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INNOVATION IN HIGH-LEVEL CAPTURE AND DIFFUSION OF TACIT ARCHITECTURAL KNOWLEDGE

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Abstract

This paper focusses on an 'Embedded Doctoral Design Program' (EDDP), comprising a cohort of design PhD candidates who are 'embedded' outside the university for a substantial part of their candidature. Specifically, the paper details the framework and outcome for Australian doctoral candidates in architecture placed in contexts outside their experience and immediate expertise, and outside the traditional academic research setting.

These contexts can be drawn potentially from professional practice, industry and commerce; in associated areas of interest as diverse as planning, property, construction, civil and infrastructure engineering, ecology, manufacturers, financial institutions and communication companies. They could also be placed within local government, NGO and NFP project teams involving community health, political science and policy definition, social science and anthropology, and even cultural sectors such as museums.

1. Background

The purposes of this arrangement are fourfold:

1. Firstly, to accustom doctoral architectural researchers to work *inside* rather than *for* the client organisations who, more typically, commission consultants rather than university-based collaborators;
2. Secondly, to afford the partner organisation (PO) a participatory role within the academic process rather than the relationship merely being circumstantial;
3. Thirdly, by cross-referral within the program's cohorts, a transdisciplinary architectural research framework emerges that enriches both doctoral candidates and their external POs for possible future extensions to the projects into unanticipated realms;
4. Fourthly, there are significant opportunities to promote both the home university department's evolving expertise as it emerges through its application within individual projects thereby offering uniquely effective transformative working approaches in situations that would otherwise appear to be too challenging to risk taking-on.

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While enrolled as individual doctoral candidates within both their wider cohort of university associates as well as within their respective partner organisations, they are working on identified built environment research challenges. In this way, the candidates are collectively constrained to a single directed research meta-challenge – ‘directed research’ as opposed to ‘free-ranging candidate-directed research’, the more typical in design-focused doctoral programs.

This type of doctoral program, *directed research embedded in practice*, is designed to seed and develop significant new relationships with partner organisations leading to long-term ongoing research relationships, ultimately generating sufficient critical mass for a self-sustaining model to evolve. This paper reports on a first foray into ‘embedded practice’ through a cohort of 4 Australian architecture PhD candidates, and is posited as being a viable model for other countries to consider adopting.

2. PhD or a ‘Doctor of Architecture’?

New ways of thinking about the architectural doctorate offer productive and intellectual clarity to a difficult nexus: the interrelationships between design practice, design research, and design teaching and learning. Established first in 2004, Embedded Design Practice has proved to be a highly innovative move for the design sector in international terms, yet as an alternative structure to conducting doctoral research – embedding the doctoral candidate within architectural practice, it takes as its model the highly successful interrelationship between the medical research institute on the one hand, and the hospital: the premier site for the intersection of medical science and research, medical practice and, as a direct consequence, problem-based clinical learning.

Despite the similarities between the professions of architecture and medicine (guild origins, restrictive practice, protected professional skills), the singularity and individuality of design compared with the common purpose of medicine accounts for medical research’s relative success, and the laggard fragmented nature of design research in comparison: in design research the common purpose is easily identified, but a common pathway is not. Heart operations have similar goals and desired outcomes *inter alia*, buildings tend not to be as clearly defined.

Architecture, the design profession with the longest association with universities, has nevertheless had only the briefest of associations with academic life when compared with medicine, for instance. The oldest university departments of architecture emerged only in the 19th Century largely through the complexities borne from the Industrial Revolution leading to the birth of professional bodies with conforming examinations. In contrast, the oldest university-based medical schools in Europe, for instance, were founded in Italy in the 12th Century. Why is there such a difference in maturity between two intellectual disciplines operating pre-professionally since at least the ancient Egyptians, and what are the implications for the global built environment today? Why should it matter?

