

## CROW'S QUIZZICAL EYE: DESIGNING YOUR DESIGNING

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### ABSTRACT

*A kind of personal manifesto on design thinking, this paper considers four interlaced ingredients:*

- *that designers are Future Curious and pro-active (following Clemens Steenbergen), using thinking focused differently from science and the humanities on different fields, with different methods and values (following Nigel Cross);*
- *that the fields and focuses of designers' thinking are constructed within Frames (of reference), arguing with and through Philip Plowright, Sir Henry Wotton, art history and Asian landscape and aesthetic traditions, noting, also, work of Carolin Stapenhorst, Klaus Krippendorf and Christian Norberg-Schulz;*
- *that, within continuously negotiated Frames (and their nested layers), following Kate Tregloan, the impulse a personal design epiphany provides is a product of its significance and the progress it engenders and that designers can prepare themselves to have design epiphanies both about an ongoing design and about their own designing practices,*
- *particularly through deliberative reflective thinking, at three levels: making design conjectures, choosing design approaches and methods and, ultimately, designing their own designing.*
- *In this paper, I am concerned with the nature of both design and designing and how what might be called 'mature' designers take charge of their own acts of designing, becoming Masters.*

**Keywords:** *Design Thinking, Designers' Frames of Reference, Design Epiphany, Reflective Thinking*

### INTRODUCTION

My underlying belief is that if you know how you design, you can choose what to strengthen, what to boost, or even what to treat in an absolutely standard but adequate way because you find it uninteresting. And, to do that, you need to be aware of your own frames of reference, of your own design approaches and where you as a designer naturally find useful concepts. This is part of mastering your own

designing. As a designer, mastery of yourself entails being able to control your designing. And, to do that requires ...

1. Taking charge of your own education
2. Managing your investments in learning
3. Actively learning from others' experience
4. Making cases for your proposals, and
5. Reflective and Deliberative Thinking.

In this paper, I am concerned with the nature of both design and designing and how what might be called 'mature' designers take charge of their own acts of designing, becoming Masters.

The Ingredients of this discussion include ...

Future Curious  
Frames  
Epiphany, and  
Reflective Thinking.

Future Curious has to do with how designers differ from, say, scientists in being far more concerned with the future than with the past. A motto derived from words of Clemens Steenbergen and Wouter Rout and observations by Nigel Cross are discussed: the Frame within which designers work is orientated toward the man-made rather than the natural or human behavioural realms, designers' methods are modelling, pattern-forming and synthesis and their values entail a concern for appropriateness.

Frames are the over-arching structures of thought under which we engage with creative work or, more broadly, with any thinking. Frames frame our thoughts, one could say. Not in detail, but in terms of limits, bones, key themes, approaches and methods, judgements of success and so on. Philip Plowright's account of three Frames dominant in architectural design since the Renaissance is canvassed and found to omit reference to current concerns for affect and people's experiences of space (or the 'phenomenological'). Art history's account of successive Frames oscillating between Apollonian and Dionysian poles is noted, together with Sir Henry Wotton's version of the Vitruvian triumvirate (and a more recent version of that). These three Western systems of Frames (synchronic, diachronic and holistic, respectively) manage to avoid granting Locality, siting, particular primary significance in determining architectural design. That is not true of some Eastern Frames. Nature as model and measure is characteristic of Chinese, Korean and Japanese garden design traditions, for example. And, there is the additional Frame associated with Chinese aesthetics, more generally, that requires an artist to place their work within the synchronic and diachronic dimensions of cultural tradition simultaneously.

Frames are nested structures, involving decisions at a number of super-imposed levels and scales. This is true, also, of a Frame where the determinants of a design outcome are the task, the site and the designer in layered contexts. Kate

Tregloan's account of Design Epiphany was developed within the model of designing that sees designing as a negotiation between two realms, that of a Framed task and that of a proposal, both of which are incrementally modified in an evolving process until a satisfactory pairing is achieved. Tregloan's account sees the impulse provided toward a successful proposal as a function and measure of a Design Epiphany. Further, she identifies a number of kinds of Design Epiphany and a set of attributes of designers prepared to have Epiphanies. Key attributes include reflective thinking, with designers knowing themselves and their preferred approaches and methods as designers.

