building and construction at various academies and faculties of the arts and architecture in Belgium and the Netherlands. In this light I have organized numerous craft, construction and material oriented workshops over Europe.

Over these years, I am increasingly challenged by the provocation of contemporary education during lectures and workshop exercises. To facilitate higher number of students, groups and classes often get larger. To facilitate the increasing lesson content, courses are compressed or integrated in theme
days or composite courses. While information and communication technologies and digital media are becoming more prevalent in our daily lives and study funding possibilities are becoming more limited, students try to multitask and balance their social lives, professional lives and side jobs with studying and learning. Furthermore, while digital design software becoming easily accessible; spatial design takes place in a three-dimensional 15-inch-reality to a greater extent.

At the present time where architectural and spatial design practices become more complex and workshop space is limited, students start to specialize themselves in early phases of their education in areas that are easily accessible by digital software. Consequently, design elements like conceptual design, animation and rendering gain more and more interest. While conceptual design can be described as the earliest phase in the design process, animation and rendering are more related to the final phases. Therefore, students have difficulties in bridging the gap between these focus areas in material workshop and construction exercises. As a result of the phenomena described above, I noticed a change in the students’ behavior: their attention and enthusiasm are drawn towards digital computation instead of architectural detailing, material development, prototyping, model making and hands-on physical workshops.

In construction workshop environments, a significant number of architecture and design students I work with get frustrated with this reduced ability to think and act outside the 15-inch-reality of the digital interface. With the absence of material reflection within the digital designing process, it is difficult to create and access tacit knowledge relating to the craft and production experiments.

As a result of increased integration of digital information technology in education, recent articles have referred to a shift from a learning 1.0 to a learning 2.0 pedagogy (Pak and Verbeke, 2012). Learning 1.0 resonates with the classic explicit learning styles applied to generation X and earlier generations. In this style, learning is based on a teacher; the learner is a passive reader or a spectator. For a great part, education takes place in a classroom (Sbihi et al, 2010). If we consider Bloom’s taxonomy of the cognitive domain (Krathwohl, 2002) as a frame of reference, this explicit learning style starts with knowledge as a starting point (A, figure 2a) and works the way up to application and analysis (B, figure 2a) in a well-structured manner. In design education, the designer has been educated to use systemized, rectilinear methods, using standards and codes (Arens, 2008).
Figure 2 a, b. (2a) Explicit Learning (2b) Implicit Learning

Compared to generation X, today’s students (born after 1982), make decisions by a trial-and-error, active and often unstructured approach. Known as generation Y (Paine, 2008), the Millenials, the ME Generation (Trzesniewski, 2010) or as rephrased in TIME magazine the ME ME ME Generation, their youth is partially shaped by computer games and extremely effective visual and digital communication. In an era of information overload, limited attention spans and scattered focus (Whitworth, 2009), these students value an implicit learning approach by learning-in-action with minimal visual introduction over explicit studying by head-knowledge (Schön, 1984; Smiciklas, 2012). Therefore, the education of generation Y should differ greatly from the learning preference of the older generation of students. In contrast to learning 1.0, learning 2.0 education is based on the learner and takes place in a community (Sbihi et al, 2010). In design education, the learning environment provides a place to make things happen. In an implicit way, the student works her way through all levels of Bloom’s Taxonomy of the cognitive domain in an unstructured manner (figure 2b)(Arens, 2008). Compared to learning 1.0, knowledge production is an individual process instead of a class act.

The discussion on implicit education is resurfacing in pedagogical discussions in different forms with change in student intelligence or change in education and learning. The craft education of 1960s Bauhaus (Gropius, 1962) and modern industrial design education of the current millennium (Koklo, 2005), emphasize training and learning-by-doing over explication. Before these design education examples, implicit learning experiments were researched and applied in language teaching.

