Teaching Research in Studio: Research Primitives

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INTRODUCTION

> Assessment of change, dynamics, and cause and effect are at the heart of thinking and explanation. Toœunderstand is to know what cause provokes what effect, by what means, at what rate. How then is such knowledge to be represented?
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> - Tufte, 1997

In the spring of 1998, final semester undergraduate architectural design students were required submit a research project associated with their studio. They were asked to keep a record of their own curiosities and interests and to begin to frame a question that was of intrigue to them and that would produce new knowledge. Examples were given in the form of puzzling questions such as, "how has interior domestic floor-area distribution changed over the last few decades?" The students were encouraged to document their specific curiosity directly out of their own design impetus.

The studio was conducted as a Digital Studio in which the primary mode of communication was through the digital computer medium. This itself was the leading prompt to the research. Texts used included Edward Tufte's three strikingly provocative books on information representation in which the three-dimensional and the visual representation of knowledge is emphasized. Accompanying this visual focus throughout the semester, the benefits that associate with having material in digital form were stressed. Students were given guest lectures on the data aspect of information systems, such as AutoCAD. The studio research instructional premises were (i) there is useful base knowledge that can be assembled from existing available digital source material; and (ii) that the computer can, through its ability to manipulate data that would be too cumbersome or volatile for the human mind, create a representational format that reveals new information.

The fundamental research panorama that was offered to students was that design emphases, activities and standards have evolved over time and setting; that this evolution is the professional and cultural contextual framework for design; but the dimensions and direction of this evolution are unknown to most architects. It was assumed that this unarticulated context for design action has altered almost imperceptibly but that these changes can be made apparent by analysis and representation of the progressive effect. The possibilities of graphical representation has expanded dramatically with the introduction of the computer as a tool of representation. As Tufte describes it,

> Modern data graphics can do much more than simply substitute for small statistical tables. At their best, graphics are instruments for reasoning about quantitative information. Often the most effective way to describe, explore, and summarize a set of numbers—even a very large set—is to look at pictures of those numbers. Furthermore, of all the methods for analyzing and communicating statistical information, well designed data graphics are usually the simplest and, at the same time, the most powerful.
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> - Tufte, 1983

It was suggested to students that they could graph, in the widest sense of the word, these subtle design related changes and detect a design vector. For the purposes of simplicity, a short time analysis period (the last 20 or 30 years) was suggested, and published sources, such as the common professional monthly journals and publications, were recommended for source material. The material was to be represented in a graphical form and the preferred method of data representation and presentation was the dynamically visual, readily achieved by scanning and modulation in one of the photographic and presentation software packages.

The research topics were to be selected entirely by the students. Teacher input was restricted to the discussion-prompt of how to frame a question and how to manipulate the raw material and reform it into a variable-based representation. The time allotted for this component was brief, most of the research being done in the two weeks between final Jury sessions.

THE METHODS

Most students in architecture do not come with a repertoire of research interests or even a predilection for the idea of research. They generally exhibit the special version of curiosity that characterizes much of architectural expression. That is, they think that new knowledge comes, essentially, from a transcendental revelation. They rarely see new knowledge as being created in a rational, articulated way. They are mostly of the opinion that new information is generated through reiterative formal exploration, brooding contemplation or fleeting revelational insight. In order to encourage them to undertake a research activity it is necessary to accept whatever topic or agenda that genuinely spurs their curiosity. This often turns out to be popular issues about the stylistic aspects of design or the practices of the profession. While this may be seen as somewhat thin compared to a traditional research agenda, the results have a greater impact on the students because they offer practical and immediate insight and are not distantly academic and, more importantly, are suitable for their studentto-student conversational exchanges. Because the research results in a such a socially based, empowering authority, the research activity encourages the students to self-examine the information processes, to treat research activity

as a truly everyday, almost mundane activity, and to begin to value the idea of research itself.

THE TOPICS

Students were asked to detail their architectural curiosity. The following synopses are samples of the resulting student research projects:

1 Does the April issue of Architectural Record "Record Houses favor some geographic areas and have these areas changed over time?

The Question: The student, living in the middle-west wondered if there was a geographical pattern to the locations of selected houses in the Record Houses issue of Architectural Record over the last 20 years.

