EDUCATING DESIGN INTUITION:
A SURVEY OF PROBLEM SOLVING METHODS USED IN ARCHITECTURE AND INTERIOR DESIGN STUDIOS

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Abstract

The scope of this research aims not only to define and explore the strengths and limitations of humans' "sixth sense" intuition, but also to discover how it can be improved in design thinking and better understood during the maturation of a design student. Intuition is aligned with, among other things, automatic, tacit and unconscious processing, implicit memory, and procedural knowledge. Broadbent (1973) argued in Design in Architecture that there were seven avenues to approach any particular problem, to include deduction, induction, algorithm, ratio, analogy, metaphor, and chance. But perchance, there might be another that is often overlooked; that is intuition. In Educating Intuition, Hogarth (2001) tackles a fascinating topic that has until now garnered little scientific attention; that is intuition. This study conducts a survey of the design pedagogy, in particular the problem solving methods taught to undergraduate architecture and interior design students. It is hypothesized that the problem solving method of intuition is not addressed. Observations as to why intuition is not addressed as a design problem solving method are provided in order to assist faculty in developing opportunities for such to occur.

Introduction

During the last twenty years, the delivery and development of these problem-solving skills have been best honed in a problem based learning (PBL) situation. In the discipline of architecture, the atelier (the architecture design studio) has served as the setting for the integration of all the skills and knowledge to be applied in a (PBL) setting. This started with the guild house and manifested within the Ecole Des Beaux Arts the world renowned architecture school in Paris which started in 1717 (Drexler, 1977). Boyer and Mitgang (1996) made an interesting observation that PBL learning has been used in architectural education since its inception:

> The good news is that architecture, by nature and tradition, holds vast potential as a model for the integration and application of learning, largely because of its most distinctive feature - the design studio. Beyond question, the design studio is a model that many other disciplines on campus, as well as elementary and secondary schools could well profit from (p. 85).

The practice of and education of an architect has, throughout history, taken a Gnostic form in what architects know as the studio. The ACSA (The Association of Collegiate Schools of Architecture) has throughout the years published the Guide to Architecture Schools (2003) and provides a good understanding of the structure and goal of the design studio:

> In a Bachelor of Architecture program, and to a lesser extent in the four-year non-professional degrees, the primary concentration is design, in both credit hours and time. In some schools, “design” may be a required course every semester. It is almost always a studio course, and certain aspects of an actual or hypothetical architectural problem are emphasized. The student, either individually or as a member of a team, working with a faculty “critic” finishes a project with a preliminary design solution for the problem, which is graphically (and often verbally) presented. For centuries, “juries” of faculty and professionals have been used to discuss and evaluate the student solutions-undoubtedly the best-remembered experiences of nearly all students. Ideally, knowledge from other courses is applied in the design studio. (p. 6)

This is that portion of the curriculum where the culmination of knowledge, technical skills and problem defining and solving occurs, dealing with unique ill-defined problems. Schon (1985) comments about the architect design studio that these, “systems of intuitive knowing are dynamically conservative, actively defended, highly resistant to change” (p. 27). This is the quintessential observation of intuition.

The purpose of this research was to determine what particular problem solving methods are being taught in the architecture and interior design programs at the School of Architecture, Southern Illinois University Carbondale. At the core of this terse survey is the hypothesis that of the eight methods of design, intuition was not being addressed. Possible assumptions as to why this method is not being addressed in the curriculum will be commented upon later in this paper. It is the author’s observation that there are initially two reasons for not addressing intuition: ignorance and dogma.

Design Methods

At the very heart of Career and Technical education is the pedagogy in the development of critical thinkers, armed with an arsenal of problem solving tools and skills. Broadbent (1973) argued in *Design in Architecture* that there are seven avenues to approach any particular problem, to include deduction, induction, algorithm, ratio, analogy, metaphor, and chance. He contends that this spectrum of design has two polarities at one end, operations research and at the opposite, Dewey's "creative leap".