Jacques Rancières (1991) describes a didactic experiment from the early 1800s in the book “The ignorant Schoolmaster” which shows great resemblance with the Millenials’ learning preference today. Instead of a “master who cramps his students’ skull full of poorly digested knowledge”, the professor involved, made the student learn by challenging them with riddles. In order to make the students understand without the aid of explication, the students were placed in a, so to speak, closed circle, they could only break out of. By linking a student to a will, the professor was able to introduce “universal teaching” and let the students learn individually. After learning the fact, the students could imitate it and finally know for themselves.

Motivated by these observations and facts, in this paper, I aim to discuss the opportunities and challenges of using framing by a visual taxonomy as a tool for sensemaking to accompany this change in learning and cognitive qualities.

In this context, I will start my study with a background study on Millennials and construction education (Section 2.1) and briefly review the concept of procedural knowledge (Section 2.2). Then I will introduce my own visual taxonomy for architecture education (Section 3), based on a discussion on frame construction and the design of visual communication in general and ideograms in specific. Following, I will present two case studies discussing the use and implementation of ideograms and one learning object (Section 4). Finally I will draw up conclusions, reflections and future prospects (Section 5).
2. MILLENNIALS AND ARCHITECTURE EDUCATION

As described in the introduction, this paper combines knowledge from a wide variety of disciplines. To frame the problems and challenges correctly, in this section, I will make a brief review of construction education to the current generation, and afterwards, I will connect this with two kinds of knowledge as described in the work of Norman (2002).

2.1 Education in the Structural Turn

In the last two decennia, subjects like craft and tectonics (Semper, 2004) have resurfaced as an active topic in architectural and educational discussions as well as in high-end practices. The renewed interest in construction has made way for a new structural logic in building (Burry and Burry, 2010; Pottmann et al., 2007). Representation and structure are treated more or less equally while the architects’ interest has shifted towards engineering and vice versa. As a result of this so-called “structural turn”, the traditional relationship between architect as a visual creator and the engineer as a technical problem-solver has changed (Leach, 2004). In this interdisciplinary act, different parties negotiate and interact. With their own specific knowledge and interest, all participants contribute to a final design using a synthesis of approaches (Cross, 2011).

The new context described above implies that students should be educated in the material potential and master the physical and structural ground principles as a first step. In this way, students will be equipped to design and work with craft and construction in an interdisciplinary working environment. Through physical exploration and experimentation in models and mock-ups, the understanding of material has to be extended. In this process the immediate connection between hand and head is calibrated, explaining the synthesis between understanding and making, theory and the actual solution (Sennett, 2008; Schön, 1983).

2.2 Procedural, Declarative and Tacit Knowledge

In the book “Design of Everyday Things”, Norman (2002) describes two kinds of knowledge, widely acknowledged by cognitive psychologists (Stillings et al., 1995). The first kind of knowledge is knowledge of or declarative knowledge. This knowledge includes the knowledge of facts and rules. The second kind of knowledge is knowledge how or procedural knowledge. This kind of knowledge enables a tacit process to succeed. When we want to master, for instance, a specific skill or craft, procedural knowledge is required.

![Figure 3 a, b. Craft Education in Architecture Studies](image-url)

In education, declarative knowledge is relatively easy to teach. Many pedagogical theories describe methods and procedures to educate facts and rules in an effective and efficient way. Compared to declarative knowledge, procedural knowledge is, on the one hand, hard to educate and, on the other
hand, hard to learn or study. First, a natural talent has to be present. Second, when learning a craft, teachers or craftsmen often don’t know exactly what they do, they just do it. The way a hammer is held, a knife is used or a pencil is positioned is best not taught by discussing the hand pressure used or the cutting or drawing angle applied through the process. This largely tacit or unconscious knowledge is best learned through practice (Wood, 2009).

For ages, tacit knowledge was transferred in a one-to-one apprenticeship. During a great period of a person’s youth, craft and skill was practiced and refined in small groups of apprentices under the watchful eye of a master until the person was able to work independently. With education in the academies I teach, this way of education does not hold for mainly two reasons. First, the high number of students makes it impossible to work with students individually on a one-to-one basis. Second, the student is expected to improve skills and to refine techniques outside the craft, building or construction course. During studio exercises, techniques have to be studied, implemented and improved upon.