Whereas medical training has been deeply centred as a university based degree or within a hospital school of medicine with university status, skill acquisition in architecture has been inculcated via a much wider range of options. From prosaic apprenticeship within practice with day-release to centres of higher education, options also included diploma programs at technical colleges and, only from the end of the 19th Century, university degree courses. There was nothing specific to architecture that has demanded that it should necessarily have university degree status, but this has changed in recent decades as the architect's repertoire, the introduction of project management, the increasing sophistication of builder's techniques, and the evermore challenging circumstances of climate change and overcrowded cities have dramatically evolved in complexity and possibility. History has repeated itself it seems.

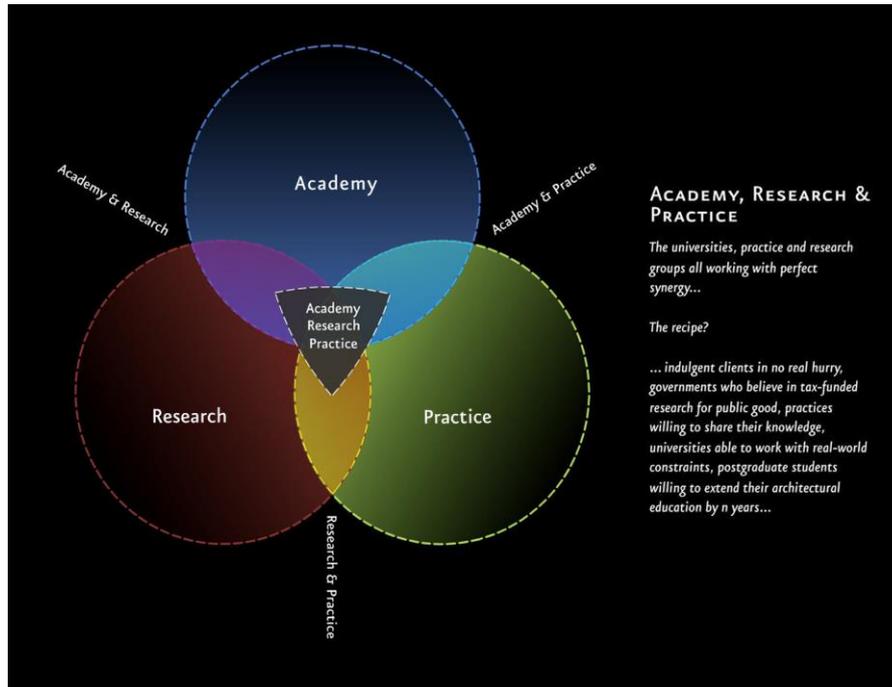
The ambivalence about the status of architecture as a university discipline has therefore been matched by an ambivalence in how best to train architects leading to a relationship between architectural practices and places of learning that lack clarity. It is not uncommon for practices to claim that the real learning takes place when the student is actually working in the office (apprenticeship model) – based on a view that the typical offerings of the universities' schools of architecture are too theoretical for a fundamentally practical discipline. When architects were first chartered through a university education in the UK, the Royal Institute of British Architects presumed that all teachers of architecture would themselves be practicing architects. This is no longer the case.

With the new challenges of need and greater opportunity through emerging building and communications technology, the design professions are approximating the medical professions; not least with the sudden elevation of the role of research becoming more conspicuously part of the design professional's activity. It is therefore timely to look at the role of professional research for the designer through comparison with the articulation of the trainee doctor to their clinical role within hospitals' workforces. Trainee doctors are explicitly embedded in sites of medical practice where they research firstly as interns with pathways towards research fellowships in ways that trainee designers typically are unable to access.

In the case study upon which this paper is based, some of Australia's most distinguished architectural practices partnered with RMIT University's Architecture and Design school in such a way as to 'embed' early career post professional postgraduate architects of all ages and experience within both the university and the practices treating both locations as sites of significant design research — the practices redefined as 'living laboratories'. In doing so, design research at the highest level is elevated from being an implicit activity to an explicit activity.

This novel flux between the universities and practices describes a two-way bidirectional co-dependence and co-production rather than the one-way unilateral relationship that has hitherto impeded meaningful research *through* design (as opposed to research *about* design or research *for* design). Going beyond the simple binary of practice and teaching by introducing research into the mix, the difficult nexus between these three dimensions can be given far greater clarity through the trilateral diffusion of knowledge properly instituted through embedding academic research within design practices.