The Method: Map the locations of randomly selected Record Houses over time. Create a computer slide-show of the national mapped published houses on a time-scaled display to reveal the shifting locational patterns.

The Findings: Indeed there are both repetitive geographical patterns in the locations of published houses and a change in the national representation over time, with the emergence of some favor towards Florida and the South in the 1980s and the Pacific North-West in the 1990s. [Student Inference: Location! Location! Location!]

2 Does history repeat itself, architecturally?

The Question: The student, wondered if there was a repetitive pattern to the iconic theoretical design solutions in urban design over the last 100 years.

The Method: Select representational iconic images of urban design solutions over time based on illustrative popularity in urban design texts. Create a computer slide show on a timed display to reveal the iconic visual repetitive patterns

The Findings: Indeed there seems to be repetitive visual-iconic image-solutions in urban design over time, with the alternation of Grand Scale and the Populist Scale iconic formulae. [Student Inference: What goes around comes around!]

3 Do the carved spirals on an ancient tomb have any common mathematical architectural constants?

The Question: The student wondered if there was a repetitive mathematical pattern to the carved spiral decoration in a 5200 year-old tomb (this research based upon instructor s instigation).

The Method: Select carved spirals examples and examine the relationship of their linear-armlength to overall radius. Plot the results with the relative locations of the spirals on a three-axes computer displayed graph.

The Findings: Although there is some constancy, the range is too wide to be conclusive. [Student Inference: Three variables can be synthesized and displayed on one graph—what Tufte calls Multifunctioning Graphical Elements .]

4 Do buildings published in Architectural Record favor one roof profile and does this change with time?

The Question: The student wondered if there was a time-favored pattern to the roof profiles of buildings in Architectural Record over the last 20 years.

The Method: Identify roof types. Graph the roof profile types for randomly selected Architectural Record published buildings over time. Create a computer slide show graph on a timed display to reveal the shifting roof profile patterns preferences.

The Findings: There are noticeable patterns in the popularity of the roof profiles of Architectural Record published buildings over time. [Student Inference: Stylistic trends exist.]

5 Has the architectural color palette in published work changed over time?

The Question: The student wondered if there was a time-favored pattern to the dominant colors ofbuildings in Architectural Record over the last 30 years.

The Method: Scan and pixelize (to remove "visual details") randomly selected Architectural Record–published buildings over time. Create a computer slide show on a timed display to reveal the shifting color patterns as abstract patterns

The Findings: There are noticeable patterns of popularity in the building colors of Architectural Record–published buildings over time. The color pallette appears to change from the earth-toned colors of the 1970s to the pale pastels of the 1980s, to the deeper vibrant colors of the 1990s. [Student Inference: Architectural color popularity changes over time.]

The final product results of all of these student instigated research projects were, at surface level, simplistic. The unseen benefit of the research was the empowerment and intrigued student reaction they precipitated. The discovery of new, previously unknown, information excited the students. The deeper benefit was for the studio instructor who was able to both draw attention to the student s ability to participate in research and to see research become a working part of the design studio. For the students, these research topics, though primitive in nature, offered a sense of discovery and authority. Students began to become excited about their own findings and sensibly critical of the practical methodological structures they were using. The topics, though seemingly lightweight and even frivolous, are ones that are of every-day conversational interest for many architectural students. Although they are highly generalized, the research topics are derived from specific curiosities and so give the student the message that one doesn t have to merely sense knowledge from generalities nor use some kind of wild guesswork. The research projects capitalized on the architectural student s aptitudes for an inventive visual mode which allowed the student the possibility of using the architect s native skills of visualization for data interpretation. Students enjoyed the challenge of " inventing the display" of this knowledge, much like they enjoy inventing a building elevation.

THE RESEARCH PRIMITIVES

From this simple exploration of research in the studio, it is possible to develop research primitives or templates for this kind of simple research. The concept of primitives derives from software protocol where, in order to ease and speed-up access in an application, a macro-based module is used to define an element that contains a priori features and is user-adjustable. This has the obvious advantage that the primitive can be customized, adapted or modified to suit. These set of simple research tasks done with senior design students as part of a studio, suggests that the same concept can be applied to research encouragement. "Research Primitives" can be developed in which students can frame a research question, based on an a priori format, around an enquiry of their own interest and develop both consequential new knowledge of their own defined need and also learn to frame research questions for their professional lives.