In order to be able to work with knowledge independently, the students should have direct access to this often tacit knowledge. In other words, the educator has to transfer from education using “Knowledge in the World” to education reinforcing “Knowledge in the Head” (Norman, 2002).

3 Sensemaking by Framing

In this research I use sensemaking with the purpose of transferring a skill, guided by Knowledge in the World towards a skill set, underset by Knowledge in the Head (Norman, 2002). Discussions on the concept of sensemaking go back to the 1970s. The first solid discussion on sensemaking was introduced in the work of Weick (1995). Interpretations of sensemaking depend heavily on the context in where it is used. In its core concept it is usually applied to describe the process by which a person gives meaning to an experience.

![Figure 4 a, b, c, d. The process of sensemaking](image)

In our daily life, we act in an environment shaped by our world of experiences (Dewey, 1997). When an event takes place within this environment, the occurrence seems plausible and we feel comfortable to interact (figure 4a). When an event takes place outside this environment, its occurrence seems implausible. We feel uncomfortable to interact (figure 4b). The most effortless reaction to this encounter is to reject the existence of the event. In this case, the environment remains troubled but similar. When there is an ambition to make this event plausible, sensemaking comes into play.

The process of sensemaking shows great resemblance with the process described in the “Ignorant Schoolmaster” as discussed before (Rancière, 1991). By linking a student with a will to succeed in a project she cannot make, the student will learn by failure, adapt and progress to overcome difficulty.

I employ three techniques as a part of the sensemaking strategy I use for educational purposes. The first process is “framing”. The frame and the conceptualization of framing originate from the work of Erving Goffmann. In his work “Frame Analysis” (Goffmann, 1974), Goffmann discusses the relevance
of a condition in which a certain given is understood. By understanding within a “world” or “reality”, selective attention organizes experiences and generates meaning within a certain event.

In other words the frame can be used as “background”, “setting” or “context”. The two processes that support framing are accommodation and assimilation. Accommodation is the mechanism by which failure leads to learning. Assimilation, on the other hand, is used to fit new experiences into what we already know (Piaget, 2001 p.3).

First, framing is used to provide a “frame of reference”. The frame and the concept of framing, used in this sensemaking procedure are of considerable importance in social sciences today. Frames in general and “Collective Action Frames” in specific help to render events, organize experiences and guide actions (Benford, 2000). In the discussion of frames, the word “salience” is often used. By making something more salient, information is made more noticeable, meaningful, or memorable for its user (Entman, 1993). The placement of a complexity of items into a frame enables a person to comprehend, construct meaning and interact with the frame content (Weick, 1995).

Depending on the profile and backgrounds of students, the frame can have a large or a small overlap with the personal environment as discussed in figure 4. For the students to meet the knowledge as framed, the student is challenged to step outside of the personal environment by challenges or workshop exercises. By accommodation, new experiences provide the knowledge to reach outside the personal environment (figure 4c). By assimilation, the new experiences extend the personal environment to the boundaries of the proposed framework (figure 4d).

The possible contribution of using frames and the juxtaposition of frames existing are discussed quite clearly in a wide variety of research and literature (Benford, 2000; Goffmann, 1974). The systemization of manufacturing or the selection of the frames themselves is often missing in these texts. Since frames vary in degree of organization, some are presented neatly and rigid while others tend to blur or change in interaction (Koening, 2004).

### 3.2 Framing and Frame Construction

In this section, I introduce a theoretical framework together with a visual taxonomy of design problems for artistic construction which joins the architectural education and framing topics.

