



Studio based research in architecture: the legacy and new horizons offered by digital technology

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Defining terms: "research" and "design" in architecture.

The most authoritative source for defining architectural research is the Initiative for Architectural Research (IAR) which was established as a joint effort of the Association of Collegiate Schools of Architecture, American Institute of Architects, and the Architectural Research Centres Consortium (ARCC) These are North American institutions but have strong links with academic and professional bodies world wide. The European equivalent is the Association for Architectural Education. (EAAE) While there are no definitions as such for research found linked to this body, the fact that the ARCC and the EAAE have co-hosted conferences to provide a forum for discussion of architectural research, would suggest the IAR source is internationally credible. The definition is contained in guidelines for the characteristics of architectural research as follows. 1

Architectural research is the search for new knowledge and new ideas about the built environment.

The guidelines go on to list the characteristics of research. First the research must have clearly identifiable goals ie. the project is directed towards a question, proposition or hypothesis. Secondly that in pursuit of the "answer" the methodology must be "relevant and accessible to the research domain in which one is operating". The outcome of this methodology must then result in significant results that "reflect a solution or enhances understanding / knowledge within the research domain". Finally these results must be presented and documented in a thorough manner.

The IAR make a point of noting that design can qualify as research if it meets the above characteristics ie. clearly defined goals pursued with a credible methodology resulting in significant results. It would seem we have a reasonably clear set of guidelines for design as research. However "design" in architecture encompasses a myriad of activities. Examples of design as a mode of research might include testing structural or construction systems, exploring new spatial qualities or investigating aesthetic systems. In broad terms

we might distinguish two branches of design activity – architectural technology and the design of architectural aesthetics and space. While mindful that there is often interplay between the two (research into technology may allow a new aesthetic or, conversely, technological advances may be driven by a desire for a particular aesthetic) this distinction is apparent in the curriculum of schools of architecture. Construction, structure and environmental design are taught as separate subjects usually under the category of technology while aesthetics of architectural form and space are introduced via lectures in theory and history and developed as design projects in studios. This distinction is often taken further to differentiate between institutions - institutes of technology may offer a degree in architectural science to differentiate their program from architecture schools whose focus may be closer to a fine arts program

The reason for distinguishing between design as technology or design as a pursuit of aesthetics and space becomes apparent when we apply the IAR guidelines. It is relatively straight forward to apply these guidelines to design with a technological emphasis. If, for example, a researcher sets out a project to design a new construction material the "question" can be clearly defined in terms of technological performance. The project can use a scientific methodology to experiment and test. These results can then be presented as significant if they meet the predefined criteria for performance. Clear question, established methodology and measurable results. Advance to go, collect PhD.

When the guidelines are applied to architectural design as a pursuit of aesthetics and space the path is less clear. If for example a researcher was interested in developing a "minimal" vocabulary of form that also had a "sensual" spatial quality.

The research question or proposition might be framed in relation to historical precedent. For example there may be a body of work and critique which articulates the qualities of minimalist architecture and the sensual qualities of architectural space. The precedent would however be reliant on a legacy of critical reflection which may have a qualitative consensus, but which may be difficult to quantify. How might we measure terms such as minimalist form or sensual architectural space? The terms are subjective and relative to particulars of time, place and culture.

Assuming that a clear question could be proposed based on an established critical consensus, how might we meet the second requirement - what methodology might be adapted to pursue such a design agenda? I am not aware of an international consensus on a methodology for pursuing the aesthetics of architectural form and space. There are obviously many ways to design and within architecture there are models of design but no current consensus on methodology. This is evidenced by the variety in foundation design programs between institutions and the often vague manner in which they are articulated. 2

If a "local" consensus could be reached as to an appropriate method for undertaking research into design aesthetics, how might the final IAR criteria be met? ie How would the outcomes of the research be defined as significant and what would be an acceptable presentation format? Given in this scenario we have proposed that the "question" would need to be related to accepted knowledge – in this fictitious example a consensus view as to what constitutes minimalist architecture and sensual space – would the research outcomes then be subject to critical review in order to be deemed significant. One would presume authoritative architectural critics would be required to view the design work in order to deliberate and proclaim as to whether the work "enhances understanding / knowledge within the research domain". One can only imagine the time it would take for a

consensus view between often competing critics over such subjective and loaded terms such as minimalist form and the sensuality of architectural space.

Compounding the problem is the question of what might constitute a suitable presentation and documentation format for architectural design critique. Unlike forms of art or science where medium and object are concurrent, architecture normally operates during the design stage with representations of the (architectural) object. These representations have traditionally been orthographic drawings (plans, sections and elevations) supplemented by parallel projections, perspective and physical models. In recent years computer generated simulations of buildings have been added to this range of simulacra. ³ In contrast domain knowledge – the large body of historical review and architectural criticism – is predominantly orientated to the end result of these representations, the realised building. Given the unlikely scenario of a researcher being able to commission design work there is a problem of evaluating architectural form and space generated as representations, against a domain knowledge generated from a critique of built form and space.

