Fluid and Tolerant Teaching

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In our contemporary environment of exponential growth in the exchange of information, the possibilities for relevant design beginnings are infinite. In the search for relevant design, one should no longer codify or limit the available starting points within the established historical cannon of design processes (the lineage of acceptable ideas and processes that are hierarchically controlled by access to information). The breadth and magnitude of ideas available have expanded everyone's knowledge and expertise. The age of professionally controlled cannons no longer exists. Any citizen can learn the history and theory of architecture on the web, or discover how to properly flash a roof to wall junction on a television program. Now, more than ever, the role of Architecture in society must be flexible enough to finds its relevance in every possible manner. The role of architecture now demands a fluid and tolerant balance in the range from what is to what should be, beginnings to ends.

Hypothesis

We believe that relevant architecture (what should be) only comes from a critical understanding of site (what is). In order to critically observe a site, one must discover phenomena and invent a tentative description, called a hypothesis, which is consistent with what is observed.[1] Site should be understood as more than just the physical features and dimensions. Vittorio Gregotti described a fuller meaning of site clearly when he stated,

> *The built environment surrounding us is the physical representation of its history: the way in which it is accumulated at different levels and meanings. To form the specificity of the site not only for what the environment seems to be, but for what it is, structurally speaking. Thus, location is made up of traces of its own history.*[2]

Webster defines phenomena as "any fact, circumstance, or experience that is apparent to the senses and that can be scientifically described or appraised." [3] Gregotti implies that one must employ all senses to identify a site's accumulated levels and meanings. He goes on to state the relevance of what is in regards to what should be.

> *Geography is the description of how the signs of history have become forms, therefore the architectural project is charged with the task of revealing the essence of the geo-environmental context through the transformation of form. The environment is therefore not a system in which to dissolve architecture, on the contrary, it is the most important material from which to develop the project.* [4]

Thus, if site is the medium of design, it must be critically observed and analytically documented. The scientific method allows one to do this. The abbreviated version of the scientific method is:

1. Observe some aspect of the universe. (inductive reasoning)

2. Invent a tentative description, called a hypothesis, which is consistent with what you have observed. (inductive reasoning)

3. Use the hypothesis to make predictions. (deductive reasoning)

4. Test those predictions by experiments or further observations and modify the hypothesis in the light of your results. (deductive reasoning)

5. Repeat steps 3 and 4 until there are no discrepancies between theory and experiment and/or observation. (deductive reasoning) [5]

The scientific method minimizes the chance of beginning with personal bias and preconceived notions. It demands both deductive and inductive reasoning. The experimental method utilizes inductive reasoning to interpret, conclude, and generalize the results. It utilizes deductive reasoning to frame, perform, and analyze the experiment. It combines accumulated experience (deductive) and personal decision (inductive) to research an idea. The author's inventiveness and creativity is then directed towards finding the relevant solution to critically observed and measurable situations. Therefore neither the art nor science [6] is privileged. Because students come to the studio with a great understanding of what they know and what they want, we must employ methods that teach them the following principles:

I. necessity to search for something they do not already know

II. methodologies to direct their personal preferences and desires

III. critical analytical tools that may be used to clarify, question, and develop the same personal preferences.

By giving them methods and tools that enable them to analyze something they do not already know (site), we believe they will use their inventiveness and creativity to produce more relevant solutions.

Through the concept of the site and the principle of settlement, the environment becomes (on the contrary) the essence of architectural production. From this vantage point, new principles and methods can be seen for design. Principles and methods that give precedence to the siting in a specific area. This is an act of knowledge of the context that comes out of its architectural modification. [7]

Experiment: Applying and Modifying the Scientific Method

For the past five years, we have been teaching upper level studios and have developed these ideas regarding the scientific method. Of course, any translation of a method across disciplines requires modifications. We have employed the scientific method to develop these notions regarding the use of the scientific method in an architectural design studio. We will now discuss our findings as a working hypothesis. To date, we have modified the scientific method for upper level studios in the following manner.