![Figure 5 a, b, c. The process of frame construction](image)

In advance of the actual construction of the cognitive framework, the work of Dewey (2009) is used to frame and describe the learning environment. The construction of the outline description of the frame distinguishes three steps. In the first step, we have to become aware of the outer borders of the range of knowledge we want to bring across. By this situation awareness, groups become explicit (figure 5a). For educational efficiency, the groups are framed to provide a simplified reality. By eliminating the unneeded features of the initial environment and weeding out the undesirable...
(Dewey, 2009), the framed learning environment is reconsidered and revised (figure 5b). At last the groups are labeled and set in logical order to expedite understanding and logic (figure 5c)(Kolko, 2009).

While creating strategies and tools to reinforce education to construct knowledge in the mind, the cognitive abilities of the humans as described in the works of Miller (1956) and Norman (2002) were considered in the process. According to these two works, two major classes of memory are distinguished, respectively the short-term memory (STM) and the long-term memory (LTM). The STM is the memory of the just present and capable of storing seven plus or minus two items. During the memorization of these items, the brain’s recoding process can combine different bits of these items into chunks (Miller, 1956). Through an interpretation of the understanding of our experiences, the knowledge is put away in the LTM. This is one of the reasons why using specific frameworks to construct a student’s mind is not an innocent choice. What is stored or understood in one interpretation will not easily be retrieved or activated by another (Norman, 2002).

![Figure 6 a, b, c. (6a) Division of taxonomy in 5 parts and seven rows (6b) Inconsistent taxonomy (6c) Consistent taxonomy.](image)

In order to ease the effectiveness of storage in the LTM and the retrieval from the LTM, a structure of a biaxial taxonomy is used. Taking the limits of the STM into consideration, the frame taxonomy is divided into seven supertypes vertically. Every supertype is divided into a maximum of five subtypes horizontally (figure 6a). In this set-up the student has to process a maximum of seven items per type.

Every subtype is related in topic to the supertype it is a part of. In order to structure the LTM more easily, all rows are spread evenly in groups of five. Consequently, the student has to remember seven times five subtypes instead of an irregular distribution. The choice to facilitate the ease of remembering instead of a bullet-proof construction taxonomy caused some of the subtypes being more condensed than the others which can be considered as a positive factor for the review of the subtypes and the general understanding of the framework.

### 3.3 Ideograms in Framing

In order to facilitate learning to a greater extent, I intended a designed visual communication of the taxonomy content. On the one hand, the human brain in general and the brain of art students in particular have less difficulty processing visual communication. On the other hand, as a result of gaming, movies, advertisement and contemporary marketing strategies, Millenials in general and digital gamers in specific are very agile in interacting with visual communication, visually oriented stimuli and visual thinking and decision making (Donohue, 2010). In this sense, ideograms can be considered as a potential learning tool to benefit from these qualities.

While learning construction and materialization, the student has to possess or strengthen the ability to visualize something she cannot see directly. Materialization, for instance, requires the depiction of a joint of three axes to understand the influence it has on the difficulty of connection detailing. Subsequently, students are challenged to picture internal forces in a structure to understand the
structural integrity of the system at hand. As a result, when comparing geometric reasoning of students in arts to students in psychology, the performance of the arts students is significantly higher (Walker, 2011).

In order to address the most effective information visualization tool in construction education, the Domain Model of Lau and Vande Moere (2007) is used. The model describes three fields. Each of these fields is defined according to three factors: Data, Aesthetics and Interaction. With the understanding of data and interaction being decisive enough, the understanding of aesthetics is discussed as being ambivalent. In this model, aesthetics is understood as the degree of artistic influence on the visualization technique. Herewith the focus on visual style and expression is used as a measurement. In this research, the communication of knowledge and data has priority over interaction and aesthetics as understood in this model. By representing data as the main measure, infographics are suggested as an effective tool.

By using symbols or signs in general we represent speech in a different form of communication. Over the existence of mankind, signs in communication have evolved from symbols that represent objects or subjects in the world into signs that represent language about the world (Olson, 2009). Where an adult person in prehistoric times wanted to communicate a tree, she depicted the world by drawing an image of a tree. Today an adult person prefers to communicate in a full-writing system that is all-purpose and an equivalent of speech. As a result of the introducing infographics in communication design in education, a more indirect approach of communication is applied. By using icons to communicate, we liberate communication from the direct spoken language and open up for a more indirect interpretation and representation of tacit knowing and ideas (Lurie, 2006).