Figure 1. Academy, research and practice relationship



Source: Autor.

3. What makes design research so different?

Design’s difficulty in being accommodated by the mainstream research community comes from the difficulty in defining design with comprehensive and universal agreement, be it amongst designers themselves, commissioners of design, key stakeholders, and end users.

Design was first identified as belonging to a class of wicked problems by Horst Rittel (1973). Wicked problems can be characterised as problems which tend to spawn new problems in their solving, and more than one viable option as an ‘answer’, not necessarily clear cut nor unequivocal all the same.

Figure 2. ‘Wicked problems’ versus ‘tame problems’



Source: Dominik Holzer.

Six principal characteristics of wicked problems have been defined by Jeffrey Conklin (after Rittel's original 10) as the following:

1. You don't understand the problem until you have developed a solution;
2. Wicked problems have no stopping rule;
3. Solutions to wicked problems are not right or wrong, simply better, worse, good enough, or not good enough;
4. Every wicked problem is essentially unique and novel;
5. Every solution to a wicked problem is a "one-shot operation"; and
6. Wicked problems have no given alternative solutions

All six characteristics have helped thwart tidy research funding processes which have been more oriented to that other class of problem identified first by Rittel as benign or tame problems, which have a well-defined and stable problem statement, definite stopping points - i.e. a solution, have a solution which can be objectively evaluated as being right or wrong, belong to a class of similar problems solved in similar ways, and have solutions easily tested and discounted, probably from a limited set of possible solutions.

Research *through* design or research *by* design invokes the following argument: research as understood in sciences is not the only source of reliable knowledge. Design as a process produces personal knowing as the essential precursor to what subsequently becomes collective knowledge. Such knowledge is different, not inferior but nevertheless different to that produced by the processes employed in sciences. It has characteristics in common with other knowledges and the distinct character of being embodied in the process of designing itself. This renders it hard to examine other than via the self-interrogation of designers and their collective interrogation by their peers.

The tacit knowledge produced in design is stored, transmitted and learnt through canonical works [possibly in a mimetic manner] such that design knowledge leads creatively to more design knowledge. Design research is the activity undertaken in designing – it is not the product of library activity.

There are several academic programs internationally that contend that research can be, and is, conducted *through* designing, and that the process of designing, as a means of increasing knowledge, parallels research in other areas in interesting ways. There exists a designedly way of thinking and communicating that is different from scientific and scholarly ways of thinking and communicating, yet is as powerful as scientific and scholarly methods of enquiry when applied to its own kinds of problems – wicked problems. Design research knowledge is integrated in the doing or making, social relations, and expertise of communities of practice. The processes of learning and membership in these communities of practice are inseparable. Knowledge is inseparable from practice. In design, it is not possible to *know* without *doing*.

4. Postgraduate life-long learning through research: three models for three career stages

The core purpose of the Embedded Doctoral Design Practice model is to offer a new type of postgraduate outcome. This model contrasts with the traditional PhD where design postgraduates are located in university schools and departments where typically they conduct research *about* design. They are so remote from practice that they are far more inclined to look at design research in isolation of the day-to-day context in which the research might be applied. This is not to say that research on this basis is redundant; rather it is unlikely to produce dividends commensurate with the expended effort. Put another way, the problems that routinely challenge practitioners are unlikely to find their way to the academy through this route – and classic research leading to books, papers, and conferences is equally unlikely to reach design practitioners. A cycle of academic researchers informing undergraduate design students through their university-based research can inadvertently spawn a cycle of irrelevance reinforcing a practice complaint that bright student designers are not necessarily honing their skills in areas of principal concern.