In summary, the scenario outlined above reveals some fundamental problems when the IAR guidelines are applied to design research categorised as aesthetic as opposed to design that has a technical agenda. In my view they are all related to the problem of "measure", in turn a legacy of empirical science.

The Legacy of Science in Architectural research.

The ease with which design research of a technological nature can fit the accepted guidelines for architectural research suggests an inherent bias towards architectural design defined as a science. Ranulphe Granville is one who articulates the bias in architectural design research, going so far as to pinpoint a seminal event in 1956 which set the concept of architecture as design science in motion.

When Design Research began, say in the 1960s, the eventual success of science was assumed. Already, at the notorious 1956 Oxford Conference, architectural education in the UK (and its sphere of influence) accepted architecture as a second class subject: ie. Science (in actuality, technology) was seen as so successful that everything should be scientific: the philosopher's stone! Architects (a significant subdivision of designers) were determined to become scientific. The syllabus was changed and design science was invented...Prime Minister Wilson and his Government declared the white heat of the technological revolution. ⁴

Out of this culture of scientific fervour emerged a way of designing - design methods. Literally a methodology for generating form and space, design methods was based on the premise of design as a series of questions / problems generated from the requirements of a functional program. These "problem sets" were mapped against site data (physical, environmental and sociological) and from this analysis the schematic plans were synthesised. These plan diagrams, which articulated functional zones, movement patterns and environmental responses, were rationally organised and extruded to form an unprecedented quantity of public buildings and large scale housing projects. During the 1960s and through into the 70s design methods ruled in both the academies and the profession - if an international consensus on a research methodology for architectural design ever existed it was during this period. Not surprisingly it probably would have been possible to define a design project in terms which would meet the current IAR research guidelines and be able to get international agreement on the significance of its advancement of design knowledge: Propositions might be framed in terms of scientific

criteria for design; a methodology could be adapted from science; while morphological, demographic and environmental data generated results which could then be used to determine the required "significant advance" in knowledge. Architectural design was measurable.

The definition of architecture as a design science is understandable in the culture of the 50s and 60s where on both sides of the Atlantic technological advances based on some very real scientific advances were transforming industry and culture. But as Granville goes on to point out

It did not matter that science as done was not as described in both scientific publications and in the philosophy of science or that the philosophers were debunking these understandings. 5

True to form, architecture, being a bit slow on the uptake jumps on the bandwagon of science at the point at which the wheels were about to slide into the muddy waters of fuzzy logic, chaos theory and continual attack from a range of critics and philosophers. While conveniently ignoring these attacks on the foundations of science, architects could not ignore the obvious (and measurable) social and physical failure of "design methods generated" projects.

While there may be outposts where design methods may still have some credibility there has been a gradual abandonment of this quasi-scientific approach to architectural design. During the 1980s models of studio pedagogy shifted from the analysis / synthesis approach described above to one of hypothesis / test. 6 Essentially an acceptance of the role of intuition in the formative design stages, in the hypothesis test model, "first moves" as to a design solution are articulated via sketches or conceptual models. These would be tested against functional program and physical criteria and re drawn in a cyclic trail of sketches and notes - the resultant design could be described as a mixture of intuition and rational appraisal.

However the legacy of design science is still omnipresent in both the terminology and the field of inquiry of the hypothesis / test model. The new "intuitive scientist" is now allowed to formulate ideas that are independent of hard data but what are the "test" criteria. Inevitably these are functional requirements and environmental concerns supplemented by a "poetic" response to urban morphology or landscape (often employing formal strategies such as axis and symmetry). In my view hypothesis / test are terms best left to secondary school experiments. As to the field of enquiry: this is still the design "program" defined in functional terms - intuitive moves but still measured against "hard" requirements such as floor area, heat gain, material cost or articulated as a "response" to site.

If the late 70s and early 1980s belonged to the poetic rationalism of hypothesis / test, the late 80s and 1990s will probably be remembered most for a "new spirit" in architecture as articulated by Peter Cook

Their architecture belongs to no school and it is not easily labelled, nor do their designs arise from a common sensibility. Rather the shared characteristic of the architects is a certain "spirit", a creative approach to form, composition and aesthetics. Although their work draws on a wide range of inspirations, it chooses not to fall back on historical or theoretical substantiation. It is by nature investigatory, demanding an understanding by eye and process, not by ideological position or category. 7

Written in 1991 this new spirit has swept from leading institutions in London and New York to invigorate architecture worldwide.