Infographics in general and ideograms in specific have been an effective tool to transfer information, knowledge and experiences. Starting from cave paintings and cuneiform scripts, ideograms show great importance today (Creeber et al., 2009). Where large amounts of information have to be transmitted in little time, ideograms are often the weapon of choice. Ideograms are used to guide actions in the design of road signs and are applied to mark places in public information (Tijus et al., 2007). In contrast with the expression that an image tells more than a thousand words, ideograms have to communicate one specific message. Because good ideographic design can save space in visual design and gives a message a certain sense of substance or thingness (Heidegger, 2002; Stsutsumi, 2013), ideograms have an increasing influence in modern software interfaces. Next to windows, pointers and the mouse, icons represent one of the four pillars of the computer landscape (Souttar, 1998). Consequently, smartphone and tablet interfaces are fully depending on ideogram buttons. Windows and Apple interfaces are influenced by ideograms to a greater extend. In this light, the choice of ideograms in this research contributes to a valuable integration into the learning 2.0 environment.
In the suggested taxonomy of figure 7, the biaxial taxonomy as discussed in section 3.1 is combined with the content adopted from various material and construction literature (Martin, 1996; Bucquoye, 2002; Ashby, 2007; Kula, 2009; Engel, 2007). Each subtype icon is depicted by a prominent part of its content.

In architecture research, multiple abstract interpretations and parameters of structures and architectures are made. For example, Oxman (2007) describes three forms of fabrication informed production processes in which the notion of craft is manifested: Material Selection, Fabrication Methods and Assembly Logic. In the work of Bell (2004) and Menges (2011) the importance of material orientation is discussed. Accordingly, Bell (2004) describes an overlap in design themes of structure, material, pattern, geometry and parametric control.
In the proposed taxonomy, these themes and production processes are complemented using the work of Martin (1996) and Bucquoye (2002) in material sense, by Ashby (2007) and Kula (2009) in a technical sense and by Engel (2007) in a structural sense. For the icon of the supertypes, an abbreviation is used. In practice it proved to be hard to find a general icon to describe the entire subtype effectively. In the taxonomy, the following supertypes are distinguished: Materials (Mt.), Products (Pd.), Processing (Ps.), Connection (Cn.), Finishing (Fn.), Orientation (Or.), Structure System (St.).

In the design of the ideograms, a basic design like used in Bell Labs iconographic characters and the design of the periodic table of elements is used. With these visual references, a single ideogram represents a part of a set that can be combined into a whole like letters to a word and atoms into molecules. To make the ideograms accessible for both visual and verbal persons, the ideograms in figure 7 are provided with a small description. Like with most use of ideograms, instruction and regularity of use are necessary for successful implementation (Souttar, 1998).

4 Ideogram Case Studies and Learning Objects

In order to test the visual taxonomy in educational practices, three exercises were conducted and one learning object was introduced. The first two cases focused on the use of ideograms in design briefs. The third discussed the implementation of ideograms in student writing exercises and student based publications. As reviewed in the previous section, ideograms are most efficient when the information they represent is known and understood. Therefore, in addition to the visual taxonomy, a learning object, a card game was introduced to the students so that they can make a better sense of the icons.

In this section I will make a brief review of the studies introduced above and share some of the results.