Deduction and Induction

The full spectrum starts with deduction, best understood as a top down, general to the particular approach in problem solving. This ideal is founded in Plato's Republic, as he describes the ideal as a shadow on the wall of the "cave", wherein we see the archetype. Induction approaches the problem from the inverse where it is a bottom up, particular to general. Raphael, in his great fresco found in the one of the salons in the labyrinths of the Vatican Museum, carefully depicts these two classic modes of problem solving, wherein we see two men conversing with each other in a great architectural space, surrounded by an entourage of philosophers, thinkers and writers. The two men, Plato and Aristotle, are in a grand argument with Plato (Figure 1) pointing a single finger upward, purporting that starting with the general to the particular is in fact the best mode of inquiry, whereas Aristotle (Figure 2) has one hand pointed down with all his fingers thrust downward, indicating that starting from the particular to the general might be the better path to understanding.

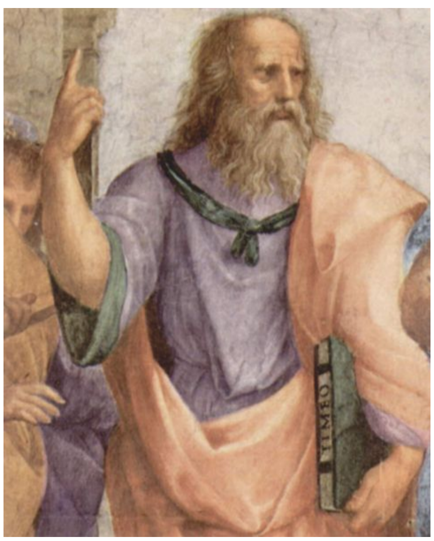

Figure 1. Plato, (Raphael, 1509-1510)

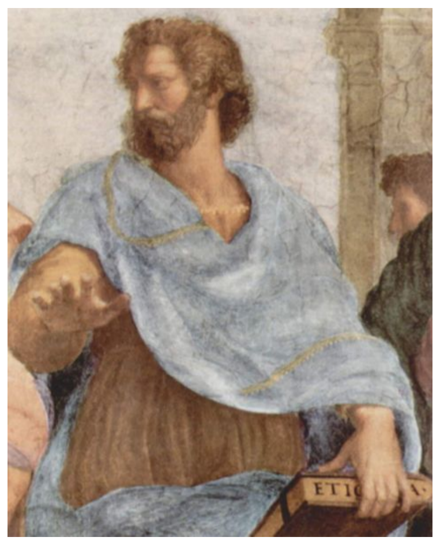

Figure 2. Aristotle, (Raphael, 1509-1510)

Algorithm

In the great treatise by Vitruvius, (200) The Ten Books on Architecture, a rubric is given to Cesar, providing him with a means by which to judge architecture. This rubric is composed of three words-utilitatis, firmitatis, and venustatis. In today's architectural idiom, it is properly taught that buildings should be functional, constructed appropriately with strength, and provide a delight to the eyes. Within the problem-solving domain, is algorithm, the method of solving problems via mathematical formula such as presented in Figure 3.

$$f_{cr} \equiv \frac{\pi^2 E}{(\frac{L}{E})^2}$$

Figure 3. Column Structural Formula (Gordon, 1978).

Where E= modulus of elasticity, I = moment of inertia, and L = the longest half sine wave along the deflected shape thus providing the load that a particular column would sustain. Two other areas where algorithm reigns are architecture HVAC (heating ventilation and air conditioning) and lighting problems. These are the kind of problems that would create disaster if solved by metaphor or chance.