1. Observe some aspect of the universe. (inductive reasoning)

Given: Universe (Some dynamic site)

Observe: Phenomena (Look for what you experience viscerally not just what you see)

Measuring Tools: your body and senses as measuring device; photography, sketch, paint, mark, make

2. Invent a tentative description, called a hypothesis, which is consistent with what you have observed. (inductive reasoning)

Given: Argument (a series of questions to promote hypothesis)

Observe: a means to scientifically describe or appraise the aforementioned hypothesis

Measuring tools: site maps, statistical data about site (rain, vegetation, history), photos, scales, you, evidence or documents to aid in proving hypothesis

3. Use the hypothesis to make predictions. (deductive reasoning)

Given: your hypothesis in regards to Universe

Observe: spatial manifestations of phenomena - Mapping models or drawings

Measuring tools: same as above (analogous site model)

4. Test those predictions by experiments or further observations and modify the hypothesis in the light of your results. (deductive reasoning)

Given: your hypothesis in regards to Universe + (circulation, program, materials and assembly, building systems, etc.)

Observe: spatial manifestations of the cause and effects the above additional factors

have on the hypothesis. How do the lessons learned about the site from the initial experiment provide a medium for accepting new data? Does the new data modify the hypothesis or does it begin to prove it? Etc.

Measuring tools: the occupant - human scale, the proposal - building scale, the site - global scale

5. Repeat steps 3 and 4 until there are no discrepancies between theory and experiment and/or observation. (deductive reasoning)

Conclusion: When consistency is obtained the hypothesis becomes a theory and provides a coherent set of propositions, which explain a class of phenomena. A theory is then a framework within which observations are explained and predictions are made.

These modifications listed above have been developed to translate into an architectural studio setting. One longer project over the semester broken up into these clear steps is preferenced over a larger number of shorter investigations. The modifications are employed and presented to the students in the following manner:

1. Observe some aspect of the universe. (inductive reasoning)

If we determine site as the context of architecture, we too must begin with site. Our teaching experiments have led us to our first conclusion in regards to site. The more dynamic and unique the given site, the more able the students are to read phenomena. If the site lacks exaggerated phenomena, our students are not sophisticated enough to see without a bias. (They resort to making up what they think they see in lieu of what they actually see.) Therefore, we give them a dynamic universe to observe. In Southern Louisiana we have the luxury of occupying such a dynamic universe, a universe caught between land and water. The sites are chosen to heighten as many of the conflicting conditions of the area as possible. For example past sites include an interstate exit into the Atchafalaya swamp, and a suburban development surrounding an international bird rookery. We accept that our ideas regarding site may be a result of the unique and sublime area we find ourselves, but it serves our purposes as teachers nonetheless. After we give them site, we task them to begin by observing and documenting the structure of measurable phenomenon at the site. We instruct them to use themselves, their senses, to first identify a phenomenon: "for all human experience is filtered through the senses, and therefore, they are the primary tools of the architect." [8] They may begin with their camera, their feet, their sketchbooks, their digital sound meters, or any other tool that requires them to observe through actual experience. This step of the process is usually clearly understood by the students. The act of collecting data based on a prescribed criteria is a familiar act from more traditional studio settings.

2. Invent a tentative description, called a hypothesis, which is consistent with what you have observed. (inductive reasoning)

Once they identify a phenomenon, we task the students to invent a tentative description, called a hypothesis, which is consistent with what they observed. We task them to find systems of measure, data, and research to clarify, to make more vivid, and to heighten our awareness to the existing latent possibilities of their observed condition. First, we ask them to address the following questions concerned with the task of analysis: *How do you translate the site through the medium you first documented?*

What happens when you take this material and investigate it three-dimensionally? How can the final product stand for, or replace the site; that is express essential qualities? Is it absent of what we perceive immediately? Is it scaled?