The reason for the potted history above is to recognize that for the last 30 years schools of architecture have used the design studios to press the boundaries of architecture beyond the legacy of architectural science. To the point where end of year exhibitions may rival the output from some fine art courses. In undergraduate programs and at masters level educators are setting design projects that explore thematic rather than functional or environmental issues. Often these themes have been adapted from current thinking in literature, film, computing, philosophy and the fine arts and are deliberately provocative. 8 Some educators argue that even at this undergraduate and masters level the architecture design project is a form of research that contributes to the disciplines knowledge base. 9 Further evidence for acceptance of undergraduate design as a form of research is the publication and subsequent dialogue on student work by leading academies and teachers. 10

The design project in the context of current professional practice is also championed as a form of research with arguments for "critical practice" eloquently presented by Peter Eisenman 11 and Diane Agrest. 12 These two are examples of the symbiotic relationship between academia and leading architectural practitioners. Both started as prominent theorist / teachers who, having tested and refined their ideas in the academic design studio, have gone on to produce buildings that operate as "texts" that extend the knowledge base of architecture. Symbiosis between university and practitioners operates across the disciplines but is exceptionally prevalent in architecture. One could argue that the undergraduate design studio has been the "ideas hothouse" that, certainly for the last 30 years has extended the knowledge base and field of enquiry of architectural design.

What is being inferred here is that the direction of the knowledge base for architectural design has moved well beyond the field of architectural science. This deviation from science is increasingly encouraged at undergraduate and Masters level and championed by leading practitioners worldwide. Given this situation one would hope that there may be some impact on doctoral studies in architecture. Perhaps there may be new programs or precedent via accepted thesis for non-technological design approaches. It was in search of precedent for such design-based research which prompted this survey of current doctoral research in architecture.

The Status of Architectural Design Research at Post Doctoral Level.

The current status of creative works (design) at doctoral level is evidenced by a review of dissertation abstracts – I have yet to find a completed PhD where non-technical design undertaken by the student forms the core activity. The primary vehicle for the search has been sources on the internet, in particular the University of Michigan (UMI) has an extensive database of dissertations. All architectural dissertations on the UMI during the period 1990-1999 have been examined to date (1,560 entries). 13 The majority of dissertations are from North American institutions although there is a significant listing from Europe and Australasia (average of 18%).

While the intention of the survey was to locate the status of design it also allows an overview of research activities in architecture in the last decade. The dissertations were categorised according to subject area as summarised below.

History / Theory / Criticism

52%

Built Environment / Cultural

15%

Technology

10%

Urban Design / Landscape

9%

Computing

6%

The remainder (3%) were spread across subject areas.

Dissertations which incorporated an aspect of design (as outlined above) occurred in 0.4%

When design by the author of a dissertation is incorporated it is usually in the form of an application of guidelines that have been generated by the bulk of the dissertation study. Typical examples are as follows: a design problem definition including specific design components; an optimisation model that incorporates the structural design goals of efficiency, economy, utility and elegance; a housing development plan for 9,000 inhabitants based on a study of traditional hot climate building typology. These examples illustrate the three types of "peripheral" design activity found in the survey (a) Formulation of functional design programs articulated as "problems". (b) Technical performance of building components. (c) Development of building typology (often based on traditional precedent). The design of briefing documents, new technology, or adaptation of historic typology is "peripheral" in that it is contributing to a knowledge base from which creative works in architecture may be designed ie. "tools" to enable design, technique as opposed to content.

This UMI data base search was supplemented by direct requests to institutions and a placement on the ARRC list server outlining the survey. Informal replies to direct queries and the request for "leads/informed comment" also underlined the emphasis on scientific method and the lack of creative works at doctorate level. Three examples will suffice.

In general, I think there has been an increase in the ambiguity of meaning behind a Ph.D. degree. I think the original meaning was that a Ph.D. was bestowed to those that demonstrated they were capable of contributing to the scientific advancement of knowledge. 14

I think it is unlikely that you will find an architectural Ph.D. program that allows the author's creative work to be the major focus. The doctoral projects that I have seen have been controlled studies in which variables are identified and qualitative or quantitative information is analysed. 15

It is a bit surprising when you think about it. You can get a Ph.D. analysing and researching works of literature, and architecture but you cannot obtain a Ph.D. for creating the works. 16

However at late notice one positive piece of information was received and that is the establishment of a new PHD by design at the Bartlett School of Architecture at University College London.

The program allows especially able and reflective designers working within the Bartlett's experimental ethos to continue their research to an advanced level. The submission for the

PhD is a project portfolio and a text, which must share an agenda but may explore it in distinct ways. The text, a maximum of 60,000 words, and the project portfolio are given equal value. 17

Due to the late arrival of this information the Bartlett initiative is unable to be discussed at length here. As the first PhD is due to be examined in early June and it is hoped that further information will be available for presentation at the conference.