Reflective thinking is at the core of meta-cognitive levels associated with Meta-designing. Donald Schön's model of reflective thinking as a designer is unfolded from its focus on present activity both in its implicit analytic dimension (regarding immediate past activities) and in its proactive and evaluative, future-orientated dimension (its design thinking dimension) over the three levels of task-orientated, reflective and reflexive thinking. Future-orientated design thinking is described across the three associated levels: making Design Conjectures, Choosing Design Approaches and Methods and Designing Your Designing. Finally, the activities entailed in Designing Your Designing at the level of nested Frames, Design Approaches and Methods and Design Conjectures are set out in brief. I will start out by discussing the ingredients in the order listed, above, but, like braids, each recurs and appears both earlier (if inexplicitly) and later.

## RESULT AND DISCUSSION

### Future Curious

#### *Curiosity versus Knowledge*

When in 2007, my then colleague, Kate Tregloan, and I sat down to design a new first year design subject as part of the Bachelor of Environments, one of the University of Melbourne's New Generation undergraduate degrees, including five Majors from our own Faculty (Architecture, Building and Planning), three from Engineering, two from Science and three from Land and Environment (Tregloan and Missingham, 2010), we adopted as a motto, the following ...

Designers are driven  
not  
by their Knowledge  
but  
by their Curiosity.

**Figure 1.** Motto for *Designing Environments*

Source: Modified from Steenbergen and Router (2003: 16)

Tregloan then noted a series of important differences between Knowledge and Curiosity implicit in the motto ...

<b>KNOWLEDGE</b>	<b>CURIOSITY</b>
Is to do with <i>what is</i>	Is to do with <i>what if?</i>
Is already defined	Is about what is <i>not yet understood</i>
By <i>others</i>	Driven by <i>the self</i>
Provides <i>safety</i>	Entails <i>risk</i>
And is rooted in the <i>Past</i> .	And is <i>Future-orientated</i> .

**Figure 2.** Knowledge versus Curiosity

Source: Author (2017)

Now retired, former long-time professor of design at the Open University, Nigel Cross (2007), in admittedly shorthand, rhetorical form, argued that the three cultures of Science, the Humanities and Design differed in a number of substantive and telling ways, but particularly in terms of the phenomena they study, the appropriate methods of inquiry and the values held by each.

According to Cross, the Sciences study the natural world, the Humanities essentially study people and Design studies the artificial. In this, Cross was following the Nobel-winning economist, Herbert Simon (1969), who famously argued that design was a ‘science of the artificial’.

Here, each culture is studying a field of phenomena at the same time as it is focused on particular parts of it. Even if we can gloss the ‘artificial’ as the *man-made* or *that-which-is-the-result-of-human-endeavour*, it’s quite easy to disagree with this characterisation because Design is not passive observation. As Tregloan noted, design is future-orientated. In short, scientists study what is, the humanities study what people do and think but, if you want to change the world, then become a Designer!

Next, Cross argued that, in the Sciences, controlled experiment, classification and analysis are its appropriate modes of inquiry, where analogy, metaphor and evaluation are the appropriate methods in the Humanities and modelling, pattern-formation and synthesis in Design. Finally, Cross said that the values of Science are objectivity, rationality, neutrality and a concern for ‘truth’, those of the Humanities subjectivity, imagination, commitment and a concern for ‘justice’ and those of Design practicality, ingenuity, empathy and a concern for ‘appropriateness’. This, of course, raises the question of what might be meant by ‘appropriateness’. The answer will be largely determined by the Frame.

## Framing Designing

interactively, we *name* the things to which we will attend and we *frame* the context in which we will attend to them.