Ratio

Rasmussen (1959) noted importance of the ratio, the golden section, "Pythagoras and his disciples were interested in it, theorists of the Renaissance took it up again, and in our day Le Corbusier (the greatest architecture of the 21st century according to some popular opinion) has based his principle of proportion, *Le Modular* on it. This ancient ratio can be manifested in the simple geometric construction of a pentagon and then extending each of the legs of the pentagon out to construct a five pointed star. This produces a ratio between the face of the pentagon to the length of the star of 1 to 1.618, ad infinitum, ad nauseum. Applying ratio as a design method, wherein solutions take on a direct appearance or some form of the golden section, has historically been employed in such great architecture as Palladio's Villa Rotunda, and the most popular *The Da Vinci Code* ideal man. The use of ratio is actually much more prominent that one would believe. In the construction of our homes and businesses, contractors make their way to the local Lowes, Home Depot, Menards or Associated Lumber Yard to purchase lumber. But alas, each piece of lumber follows a particular ratio that works with the 4'x8' sheets of drywall or plywood decking, that works with the 2' modules in which the building's concrete foundation was cast.

Analogy

One of the popular phrases used in our American materialistic society has been, "Lets keep up with the Jones", which in fact is solving a problem via analogy. This is a method that can be considered rather slothful. There is a lack of creativity in this approach, but it is all so easy to employ. Therefore, to solve a problem in architecture one would create a solution similar to a previous design. An example in the southern Illinois region would be the College of Liberal Arts building, Faner, on the Southern Illinois University Carbondale campus, wherein the architect Robert Geddes used a design that is in fact constructed in two other locations in the United States. We use analogy not only to solve problems, but almost exclusively to describe the things we desire, or to describe something novel, e.g., "it tastes like chicken".

Metaphor

Broadbent (1973) commented about metaphor and its deep roots in the history of language and philosophy:

> As we have seen, metaphor is that 'figure of speech in which a name or descriptive term is transferred to some object different from, but analogous to, that to which it is properly applicable'. Certainly, the original Greek word meant transference' but, for Aristotle at least, there was far more to it than that. 'The greatest thing by far,' he said, 'is to have a command of metaphor.' And what is more, he went on to say, "This alone cannot be imparted to another: it is the mark of genius, for to make good metaphors implies an eye for resemblances (p. 332).

As a casual observation, Aristotle's description of a person with the eye for metaphors rings similar to Howard Gardner's "naturalistic intelligence". Two examples wherein architects have used metaphor as a design problem solving tool, in particular as it gave raise to the actual architectural form of the buildings, are the EMP (experimental music pavilion) in Seattle, Washington and the Sydney Opera House. Frank Gehry, the architect of the EMP, wanted to capture the essence of Seattle's modern music scene especially some of the greatest rock and rollers. He chose to mimic the architecture form of the EMP after Jimi Hendrix, the "are you experienced?" musician, who in the crescendo of the performance would destroy his guitar by smashing it against the amplifiers. Gehry used this image to design a building form that has a similar appearance of a destroyed guitar, with the broken strings manifesting themselves as fiber optics along the façade of the EMP. Jorn Utzon's design of the Sydney Opera house was a little bit tamer but still exhibiting that great eye for metaphor. His Sydney Opera House in the harbor takes on the appearance of ships with the rig at full sail. Because the Opera house took more than a decade to complete, some architectural critics took the liberty to comment that the structure looked like turtles copulating, a metaphor not intended by Utzon. Lakoff and Johnson (1980) provide an in-depth analysis of the use of metaphors in their text *Metaphors We Live By*.

Chance

What instructor, upon walking into a classroom on the due of an assigned project, has not asked the students the loaded question, how did you come up with this design/solution/paper/idea, only to be met with eyes wide open with blank stares? Upon which reaction, the instructor would query the students a little deeper as to the method of their problem solving, where a brave soul would come forth and pronounce, "It just came to me". Alas chance, but what is chance? In one case, it could the trained mind open for fertile opportunities. To another, chance is more deterministic, be it the hand of God, fate, or the environment. Some fifteen years ago, while visiting the largest architecture firm in the world, I came across an architect working behind a large computer screen manipulating the vertices in 3-dimentional space. As he was elongating one of the vertices to become the top of an all glass and steel structure that looked like, a Dairy Queen ice cream cone, I asked if the hand of God was on every mouse move. He quickly retorted, making sure that none of the senior congregation could hear, "No; please say nothing more!"