Although work is still being done to develop these primitives, four aspects of their nature became clear in the studio exercise. These were the variables of time, place, classification and anomaly/ coincidence parallelism.

Time

One premise variable for a research primitive involves the effect of time. This approach is best characterized by imaging based on Tufte's idea of "multiples in Space and Time."

"Multiple images reveal repetition and change, pattern and

surpris— the defining elements in the idea of information.

-Tufte, 1997

The core of this is the knowledge of pattern changes (or, of more interest to students, trends over time). Most students want to know where things are going, that is, where they are coming from. In an intuitive-based profession, what they want is a sense of affirmation of their intuition. This time based trend analysis is useful for their eligibility and group membership but also because the notion of intuition is that it is commonly recognized as knowing what s happening , which itself is dependent upon knowing what has happened. The evolution of an idea, a movement, the development (over time) of a sensibility, is a critical operational element to much design activity. And, in the words of the novelist John Gardner, "intuition is the articulation of understanding ." Understanding in architecture has been generally ascribed, rightly or wrongly, to recognizing these "architectural movements" that have commonality of change over a specific time period. For students, it is the differential—the relative change over time—that is the most valuable information. It is rational information they can absorb into their unarticulated, assumed supra-rational, intuitive design process. Consequently, a recurring, useable design primitive can be built on change over time.

Place

Place is another research primitive base. This approach too is based on Tufte's "multiples in Space and Time." Students often have a keen sense of place, not in any sophisticated academic sense but in terms of an urban-regional-cultural descriptor. They see geographic regions as characterizations, even as stereotypes of place. It is to them a useful way of dicing the expanse of the physical and opportune world and framing expectations. They use these regional titles as catchwords for a host of implications. This interest can be employed in the making of a primitive because current data sources fall naturally into this regionalist structure. It already exists in the physical world of climate, topography, environment, and costing and has readily available associated research based data. Constants that vary with location such as geography, city, neighborhood, or other regional attributes form the basis of this primitive. The idea of place-context knowledge is seen as both practical for students and true in the sense of the articulation of global tendencies towards ethnicity, decentralization and localization. A useable primitive can be created by slicing the world according to place-difference variables.

Classification

The traditional role of classification is still a fertile area for research. In the context of the recent theory arguments within architecture, there is increasing opportunity for a classification based research as part of a design studio. The advent of the typology, topology, morphology and the deconstructive perspectives have boosted the classification discipline of knowledge generation. Students, mostly under the direction of faculty, still use classification and precedence as a means to uncover the unarticulated direction of a design impetus. When looking at theory based agendas today, it is clear that such classification is at the heart of identifying theoretical stances in design. One very influential and popular book by Kate Nesbitt is built on a structure that overtly uses classification as a framework for synthesizing theory. There is a special learning state for this kind of classification, in the visual fields, which Tufte calls the confection, that is, the "assembly of many visual events . . . brought together on . . . paper," (Tufte, 1997). Students often enjoy the empowerment that such classification offers—a form of theoretical diagnosis. Although not always fruitful in terms of traditional research results , this is a rich area for active research encouragement. Tufte continues, "by means of a multiplicity of image-events, confections illustrate an argument, present and enforce visual comparisons, combine the real and the imagined, and tell us yet another story." (Tufte, 1997) A useable primitive can be developed by franking the world according to classification variables.

Anomaly / Coincidence and Parallelism

This is one more channel for research that is contemporary and contextual, but is a difficult one. The abiding design agenda for many students today is the personal. They often see the primary value of design as its individuality and uniqueness combined with its referentiality. This agenda is similar to the classification variable but differs in that it seeks a bi-polar (or multi-polar) relationships between variables. Students sometimes like to define their foreground design ideas in contrast to backgrounds—the special amongst the ordinary. But they also, sometimes at the same time, like to define their foreground design ideas as subtly, even secretly, connecting with some aspects of the background—the metaphor in design. As Tufte notes,

> "Embodying inherent links and connections, parallelism synchronizes multiple channels of information, draws analogies, enforces contrasts and comparisons .... collate like with like: pairing, orientation, simultaneity, overlap, superimposition, flowing together on a common track, codes, pointer lines, sequence, adjacency, analogy, similar content. Parallelism provides a coherent architecture for organizing and learning form images . . . By establishing a structure of rhythms and relationships, parallelism becomes the poetry of visual information."
>
> Tufte, 1997

A research primitive can be built on this attribute by seeking to discover the anomaly in elements in a field, or to draw coincidence from elements in a field. This is particularly useful where a verbal or written text is the means of articulating the variable, such as in a published design critique. A useable primitive can be created by slicing the world according to these field-difference and field-commonality variables.