(Schön, 1983: 40)

The idea of a 'frame of reference' is important in numerous intellectual fields: sociology, artificial intelligence, anthropology, philosophy and the history and philosophy of science, at least, often using other terms and not covering exactly the same referents. The traditional way in which the history of art is taught as a succession of stylistic periods is itself founded on the idea of periodic successions of governing ideas or frames of reference. Here, for simplicity, I'll use the term 'Frame'. And, following Cross, we have ...

### **FIELD / FOCUS + METHODS + VALUES >> FRAME.**

**Figure 3.** Elements of a Frame

Source: Author (2017)

Within our context, I begin with two quotes ...

I think that the richer the associational resonance, the richer the possible interpretations and the richer their inter-layerings the better the work of architecture. Further, I think that the richer the possible experience, the richer the possible uses and the more the modes of appropriation invited the better the work. That work is best that simultaneously achieves these ends with the greatest economy of means – that is, it exhibits maximum richness, maximum subtlety and maximum mnemonic resonance with the minimum of architectonic means.

Missingham (1987: 84).

A consequential project both connects to generationally shared set of social, political, and cultural desires, which exceeds authorship, and at the same time develops within the practice as a sustained set of material, organizational and formal interests that connect across time, at disparate scales, programs and sites, and with a particular authorial stamp.

Reiser and Umemoto (2017, from publicity for a lecture at the University of Melbourne)

In the first quote, writing about Jane Davies' student design thesis project, my first sentence focuses on building form, even iconography. The second sentence

concerns people's experience and their adoption of a built facility and the third concerns resource parsimony. In short, I am appealing to something like the Vitruvian triumvirate (if not in the usual order): delight, commodity and firmness. The second quote, thirty years later, couches a similar trio (together with noting 'sites') within three social dimensions: of shared community values, of organisational values and of artistic signature. Both sets of remarks expose the authors' Frames of Reference for thinking about architectural design. All statements of what makes good architecture do this.

### **Designers' Frames of Reference**

Philip Plowright (2014) claimed that the history of architectural design has been dominated by three Frames:

- 1 Patterns
- 2 Resolution of Forces, and
- 3 Concepts.

Architects whose designs are Framed as *Patterns* are fundamentally interested in shape, both of buildings as a whole and as two-dimensional diagrams in plan, as types, or as surfaces. Historically, we can think of Palladio with his interest in proportion and the harmony of the spheres, of Le Corbusier and his Modulor and of Dom Hans van der Laan and the elegant, perception-based proportion system he used in designing a number of Dominican monasteries and nunneries (Van Der Laan, 1983, Voet et al, 2016). More recently, we can think of Frank Gehry or Zaha Hadid. Plowright's own examples include Durand, Raphael Moneo and Aldo Rossi (Plowright, 2014: 39-40).

Architects whose designs can best be understood as Framed as *Resolution of Forces* include the designers of the building I work in, the Melbourne School of Design: John Wardle and Nader Tehrani (Clark, 2016). But, the most influential relatively recent body of work in this vein is that of Christopher Alexander and the Center for Environmental Structure at the University of California, Berkeley, on patterns and pattern language (Alexander et al, 1977). Plowright's own examples include Viollet-le-Duc, Frank Lloyd Wright, Foreign Office Architects, BIG and MVRVD (Plowright, 2014: 40-44).

Architects whose designs are Framed as *Concepts* are now too numerous to cite but, though commonly thought of as a formalist (Patterns), Peter Eisenman has the longest recent history of driving his designs by Concept. (Eisenman, 2004, Eisenman Architects, 2002) Rem Koolhaas and Bernard Tschumi are also prominent, particularly with students. (Office of Metropolitan Architecture, R. Koolhaas and B. Mau, 1998; Tschumi, 1994, Migayrou, 2014) Plowright provides

no examples (2014: 44-47). A dominant, cognate Frame in Melbourne architecture is that of *Architecture as a Cultural Practice*, with Peter Corrigan as its late champion (Haman 2012).