It is a given in our experiment for the students to utilize their four years of acquired knowledge of making and observational skills to discover a means to scientifically describe or appraise their hypothesis. We require that they transform collected data (photographs, sketches, notations, maps, statistics, etc) into a 3-dimensional language (space.) They may model or draw, but they must document in a rigorous manner. The definition of rigor of this translation is essentially up for question. It is mostly internal to each specific investigation. In essence, the sustained critical questioning and reaction constitutes a basic definition for clarity of rigor. Our experiment has shown us that as students attempt to analytically process data into measured 3-dimensional languages, they sharpen their hypothesis. By requiring them to substantiate their decisions with their collected data, the students cannot depend on personal bias. They must rely on the site and the information concerning site to invent or to make predictions. This step is also familiar to architecture students. Often more loosely called the concept, the hypothesis differs mostly in that it must be based on observed and measured data. Through insistent, open-ended, critical questioning of the intent, a rigorous hypothesis is fairly easy to form.

3. Use the hypothesis to make predictions. (deductive reasoning)

Thus, the next step begins. Through the process of clarifying a hypothesis, the students have begun to make spatial manifestations of their observations, their phenomena. We name these manifestations "analogous site" studies and require the students to conclude this step with an analytical three-dimensional analogous site model. The resultant 'construction' is neither the real site nor is it a literal expression of their research. The physical manifestation of step two, these manifestations represent an empirical study/analyses of an interpretation of the site and the data. The students are mapping a new site to show or establish the features and details of an observed phenomenon. This task necessitates a rigorous and self-critical relationship between the author, their hypothesis, and the various drawings, photography, collage, collected text, and the spaces produced. If relevant architecture begins with what we can critically observe, then these analogous sites present the beginnings of "architectural production." This step is the first true challenge to traditional studio procedure. No separation is made between art and science, between factual data and personal spatial interpretations of that data. Both are seen as valid, critical, and prone to rigorous development.

4. Test those predictions by experiments or further observations and modify the hypothesis in the light of your results. (deductive reasoning)

This step begins as step 2 does with a series of questions for the students to address:

a. Did the analogous site model provide a universal site experience? If not, do you need to add something into the analysis?
b. What are the spatial qualities captured in the analogous model? (Use verbs, or activated descriptive terms, to answer) This list will help you negotiate the requirements of the program.
c. Identify discrepancies between the predictions of your hypothesis and the model produced. Does your hypothesis need to be updated in light of discoveries made in the model, or visa versa?
d. Identify whether the model should be seen as primarily a formal representation of space, or a methodology of space making. Do you insert the model into the site and develop it towards the program, or do you develop the program by employing the methodologies of the model?
e. Refine or define your program in relation to the hypothesis.
f. Propose specific site location that will provide opportunities to best vivify and define the logic and reasoning dictated by the trajectory of the investigation. This would be done best in another mapping of your specific area accompanied with a written narrative. If you feel you have already done this mapping, compose the narrative, and then re-construct at a larger scale, taking into account adjacent

relationships you removed in the analogous site. Also, gather all of the photo information of the area you have chosen to occupy. There is more to be discovered.

g. Read over the program and designate the qualities of space they require in order to satisfy your overall hypothesis. This is an essential act of translation from the experiential data that *does* exist at the site into the experiential data that *should* be at the site. Begin to think of the events, actions, motions, dwellings, and experiences your initial reading captured and where the program supports, contradicts, nullifies, opposes, compliments, and might enable those same events. This is done also in three dimensions where you take what you have done and continue to develop the process.

h. Rank the following in an order of exploration: Site Relationships, Circulation, Program spaces, Code Requirements, Infrastructure/Building Systems, and Building Assembly/Materiality. Ask yourself; what in relationship to my hypothesis as defined above should I consider first and why? Test your hypothesis against these requirements of architecture. Again, your hypothesis may need to be adjusted once confronted with the new requirements.

These questions are meant to help the students proceed and keep focus as they move into what they consider the making of architecture. These queries are also formulated to help them pursue their hypothesis systemically and not abandon all that they have done to this point. These questions are a modification to our own experiment composed after earlier failures. Without the clear steps and procedures, the students tended to abandon or dismiss process as disconnected with the traditional methods of architectural production. The steps have been employed to find a translation of methods of architectural production (plan, section, model) into an experimental process. Where a geneticist might combine DNA strands to observe the results, we produce space and material to observe the results. As teachers we must assist the students in resisting the notion that process can end, and they can start working on the building. We must engage a sustained reconsideration of process where building and process are one.