4.1 Ideograms in Design Briefs

Ideograms can play an important role in the communication of educational design briefs for two reasons. First, with 50% of the human brain, directly or indirectly dedicated to visual functions (Norman, 2002) the efficiency of the use of ideograms is significant larger than a text oriented variant. When a text based design brief is read, the letters have to be decoded into shapes first. Second, the shapes have to be fitted together to form words. Next, the words are combined to sentences, paragraphs and chapters. The way we perceive an image based design brief uses significantly fewer steps. The images are comprehended with minor mental effort (Smiciklas, 2012). Second, students in their earlier years of the art education are often used to clarity in task and problem descriptions as prevailing in secondary education. With the more implicit art and design pedagogy, students have to be introduced to an open-ness and uncertainty as prevalent in creative industries (Orr, 2008). By providing the student with visual tokens as handles to hold on to, the student can follow a certain direction. Because the used ideograms do not represent the information of the exercise directly, the student is gradually introduced in the complexity of design tasks.
To demonstrate this process, the following figures were prepared to describe a design brief in text first and by ideograms second.

| You are asked to design a shelter for 4 persons to wait for a bus connection. In this assignment you have to design with the qualities of surface active structures by using wooden strips in a triaxial orientation. You can manipulate the strips by cutting. The different parts have to be connected together with mechanical fasteners. The surface has to be smooth to avoid injury during use. |

**Figure 8. Textual Design Brief**

**Figure 9. Visual Design Brief**

The study discussed next is a form-study studio-exercise performed at Amsterdam Academy of Architecture. The exercise was performed by 10 different groups over two years. Each “period” consisted of an eight week period. Every week the student worked on a different sub-problem combination within a three hour time period. Eight similar exercises were conducted over a period of half a semester.

In the form-study classes discussed, two to three groups of twelve students worked simultaneously. In this set-up, I collaborated with the teachers Arjan Karssen, Michiel Kluiters and Koosjan van der Velden. All teachers are practicing artists, designers and architects.

In this study, for data collection, three sources of evidence were used. The first was a subjective score of a student inquiry. By comparing scores from the inquiry before the workshop to the scores after, a learning curve was calculated. Secondly, the results from all workshops were archived. For each form-study exercise, the student made a small one-page report by answering two questions accompanied by a photo or sketch of the result. The form-study archive described a summary of the student learning curve, and makes subsequent workshops comparable. Finally, apart from the participating form-study teacher, the outcome was reviewed by the collaborating teachers. This way, a student work review was followed by the participating teacher accompanied by an independent review of the external teacher (Luyten, 2012).

**Figure 10. Geometric Form Taxonomy**

The students acting in the form-study exercises had different backgrounds ranging from architecture to physics and landscape architecture to urban design. As a result, not all students were educated in all topics described in the visual taxonomy. To bypass this problem, the structure system supertype was substituted by a taxonomy of geometric forms instead.
In the exercise presented in figure 11, the students were asked to perform a form-study by using polystyrene molds within the restriction of a pyramid geometry. The molds had to be made from plates, processed by cutting and assembled by glue. After finishing the mold, the negative volume was filled with plaster to become a positive volume study.

In the exercise presented in figure 12, students built an inflatable structure. Starting with the geometry of a donut, patterns were made from foil and assembled to become a circular round tube. By inflation, the structure is erected.

The review of the project consisted of a written inquiry and an interview. In the written reflection two things stood out. First, the sub-problems provided a good overview of the topics to work on during the form-study. In the start of the study, the amount of sub-problems seemed a bit overwhelming for the time provided. After about three to four weeks most students managed to
incorporate all sub-problems into the form-study. Second, by changing the physical medium for idea communication for written text, the students expressed a different way of understanding. By understanding through the act of writing (Orr, 2010), the student was able to take a distance from the subject and show a deeper learning and understanding.

In the reflection interviews at the end of the form study, the data collection as described before was discussed. In these interviews a majority of the students were pleased with the use of visual sub-problems in the design brief.

As a result, the ideogram design brief served as an effective description of the learning environment to facilitate implicit learning as describe in figure 2b. By using the ideograms as “the rules of the game”, the student was able to construct their own individual knowledge. Instead of a rigid explicit learning process, the students learned by trial-and-error. The more the student allowed making mistakes in the process, the more the personal environment increased.