Supposing we grant Plowright's view that there are dominant Frames in architectural design, then the contemporary reaction to computer-supported design thinking in architecture (as with parametrics) is a fourth Frame which we could refer to as *Affect*. It is usually referred to as *Phenomenology* or *Psychogeography*, concerned with people's experience of the built environment, particularly with interior experience and emotional effects (Norberg-Schulz, 1971, 1980, 2000, and Coverley, 2010). Robert McCarter (2016) argues both that the very reason we have architecture is to support interior experience and that most human experience is of interiority. For the Frame *Affect*, everybody's contemporary champion architect is Peter Zumthor, but we could equally fondly think of the Baroque architects Bernini, Guarini, Fischer von Erlach and Zimmerman or the Ottoman Sinan.

### **Carolin Stapenhorst on Concepts**

In Carolin Stapenhorst's recent book (2016), she identifies three primary senses of the term 'Concept' as it is used in architectural discourse and provides each with a Chapter:

CONCEPT as Repository of Rules, Strategies and Criteria

CONCEPT as Generator and Communicator

CONCEPT as Explorer of Non-architectural Knowledge.

There are two other senses of "concept" in Stapenhorst's book to which she doesn't draw the same attention:

CONCEPT as Result of and Guideline for an Ideational Process, and

CONCEPTual use of Architectural References (= precedents).

The first sense is that often taught as the 'Governing Idea', which is then to be used in the second and fourth senses, ideally.

### **Krippendorf's Semantic Turn**

In his 2006 book, *The Semantic Turn*, Klaus Krippendorf argues, essentially, that designers are working in a *semantic ecology*, that the act of designing is an interpretative one, that designs themselves both are constructed as meaningful entities, as complexes of affordances inviting interpretation and use and, when manifest in the wider world (outside the office, factory or school) are subject to interpretation in terms of their status, function, merit and aesthetics. Designs are laden with meaning and enter an ecology of meaning and values in the very nature

of being human artefacts, and they are not evaluated, in practice, through people's ordinary engagement with them primarily on technological grounds but on essentially semantic and emotional ones. I put it like this (Missingam and Selenitsch, 2002: 10 of 18):

most artefacts are only partial manifestations of the designed entities that are inextricably associated with particular sets of ideas

Krippendorf raises Plowright's Frame of *Concepts* to being *the* Frame. In this so-called Age of Information, I don't think that we should be surprised by these developments.

### **Frames of Reference in Western Architectural Thinking**

Plowright's is a *synchronic* account of Frames of Reference in architectural design, concerned primarily with identifying and cataloguing key examples of Patterns. Art historians will be more familiar with a *diachronic* account, concerned with changes over time, often built around the idea of reactionary periods successively transcending each other, oscillating between Apollonian and Dionysian poles (Nietzsche, 1872): the Renaissance, the Baroque, Neo-Classicism, Romanticism, Modernism and Post-Modernism, for example. (We could consider this an oscillation between Plowright's *Patterns* Frame and an *Affect* Frame.)

Neither account attempts to embrace more fully the complexity of everyday architectural design in the way that Henry Wotton's three-part version of ideas from Vitruvius does: Firmness, Commodity and Delight – or, in contemporary terms: Technology, Amenity and Poetry (the version used in my undergraduate elective subject *Design Workshop* because many students took 'Commodity' to be a matter of Economics theory). This influential trio is simplistic but useful and may be referred to as a *holistic* account not because of its achievement but because of its intent.

The synchronic account focuses architects' attention on the building, the diachronic account focuses architects' attention on the building and the holistic account focuses architects' attention on the building. All three accounts tend to omit focusing on crucial aspects of Locality (cultural- and socio-political and economic context, topography, climate, ecology or what first Australians refer to as 'respect ...' or 'concern for country').

But, these are Western views. Other Frames have dominated and do elsewhere.