Issues:

In summary key points to emerge from this paper are:

1 The legacy of empirical science inherent in current research guidelines.

2 Current internationally accepted guidelines for research in architecture are difficult to apply to aesthetic / spatial design, hence perhaps a lack of precedent for design of a non-technical nature at doctoral level.

3 In architectural design, there is a substantial anomaly between PhD programs and undergraduate / masters degrees where the direction of the knowledge base for architectural design has moved well beyond the field of science.

Among many issues to consider are:

Local / Global

What is an internationally credible methodology that is relevant to the domain?

Does there have to be international consensus or will the design project as the container for research develop locally (as the Bartlett initiative suggests) around relevant institutions?

Virtual / Built

Problems of "documentation" for architecture – domain knowledge is based primarily on built form while design operates on representations.

Technology / Aesthetics

What is the relationship between technology and architectural aesthetics? Research into technology may allow a new aesthetic or, conversely, technological advances may be driven by a desire for a particular aesthetic... might not design at this level incorporate both technology and aesthetics.

Post Script: A research design agenda utilising advances in digital technology

The above issues will be informally discussed in relation to a personal design agenda based on current research into the relationship between technologies of representation and the generation of architectural form. This has been explored via a forthcoming publication, the abstract of which is included below.

It has been argued in a recent text by Robin Evans (Evans 1995) that developments in drawing technique have both enabled and constrained the historical direction of architecture. Robin Evans summarises his argument on this relationship between drawing and architecture by way of a diagram "The projective Cast" which presents architectural activity as a tetrahedron. The four nodes- orthographic projection, perspective, observer and designed object make explicit the schism between architectural representation and the realised building. In Evan's words "design is action at a distance". This paper describes recent computer based procedures - emergent form, immersive editing and computer aided construction - that have the potential to allow a substantial reworking of Evan's thesis. It is suggested here that the implementation of these processes allow the nodes of Evans diagram to dissolve and the distinction between designer, digital model and realised project is blurred. Perhaps to the extent that the designer crafts the realised building as opposed to "action at a distance" via drawing. 18

This paper outlines a research agenda. Rather than explore these ideas further via critical reflection on the work of others the intention of the author is to "test" the central proposition - that computers enable the collapsing of "action at a distance" - via a series of architectural projects.

Endnotes

- 1 <http://www.architectureresearch.org/about/characteristics.html> 26.05.2000
- 2 For an example see: Pearce, M. and Toy, M. *Educating Architects* London : Academy Editions, 1995
- 3 Digital representaiton has had a signiicantimpact on architecture. I discuss this at length in: Moloney, J. "Digital Craft", *Architectural Science: Past, Present and Future*. Proceedings of the 32nd Annual Conference of the Australia and New Zealand Architectural Science Association, Victoria School of Architecture, Wellington 1998. pp 289 – 294
- 4 Glanville, R. "Researching design and designing research." *Design Issues*. v. 15 no2, Summer 1999, p. 80.
- 5 *ibid*, p. 80.
- 6 See Ledewitz S., "Models of Design in Studio Teaching", *J.A.E.* 38/2 (1985) 2-8
- 7 Cook, P. and Llewellyn-Jones, R. *New Spirit in Architecture* New York: Rizzoli 1991 preface
- 8 For an example of design program as provocative pedagogy see Rhowbotham, K. *Form to Program* London: Black Dog 1995
- 9 Teymur, N. *Architectural Education: Issues in educational practice and policy*, London: Question press, 1992.
- 10 Prominent schools of Architecture have a long tradition of publishing design studio projects. See for example the Architecture Association (London) publications AA Files.

11 Eisenman, P. in Heyduk, J. (ed) Education of an Architect New York: Rizzoli 1988 pp 190-193

12 Agrest, D. Architecture from Without Cambridge, Mass.: MIT 1991

13 The UMI data base has been used as a source for such analysis of architectural dissertations See a discussion paper by Richard H. Schneider at <http://www.polaris.net/~arcc/web/rmrdoc.htm> 26.05 2000

14 Email correspondence with Chuck Eastman Professor, Colleges of Architecture and Computing, Georgia Institute of Technology 09.05.2000

15 Email correspondence with Nancy Yen-wen Cheng, AIA Department of Architecture University of Oregon 29.04.2000

16 Email correspondence with Thomas Seebohm, Ph.D. Associate Professor of Architecture Faculty of Environmental Studies University of Waterloo 05.05.2000

17 Email correspondence with Jonathan Hill. Senior Lecturer in Architecture, the Bartlett School of Architecture University College London 11.05.2000

18 Moloney, J. "Collapsing the Tetrahedron: Architectural History and Geometry" Forthcoming in: Proceedings of 15th Conference on Computers and the History of Art, Glasgow 1999

Most institutions teach design via the practice of design studio which is in effect a master / apprentice model. The studio master may be required to follow a school curriculum but the methodology used will vary accordingly and often be deliberately explorative and experimental.

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