4.2 Ideograms in Student Publications

When first year students are introduced to the discussed ideograms, a great part of the graphics are just data, the images make little sense. To give meaning to the ideograms and convert the data into knowledge (Kolko, 2009), a writing exercise is conducted.

![Figure 13. Pages from the material course book](image)

The exercise was performed at the material course of Sint-Lucas School of Architecture in Brussels and Ghent. In the classes of Brussels and Ghent combined, about one hundred students participated. During the first lecture, all students were provided with a combination of two ideograms. The first icon represented a material family whereas the second icon was one of the thirty remaining subtypes. Starting with these icons, the students were asked to write a text about the combination of both. In the end of the course, all texts were joined into a magazine and provided as a reference for future projects.

During the discussions and reviews with the students, one specific quality stood out. Once the student understood the language, the ideograms were easily adopted and introduced in other documents than the book. With a common language, the students felt able to communicate the
different construction aspects of the design. In a building report of a piece of furniture, for instance, they prepared chapters lined up with the ideograms and corresponding meaning to address the different design decisions made.

By providing the student with the opportunity to review a combination of two ideograms in depth instead of a range of ideograms superficially, the student described a more effective increase in their personal environment. By focusing on a small learning environment, steps to increase the environment were more effective. By understanding these steps, the student was more confident in elaborating similar research.

4.3 Ideograms in Educational Games

In order to introduce students with the visual taxonomy in an unstrained manner, a Quartets card game was designed. Inspired by Froebel’s Gifts (Bowen, 1897) and Dewey’s Learning Objects (Dewey, 1997). In this game, by a strategic series of questions, the student has to collect as many quartets, completing sets of four subtypes of the supertype.

Figure 14. Sensemaking in Construction Card Game

The game has not been used for educational purposes yet. Currently it is used to communicate the visual taxonomy with colleagues and design professionals. It is also employed to provide feedback on the ideograms, supertypes and subtypes.

Until the introduction of the game, discussion on the content with fellow researchers and colleagues proved to be difficult. By presenting the visual taxonomy as a whole, too much information was presented to be able to be discussed effectively. While playing the game with colleagues in an informal setting, the amount of ideograms was increased by small steps. As a result, discussion on the ideograms and the information behind progressed more easily.

5.0 Conclusions and Future Prospects

In this paper, I have reviewed the use of framing and communication design as a tool for sensemaking in architecture education. Using a frame construction strategy, I have designed a visual taxonomy of construction supertypes and subtypes. For the design of the taxonomy ideograms are used.

I briefly discussed two case studies and one learning object as preliminary field applications. The first case study introduced the use of ideograms in design briefs. The second case study illustrated a writing exercise based on the visual taxonomy. Finally a learning object in the form of a Quartets card game is presented.

I found that the frame provided opportunities for visual presentation of complex tasks. By subdividing an abstract task into visual sub-problem elements, a more structured design process was visible. Furthermore, the ideograms served as an efficient medium device in student conversation.
and workshop reports. Next to the communication of the workshop set-up beforehand, the ideograms showed great potential in the structure of student writing.

The strategies and tools were more efficient for providing educational games and student publications, compared with the design briefs. While the educational games and writing exercises were used to make sense of the ideograms, the use of ideograms in design briefs needed to be introduced. The majority of the ideograms were perceived by the students as easy to understand and comprehend whereas some needed a small introduction.

Two main problems with the strategies and tools were observed. First, in some cases, a misunderstanding was present in the use of the visual taxonomy. In dialogues, colleagues addressed the fact that design is not merely the sum of its parts. They expressed an anxiety towards the use of a combination of ideogram sub-problems to describe a design brief, emphasizing that there is more to design than just solving connections, material choices and product processing.

Second, students with a more narrative focus towards design expressed that the engineering and building aspect of the taxonomy was partially impeding their conceptual focus. Some of the students felt too restricted in the ideogram design briefs and treated it like a “fill-in task”. Some others thought that they didn’t need it and the ideograms were just blocking the way of becoming a good designer.