## Nature as the Model and Measure

We can start examining other cultures' designing Frames through considering four cultures' attitudes to stone, for example: Korea, Sri Lanka, Japan, and China.

I start with Korea, because it appears to have the most direct relationship between stone and design. A characteristic way in which certain kinds of Korean garden are established is to place a pavilion on a large or interesting natural outcrop of living rock without in any way modifying the rock. What is of importance is the view out across the landscape from the pavilion. Here, nature (man-modified and otherwise) is to be admired and not disturbed (Korean Institute of Traditional Landscape Architecture, 2007: 255-300).

In Sri Lanka's ancient palace complexes, natural granite boulders, often very large, appear to be exploited in a curious way. Generally, the building complexes are relentlessly rectilinear and apparently constructed without regard for the boulders that are naturally strewn around much of the north of the island. But, this must be an illusion. Seemingly, the boulders simply disrupt the building texture wherever they occur. But, the result is, in every case I encountered, a dialogue between the natural and the man-made. Each realm is stronger and more interesting for the forced juxtaposition. And, this sensitivity continues, for Sri Lanka's most celebrated architect, Geoffrey Bawa, understood this device and often employed it (Robson, 2002: 31, 93-94, 204-205, 209) Here, nature and the man-made mutually contribute to a richer whole.

One ancient and still used term for landscape gardening in Japan is *seki*. It means 'placing stones'. In the Japanese garden, the designer finds his individual stones in the mountains, on an island or in riverbeds and uses each stone in the garden more or less as it was found in a new association with new fellows. Here, nature is represented in modified form and individual stones are respected for their nature. However, in the collective, it is a representational use of the stones, symbolic and an aid to meditation and there is very little that is actually natural about the garden. It is very closely designed. (Slawson 1987, Keane 2002)

The private Chinese garden tradition is similarly representational, symbolic, an aid to meditation (contemplation and reverie) and even less actually natural. The natural world is held to be the supreme model, but the garden is a compressed, enhanced, distilled representation. The stones that make up artificial mountains are usually carefully crafted but it is the specimen stones (usually limestone), looking like frozen champagne explosions or baroque versions of Henry Moore sculptures that visually set this tradition apart. These stones are to exhibit *qi* with their writhing forms and they usually balance on their point, at a tense equilibrium, poised as if they could topple at any moment. (Rambach and Rambach, 1987)

What is common to these traditions is the dialogue with *Nature* as a continuing aesthetic and spiritual tradition, as *THE* Frame, providing both models and measures of success.

### **Norberg-Schulz and The Meaning of Western Architecture**

Now, it's simply not true to say that there are no important western thinkers in architecture that have argued that *Locality* (as is otherwise missing from *Design Workshop's* modified version of Wotton's version of Vitruvius) ought to be considered a key determinant of architectural design. One of the reasons I particularly enjoy the opening chapters of Norberg-Schulz's (1974) *Meaning in Western Architecture* is the way in which he stresses that the differences between Egyptian, Greek and Roman architecture were based in very different ideas about the nature and function of buildings and cities and, in turn, that these different ideas were rooted in differences of geography and topography (or place) and local materials. *Bannister Fletcher's A History of Architecture* (Musgrove, 1987) is a much older architectural history text now no longer fashionable that took location as the key determinant of architectural style.

In my own country, it could be argued that the dominant Australian architectural Frame, despite eighty-plus per cent of us living in cities and what has happened architecturally in Melbourne, is that of the *Pavilion-in-the-Landscape*, championed by Gabriel Poole, Glen Murcutt, Peter Stutchbury and Troppo Architects, for example. (Goad and Bingham-Hall, 2001)