Intuition

But perchance, there might be another design problem solving method that is often overlooked, that is *intuition*? In *Educating Intuition*, Hogarth (2001) tackles a fascinating topic that has until now garnered little scientific attention that is intuition. Hogarth (2001) arrives at the following working definition: "The essence of intuition or intuitive responses is that they are reached with little apparent effort, and … involve little or no conscious deliberation" (p. 12). By this account, intuition—which does not encompass innate instincts or regulation of autonomic processes such as breathing, is a product of associative learning that occurs outside working memory, which provides the design educator opportunity for pedagogical interventions. The initial scope of this research aims not only to define and explore the strengths and limitations of humans' "sixth sense" *intuition*, but also to discover how it can be improved in design thinking and better understood during the maturation of a design student. Intuition is aligned with—among other things—automatic, tacit and unconscious processing, implicit memory, and procedural knowledge. The concept of thin slices *Blink: The Power of Thinking without Thinking* (Gladwell, 2005), is the idea that the information we process and the decisions that we make can be broken down into sequential slices, and that often the most important information and the best decisions come from that first slice. Galdwell (2005) cites a number of examples of people who have learned how to isolate and then minimize the smallest slice, upon which they can base a decision and expect it to be correct with a sufficiently high degree of certainty.

Method

In the spring of 2005 a survey was conducted of the entire architecture and interior design student population. In the School of Architecture at Southern Illinois University Carbondale, the two design programs of architecture and interior design have the same "core curriculum" the first two years. After the "core" is completed, they venture on to their respective design studios. In the design studios, the skills and knowledge form the core are developed into (one hopes) sophisticated problem solving tools.

The survey set out to accomplish two major observations: first, employing a Myers-Briggs Type Indicator, Myers and Kirby (1994) revealing each student as one of the sixteen personality types. The final outcome of this research hopes to identify correlations between personality types, and problem solving methods employed will be addressed at a later date. The second portion of the survey established what particular problem solving methods are being taught in the curriculum of both the architecture and interior design programs. The core of the survey asked the following eight questions of the students:

1. In your design education thus far, have you been introduced to *deduction*, (that is starting from the individual things, a bottom-up) approach to problem solving as a design method?
2. In your design education thus far, have you been introduced to *induction*, (that is a concept, top-down) approach to problem solving as a design method?

3. In your design education thus far, have you been introduced to *algorithm*, (that is using a formula or mathematical) approach to problem solving as a design method?
4. In your design education thus far, have you been introduced to *ratio*, (that is using some give form such as the golden section 1 to 1.618 or the Japanese Ken) approach to problem solving as a design method?
5. In your design education thus far have you been introduced to *analogy*, (that is using the likeness of one thing to design another) approach to problem solving as a design method.
6. In your design education thus far, have you been introduced to *metaphor*, (that is using a comparison which imaginatively identifies one thing with another dissimilar thing, and transfers or ascribes to the first thing some of the qualities of designing the second? Unlike a simile or analogy, metaphor asserts that one thing is another thing, not just that one is like another) approach to problem solving as a design method?
7. In your design education thus far, have you been introduced to *chance*, (that could be luck, providence, special guidance, or some form of determinism) approach to solving as a design method?
8. In your design education thus far, have you been introduced to *intuition*, (that is instinctive knowing, without the use of rational processes) using direct perception of something without conscious reasoning to design) as an approach to problem solving as a design method?

Procedures

Students enrolled in the majors of architecture and interior design were asked to complete the design methods survey. The students of each major studio, freshman, sophomore, junior, and senior were approached to participate in the design problem solving survey. Included in the survey were demographic information identifying their major, standing and gender.

Data Analysis

The researcher employed a frequency distribution of the design methods taught. This produced a list of the values (design method) that a variable takes in a sample ordered by quantity, showing the number of times each value appears.

Findings

Findings for this study are discussed relative to the eight research questions posed for in the study. Analysis of data identified 121 architects and 49 interior designers, with a gender distribution of 89 females and 103 males. Analysis of data determined students were introduced to the eight design problem solving methods starting at the high end with analogy followed by metaphor, ratio, deduction algorithm, induction intuition and finally chance as noted in Table 1, Distribution of Design Problem Solving methods Taught.