University researchers can similarly accuse practice of being too inclined to reinforce the *status quo* and not devote sufficient time, energy and resources in developing and applying new knowledge to their practice. RMIT University's School of Architecture and Design in Melbourne is an exception and has been experimenting with alternative modes of postgraduate design research for over 25 years. As a comprehensive strategy for PhD candidates of any age minded to devote 3+ years to doctoral study around their practice, embedded practice builds on RMIT's broader postgraduate experiments by adding to the established distinctive postgraduate research programs aimed at different groups of professional designers and alternative ranges of experience: emerging practitioners, mid-career practitioners - established and renowned practitioners with twenty plus years of experience (the RMIT 'PRS' cohort), and retiring practitioners.

These three postgraduate programs could be respectively entitled *Embedded Practice* (reported on here), *PhD by Project* (referred to here)², and *PhD by Publication* (also referred to here). In shifting from research *about* design to research *through* design, these programs compel postgraduates to confront the application context, addressing problems of inadequate knowledge diffusion between design practices, and between the practices and the academy.

During the past six decades, design practice has shifted substantially. Contemporary design is primarily the product of complex interactions between teams of people from diverse disciplines. Commercial demands and time pressures often leave little space for innovation. Thus, most innovation within design practice happens at the margins: it occurs within the handful of practices that are large enough to support significant research, none of which are based in Australia. An embedded cohort undertaking design research has an important part to play in creating a substantially enhanced innovation environment in which all scales of venturesome practice can engage using the academy as its hub in promoting enhanced design environments

² Info on RMIT's program.

that will benefit the quality of life for all Australians and grow our cultural capital. Therefore, the critical aspect of the enrichment of practice through research is a scholarship environment that suits all ranges of experience.

5. Embedded practice for early career architects

Ideal candidates are early career practitioner researchers who have had 3-5 years of professional experience, and who have identified a clear career path in practice-based research valuing the opportunity of a PhD to enrich their journey. At the completion of a design degree, high achieving students are motivated to continue to design in ways that challenge current discipline boundaries. Lacking the opportunity to pursue research through design in conventional architectural practice, however, these students choose 'venturous' practice linked to higher education doctoral degree programs. The embedded practice model addresses this challenge by extending the PhD into applied design research pathways suited to high achieving graduates and established designers with track records established in venturous practice thereby building diverse research teams that ground design research in design practice.

6. PhD by Publication for 'sunset' practitioners

The *PhD by Publication* suits peak-of-career and retiring practitioners who wish to undertake a PhD by Publication as a means to re-interpret their life's work critically through assisted reflection. Their motivation is not only to enrich personal perspectives of several decades of contribution to the built environment; but to execute a wider critical review openly in a way that offers the most not only to themselves, but to peers and students alike. The PhD by Publication is aimed at designers who have had at least 35 years in practice since graduating, whose careers have reached a point of critical acclaim with their peers and who desire a return to the university where they can critically examine their career's work. They would do this with a view to identifying both the strengths that have led to their successes as well as weaknesses that they have observed themselves - or at least the obstacles that have thwarted their ambitions: the extent to which they were able to accommodate the obstacles, if not surmount them. Mature candidates such as these can seek a fresh set of insights that universities can uniquely provide them with, providing both the public spaces and the community of scholars to support the intellectual unpacking of significant careers.

7. Yielding excellent and innovative design research

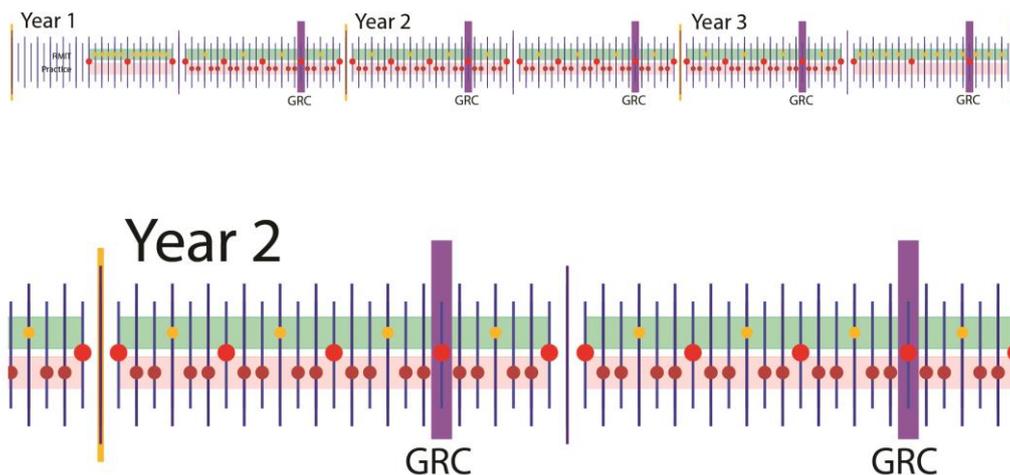
These are innovative pathways to the take-up and utilization of postgraduate level research outputs. The first, EDDP, is through the distillation of innovative contemporary design practice through doctoral research at three levels. Early career researchers undertake their PhDs embedded in design practices for 90% of their study. This affords a novel direct conduit between the academy and the practices involved. New discoveries at the level of the university have new pathways to the sites of their usefulness. Close to retirement career practitioners with