### **Then-Now, There-Here / Gujin [古今], Bici [彼此]**

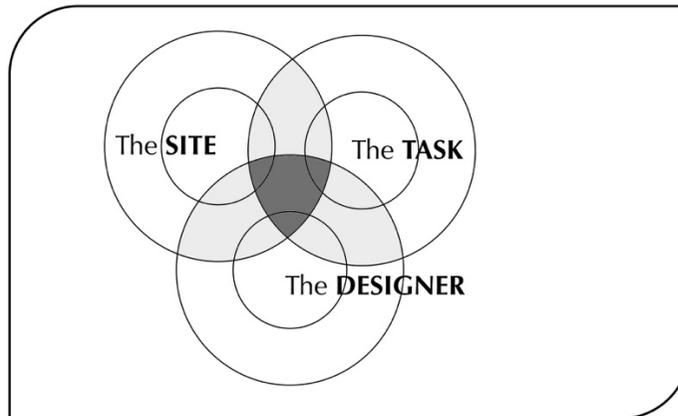
As with its gardens, traditional Chinese aesthetics requires an artist to place their work of art ideally in the Chinese philosophico-aesthetic cultural tradition simultaneously in both synchronic contextual and diachronic senses. The expressions used are 'then and now', 'here and there' (Wu, 2012). This is a very rich, culturally affirming Frame. It is almost what we expect of our contemporary PhD students: that they contextualise their work within a historical stream of disciplinary concern and demonstrate, also, that they are across current thinking on the matters they are studying (Missingam, 2016). (I think that both the Korean and Japanese traditions might expect something like this, also, but have seen no direct evidence of it.)

This is a Frame that is entirely consistent with a Semantic Ecological one.

## Epiphany

Now, effectively, I do have my own Frame that I've been showing students for years that also includes Locality, the Task and the Designer with a Context, defining the field of possibilities (**Figure 4**) ...

CONTEXT: **defining the field of possibilities**



**Figure 4.** Key Determinants of Design Outcomes

Source: Author (2017)

Importantly, Frames are nested structures. For example, a Frame focused on People (those who determine the Task, above), might note at least three scales of concern:

### The SCALE OF **THE COMMUNITY**

Primarily expressed in *symbolic* ways: reifying + giving presence;

### The SCALE OF **THE GROUP** / FAMILY or ORGANISATION

Primarily expressed in *behavioural* ways: function; and

### The SCALE OF **THE INDIVIDUAL**

Primarily expressed in *psychological* ways: perception + affect.

It should be easy to see that each of the other Key Determinants is equally and often associatively nested.

We can think of the site as the footprint of the building(s) designed, only, or as that immediate area plus circulation around it, perhaps with terraces and gardens. We could think of the site as the whole plot of land on which a building will sit, boundary to boundary. We could think of the site as the parcel of land in its immediate urban, suburban or rural environs or in terms of the valley in which it sits or the forest surrounding it or the hillside on which the building might be located.

Finally, as a designer, each of us is an individual. But, in the world of practice, we usually work in teams, as a company or professional practice, and we are members of our profession and of the wider intellectual discipline of architecture with its history and traditions. We are all of these kinds of designer simultaneously, even when working 'alone' on a single project.

Now, given such a Frame, how does a designer get good ideas and how can they prepare themselves to have good ideas?

### **Tregloan on Design Epiphany**

In her account of Design Epiphany, Kate Tregloan (2014) developed a version of the model of designing that sees a task and a proposal for its resolution as an evolving pair: Framed task and proposal. (For a related discussion but couched in very much older terminology, see: Dorst and Cross, 2001.) Initially, the task is ill-defined, possibly because the Frame that encompasses it is relatively inexplicit. Accordingly, appropriate proposals for completing or satisfying the task are similarly ill-defined, probably even more so. In this model of designing, over time the designer gradually and incrementally refines the definition of the Frames and hence the task and modifies proposals accordingly until a sufficiently appropriate pairing is arrived at. A Design Epiphany, that famous "aha" experience, may occur in the process of that designing.