The students often struggle with carrying over the spatial conclusions from the early steps into the program, the making of architecture. These questions do not alleviate this dilemma but they do give insight in how to proceed. They force the students to critically look at what they are proposing (their hypothesis) and find a stronger connection between 'what I want' and 'what should be.'

Step four is the longest of the scientific method. It requires the student to make drawings or models as the response to multiple inquiries concerning their hypothesis. It demands reiteration and systematic processes: each artifact the students make leads to the next artifact. The more the artifacts are questioned, the more they are made, and the more they develop, the more architecture they produce. In other words, the more experiments they do, the closer they get to resolving their hypothesis according to the terms of architecture.

5. Repeat steps 3 and 4 until there are no discrepancies between theory and experiment and/or observation. (deductive reasoning)

If the hypothesis is a working assumption, we designate the emerging architecture as the material evidence, the final project as the conclusion of the experiment. Arguably the method could remain open-ended and cycle through steps 3 and 4 endlessly, but the studio format sets known parameters for the students (time, product, behavior). After completing the cycle from steps 1 to 4, the two extremes of this cycle can be tested against each other. The architectural proposal is tested for a measure of clarity in the rigor of its analysis, the development, and its proximity to the initial position of the hypothesis. Embracing what they already know, we schedule scalar deadlines requiring students to develop architecture consistently (step 4) and at multiple scales (steps 3 and 4). They must keep testing their hypothesis at the scale of site (universal) as well at the scale of the human (particular). The effect of this repeated testing is monumental and critical to the development of their predictions and the substantiation of their observations. Everything they are making, be it a detail or a site circulation path, goes towards addressing their hypothesis. When consistency is obtained the hypothesis becomes a theory and provides a coherent set of propositions, which explain a class of phenomena. A theory is then a framework within which observations are explained and predictions are made.

Theory

For the past 5 years we have been applying and adapting our modified scientific method in our advanced architectural studios. At the conclusion of each studio, we reflect on our experiment, modify our hypothesis in light of our results, and start the process again. Between the two of us, we have performed 15 experiments. Based on our working assumption and the results of our experiments, we believe applying a modified scientific method to the advanced architectural studio is one of the best ways for students to produce relevant architecture. The foremost advantage of the scientific method is that it is unbiased. It demands both inductive and deductive reasoning in order to observe, measure, conclude, and produce. It stipulates the analytical study of site (universe) for what it is and thusly provides conclusions for what it can be (architectural modification.) It consistently requires the student to question their hypothesis, to try and prove it false or true. It accepts failure for through failure it gains clarity and focus. The scientific method *"winnows the truth from lies and delusion."* [9] Finding a critical balance between inspiration and procedure is difficult. It is much easier to rely solely on an un-modified scientific method, or to submit to art and inspiration as primary. But, the benefits of demanding students to be continuously responsible for taking a position on the relationship between art and science in today's complex fluid culture are crucial and should not be diminished or dismissed.

Endnotes

1. Noah Webster, *Webster's New Universal Unabridged Dictionary* (New York: Simon and Schuster. 1979).

2. Vittorio Gregotti, 'Lecture at New York Architectural League' *Section A.*, No. 1 (Feb/Mar 1983).

3. Noah Webster, *Webster's New Universal Unabridged Dictionary* (New York: Simon and Schuster. 1979).

4. Vittorio Gregotti, 'Lecture at New York Architectural League,' *Section A.*, No. 1 (Feb/Mar 1983).

5. http://phyun5.ucr.edu/~wudka/Physics7/Notes_www/node5.html

6. 3. Noah Webster, *Webster's New Universal Unabridged Dictionary* (New York: Simon and Schuster. 1979).

7. Vittorio Gregotti, 'Lecture at New York Architectural League,' *Section A.*, No. 1 (Feb/Mar 1983.) 8.

8. Holl, Steven, *Intertwining* (New York: Princeton Architectural Press. 1996).

9. http://phyun5.ucr.edu/~wudka/Physics7/Notes_www/node5.html