Table 1

Distribution of Design Problem Solving methods Taught

Problem Solving Method	Percentage Introduced to Design Students
Deduction	68% taught
Induction	64% taught
Algorithm	66% taught
Ratio	73% taught
Analogy	79% taught
Metaphor	78% taught
Chance	59% taught
Intuition	65% taught

Analysis of data determined the differentiation of design problem solving methods taught to architecture students compared to design problem solving methods taught to interior design students as noted in Table 2, Distribution of Design Problem Solving methods Taught by Discipline.

Table 2

Distribution of Design Problem Solving methods Taught by Discipline

Major	Architecture	Interior Design
Deduction	69% taught	69% taught
Induction	67% taught	67% taught
Algorithm	71% taught	67% taught
Ratio	72% taught	75% taught
Analogy	82% taught	80% taught
Metaphor	81% taught	84% taught
Chance	55% taught	73% taught
Intuition	66% taught	65% taught

Discussion

The heart of this terse survey was the hypothesis that of the eight methods of design, intuition was not being addressed. Data reveals that chance followed by intuition is in fact the least important design problem solving methods introduced to design students in the studios. It is not surprising that chance ranks last, how does one teach chance if not by chance? It is the author's observation that there are initially two reasons for not addressing intuition, ignorance and dogma. Pertaining to ignorance, intuition has not been one of the mainstay methods of design problem solving taught or even encouraged in the studio. Most design faculty do not consider it a viable or rational mean. Hograth (2001) clarified this dilemma:

> Because intuitive processes operate beyond conscious awareness, intuitions can essentially be considered faits accoplis, things that must be dealt with *after* the fact. It is therefore critically important to recognize that, in order to understand and improve intuitions, you must understand *the process by which they were acquired*. If, for some reason, that process has been biased, the outcomes of the process (i.e., intuitions) are also likely to be biased" (p.194).

In fact, for young students to even suggest that their design solution "just came to them via some unknown cognitive process" would be anathema for them.

The second observation as to the negation of intuition as a design problem-solving tool deals with the dogma of the studio culture. Architects and designers have a reputation of being egotistical and demanding of their apprentices a strict line of reasoning (the professors only). It is not surprising in Wolf's (1981) satirical text *From Bauhaus to Our House* he refers to Walter Gropius as the "great white prince", indicating his arrogant and superior attitude about his design thinking. Gropius went on to teach at Harvard School of Design and set in motion the style and idea of modern architecture.

Recommendation

Boyer and Mitgang (1996) suggested in the tantamount critique on architecture education, *Building Community a New Future for Architecture Education and Practice*, the following:

> For much of this century, design has dominated the architecture curriculum at nearly all schools. It is a place-the design studio-where students spend as much as 90 percent of their time and energy. It is a product-the tangible result of thinking about and making architecture. And it is a process-a way of thinking during which the many elements, possibilities, and constraints of architecture knowledge are integrated" (p.85-86).

The key phrase from Boyer and Mitgang (1996) is process-a way of thinking; herein lays the domain for other avenues of design problem solving, to include intuition. Intuition interventions are introduced and employed in the students' design process. Encouraging and educating design intuition could possibly provide a novel and heuristic approach to those ill-defined problems that architects and interior designers daily deal with. In doing so the author believes that design students often are misled or confused by extraneous information. When students look at a slice of design/architectural information, which is too thick with extra details, then they find themselves basing their decisions on facts and opinion, which have no bearing on the facts of the situation. Maybe "thin slicing" of data and information via intuition might prove beneficial (Gladwell, 2002).

Conclusions

In the near future, if it does not already exist, the separation and difference between machines of problem solving and architects and interior designers will be blurred, if not eradicated. Many of the problems encountered by architects and interior designers will be quickly solved by machines. As the machine becomes more like us, it is critical to continually expand our ideas and notions about what intelligence is, how one goes about identifying and defining problems, and the generation of solutions via a toolkit of problem solving methods that even include intuition and chance.

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