high levels of peer esteem through awards and publication have the opportunity to be candidates in an innovative doctoral research mode: PhD by Publication (where the buildings are seen as the publications). By embedding themselves for part of their working week within the university, they undertake their research through *guided reflection* at the academy: the premier site for independent critical enquiry surrounded by their peers, their academic colleagues, and the future designers who form the undergraduate community. These models require fine-tuning to be sufficiently agile to match the realities of practice and the variety of international contexts that architects work in, in order to help counter the tradition of lengthy tomes gathering dust in forgotten parts of the library, the fate of many worthy PhDs by Thesis in the architectural realm.

Associated with the primary activity of doctoral research are the two pathways for wider dissemination and take-up: peer review and exhibition, exegesis and presentation. Both the PhD modes described above (Embedded and By Publication) are conducted in an open forum – both at the site of professional practice and practitioners situating themselves at the academy. As part of their study, they must reveal their work and their working for expert scrutiny at a minimum of two annual public peer reviews consisting of a panel drawn from local and overseas experts ('critics'), and a critical public audience.

Exhibition, exegesis and presentation, are exactly that, and differ from the 'classic thesis' in that they are responses to the visual research culture that design practice represents. All three are excellent means through which to engage a wider audience for critical interaction beyond the formality of the GRC peer reviews. This extended audience includes other design experts, colleagues from other universities, interested parties from the Government, local authorities, related industries, concerned individuals, and the general public.

Figure 4. **Periods**



8. Concluding remarks

The models described above can offer an especially appropriate path to utilisation in this period of rapidly advancing design practice. On the one hand, we have a new model for practice engagement and, on the other, a new model for knowledge diffusion. These models allow periods of professional development to be mapped into entry points in design scholarship. They can form two sides of the same coin in a freely exchanged Creative Commons currency that both supports and advances digital practice. Design corpora can be activated as a vital literature and, in turn, lead to better design.

The embedded practice model seeks to capture tacit knowledge from the industry. Early career practitioner researchers embedded in design practices are put in a position to capture such knowledge and inform the future of architectural practice, both from within practices and by their contribution to architectural scholarship. The research findings of past PhD candidates have had an enduring relevance within practices, and have encouraged new methods of working. An example of this is the uptake in one practice of the use of digital media tools to make and manipulate multiple iterations in stages of design. (Benton, 2008) Another is the uptake of digital design techniques by a smaller practice, such as employing parametric and computational based approaches tailored specifically to small practice, that increase the scale and capacity of the work they are capable of undertaking. (Hyde, 2010) The findings of past PhD candidates have been introduced progressively into undergraduate teaching through studio and technical teaching by the candidates and the practitioners they work with. The innovative approaches developed by past candidates have also been disseminated widely through numerous presentations to a broader community of architectural and engineering practices, as well as to planning and council authorities.

The techniques developed through embedded practice can be appropriately coupled with the retrospective insights and lessons generated by late-career 'sunset' practitioners unpacking the varied obstacles and successes of long careers through the PhD by Publication model. The broader result of these models will be to protect Australian expertise and develop greater resilience in the design industry, which is demonstrably affected by business cycles.

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