With respect to the first aspect, a certain holistic quality was missing in the visual design briefs and workshop communication. This problem seemed greater with visual design briefs when compared to textual briefs. Students found it harder to find an overlap in images than in words. When necessary, this problem was overcome by introducing a design starting point or inspiration for the students to work with. By using inspiration of color, smell, a specific sound piece or style as a design starting point, discussion on design decisions progressed more easily.

The problem discussed in the second aspect was different in each case and depended heavily on the student background and origin and ambition. Students with a non-technical background with the ambition to design and build in an interdisciplinary design context found an effective basis in the visual taxonomy. By starting on the problems of the individual ideograms first, they were able to successfully finish the design brief by integrating the sub-problems into a built design. For students with a great ambition in conceptual parts of the design, the taxonomy seemed too rigid and explicit. When it is necessary for the students to be informed about the technical content of design, an awareness of discussions on interdisciplinarity and transdisciplinarity has to be present first before the technical layer of design makes sense next.

The use of ideograms in the discussed exercises helped to reduce the time of introduction. During the cases presented, I have observed a common pattern of student behavior. While communicating a textual design brief, art and design students searched for a place to sit down first and start reading next. The reading was combined with an extended or late lunch. Next, the students started drawing immediately to make sense out of the written description. But the textual description was perceived too abstract. Then a discussion took place to compare the interpretation from one student to another. On the one side, this recoding by drawing enhanced the ability to understand written exercises. On the other side, the described process took a large quantity of the workshop or lesson time. Furthermore, parts of the exercise were mistranslated or left out. As a result, the students ended up with an incomplete project.

In contrast, when using ideograms within design briefing, students were able to distinguish the multiple sub-problems more easily. The design-brief was introduced directly after the student entered the workshop or lecture space. In most cases, the design-brief was read in a standing
position with jacket and backpack still on. After a short view at the design brief, a short discussion took place. The students put down their backpack, took off their jacket, group tools and materials and immediately started to work or opened their laptop and started writing. Consequently, the students had less difficulty incorporating the sub-problems into the form-study, design or written research.

While the visual framework was designed for use in architecture education, framing and frame construction in general and the ideograms in specific can also be used in other educational contexts. First, in the Netherlands, technical education in primary and secondary school is currently making progress. A simplified version of the taxonomy can potentially assist this movement. Second, the use of framing, frame construction and ideogram sub-problems can be useful for other disciplines to support sensemaking in more abstract learning environments.

In the near future, I am planning to discuss the use of color in order to make the taxonomy accessible for other disciplines. By using color-themed supertypes like those used in the diagrammatic tube map of Harry Beck (1933) and the learning object discussed, the connection of the subtypes will be more visible. To extend the qualities of communication design, more infographic styles (McCandless, 2009; Toseland, 2012) will be explored for implementation in construction education.

For the similar studies, I recommend a thorough review of the relevant learning environment before starting the framing, frame construction and ideogram design. This framing methodology in this study is used as an interface to transfer knowledge and is not an aesthetic design tool in itself. Focusing on the aesthetics first may harm the pedagogical effects.

In conclusion, the visual taxonomy is promising in terms of teaching more efficiently, helping students work more effectively and making the design results more reliable. I believe that including the added-knowledge collected by rigorous testing and the suggested improvements, it can serve as a valid tool for technical education in general and architecture education in specific.

**Acknowledgements**

This paper is a result of PhD study of the author at Eindhoven University of Technology and LUCA / Association KU Leuven Brussels. The study is advised by prof.dr.ir. J.J.N. (Jos) Lichtenberg, dr.arch. Burak Pak and dr. Laurens Luyten.

**References**


Bowen, H.C. (1897) Froebel and Education through Self-Activity, Charles Scribner’s Sons, New York, US.


Miller, G.A. (1956) The Magical Number Seven, Plus or Minus Two: Some Limits on our Capacity for Processing Information, Psychological Review, 63, 81-97, Washington, US.