The Research Primitive and Research in an Architectural Practice

In general we can categorize information within the profession into three types in the realm of the practice of architectural knowledge. There is technical knowledge. This deals with the scientifically based aspects of structures, construction and, sometimes, the social science aspects such as sociology and psychology. Research in this area generally requires laboratory environments. At the moment this is done at the academic doctoral level and also at the proprietary level by manufacturers and disseminated through trade literature and practice. There is also design knowledge or knowledge necessary to undertake a design project. Design research is currently addressed by theory discourses. This often involves information aspects which, because of their nature, are unmeasurable and therefore do not lend themselves to research description. This is generally conducted by the academic theorists and articulate designers who generalize from their own critical position or synthesize from a review of the positions of others. And there is practice knowledge. This is derived from the spectrum of information needed to participate in the practice of architecture and includes project design processes and practice management processes. Current research in this area is based in academia and supported and disseminated through the professional organizations and the professional journal presses.

But, as Boyer and Mitgang noted, for the architectural profes-

sion, the meaning of research and scholarship needs reinterpretation if schools are to continue to be intellectual and humanely relevant environments. The Boyer Report concluded that a better fracture of the research field was to see it in terms of "the scholarship of discovery, the scholarship of integration, the scholarship of application and the scholarship of teaching" (Boyer and Mitgang, 1996).

It is the scholarship of discovery that this studio task sought to enhance using a self-directed agenda and a research primitive framework. The research primitive approach denies the boundaries between the formal research areas by placing the enquirer in the mode of an outcomes based quest for research rather than the constituency-based structure. The primitive combines all or any of the above research agendas into a pragmatic research interest. What curiosity the students developed in these projects was based on a kind of amalgam of the above three areas, negotiated out of a pressing personal interest. It is suggested that these student interests form the edges to the research and that the research primitives be used as instruments of ease to allow students to access and utilize the research framework to create personal, empowering new knowledge.

THE LESSON

The objective in this studio exercise was to seed an interest in research as a rewarding, empowering and useful contribution to the individual and to the studio (and society, by means of a professional school being in locus mundi). In this, it was successful. It was achievable in studio because of the short-cutting use of a simple preformed research shell which is being called here the research primitive.

It is the personally-driven quality of this studio research that makes students so satisfied to have conducted it. In a sense it could be said that it is market driven since it is the demand for this knowledge (by the student) that has led the enquiry. It could be said too that the advantage of seeding a research interest is that current architectural research in the profession is mostly supply driven (by professional researchers, manufacturers and business managers). By extension, this use of a research primitive returns the focused interest to the researcher-user. There is a self-directed, utilitarian relationship between the researcher and the topic of inquiry -- a need-to-know condition. The researcher-architect is observing the architecture profession for new useable knowledge about how things are and can be within the profession. In the world of business this form of keen and inferred customer or user inquiry is known as contextual inquiry or empathetic research design,

> "Market researchers generally use text or numbers to spark ideas for new products, but empathetic designers use visual information as well. Traditional researchers are generally trained to gather data in relative isolation from other disciplines; empathetic design demands creative interaction among members of an interdisciplinary team... ...representatives explore their customers s worlds with the eyes of a fresh observer while simultaneously carrying the knowledge of what is possible for the company to do, they can redirect exciting organizational capabilities toward new markets. Consider it a process of mining knowledge assets for new veins of innovation.
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> - Leonard and Rayport, 1997

The hope in this studio based research is that a life-time professional appreciation for the benefits of research will be engendered in architectural students and that they will be willing to support and perhaps engage in research in their future professional lives. The benefits to them as individuals, to them as members of an architectural practice, to their clients and to society in general may be better informed designer behavior and research appreciation.

> "The world is complex, dynamic, multidimensional; the paper is static, flat. How are we to represent the rich visual world of experience and measurement on mere flatland?"
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> - Tufte, 1990

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