Tregloan describes Design Epiphany, so:

1. Epiphany is an experience of personal insight in response to a particular situation
2. It is concerned with creative outcomes (novel, valuable and suggestively fecund – my definition of 'creative' rather than Tregloan's related version, from Missingam, 2010)
3. Epiphany is both an emotional and intellectual (affective and cognitive) experience
4. Design Epiphany is a cognitive outcome (rather than a process) that may offer insight to either or both design outcomes or processes
5. Fruitful intersection of developing task and resolution proposals is key outcome and test of a Design Epiphany, and ...
6. The value to a design project of a Design Epiphany is related to change in momentum toward a successful proposal.

That is, the impulse from the Design Epiphany is the momentum it provides toward a successful proposal. Or, in Tregloan's shorthand version ...

## **Design Epiphany Impulse = Significance X Progress.**

### **Figure 5. Design Epiphany Impulse**

Source: Author (2017)

This account of Design Epiphany allows both for ‘slow burning’ Epiphanies and for the more recognisable, ‘instant’ Design Epiphanies that are usually noted and reported – as in the commonplace comparison between, for example, Beethoven’s working out of the theme for the 5<sup>th</sup> Symphony over 40-odd years as compared with Mozart’s reputed practices.

Tregloan identifies a number of types of Design Epiphany, including those that may be most familiar to you:

Design **project** epiphany (with which we are most familiar, where the insight propels the progress of the proposal), and

Design **practice** epiphany (in which the designer’s insight relates to how their own designing might better take place or better be conducted: more efficiently, more effectively or more expressively – Professor Emeritus Graham Brawn’s three “Es” of better designing in words not actually used by Tregloan but implied).

And, finally, for Tregloan, a Designer prepared for Epiphany is ...

1. **Active:** working on many levels with many simultaneous agendas
2. **Opportunistic:** ready to take advantage of ambiguity
3. **Confident:** clear about ambitions and abilities
4. **Informed:** having relevant information together with knowledge of procedures
5. **Adventurous:** flexible about means to achieve desired outcomes
6. **Skillful:** practiced in many forms of representation and able to build on them
7. **Balanced:** can integrate abstract with practical views of designs and possible designs
8. **Reflective** (when designing): able to use perception and judgement, diverging or converging, with productive engagement
9. **Reflective** (on the design and designing): aware of the impact of personal perspectives and preferences.

(With all these references to Tregloan’s work, I have sometimes quoted verbatim but have usually modified the original wording to shorten it, but always trust that I haven’t altered Tregloan’s meaning too radically. Please, consult the excellent original.)

## Reflective Thinking

Now, it's this last pair of characteristics of a designer prepared for epiphany that I'd like to pay a little more attention to, this reflective thinking as designers.

Consider the following comments:

For the most part, ..., students hold unrealistically high expectations for their performance. Once they become aware of their perceived shortcomings, they believe they should be able to produce complete and perfect designs. They see shortcomings as failure, and when they reproduce their shortcomings, they experience a blow to their self-esteem. They do not as yet have the idea of a learning process in which imperfect actions are continually modified through reflection-in-action. Hence, their growing awareness of complexity and dilemma leads them to discouragement or even despair.

...

It was a relief for them to become aware of their unrealistic expectations for their own performance. It helped them to be able to lower their own expectations and to see incompleteness, corrected in the doing, as a necessary concomitant of effective practice.

(slightly modified from Schön, 1987: 291 and 292)

Further, the empirical educational, pedagogical evidence is that being able to think meta-cognitively about your own thinking allows you to improve your thinking in general regardless of the field within which it is applied. It encourages a life skill that transfers to success in other academic subjects and to all your endeavours as professionals and citizens.

And, student TEW's comments:

... in design studios it should be part of your assessment to write a piece reflecting & evaluating your work / end result (a post completion essay) comparing your hopes & dreams for the project against actual outcomes. I think it would be a great tool for students to try to learn from their mistakes & also for tutors to get a better understanding of their students and their work.

Let's begin with what Donald Schön (1983) calls *knowing-in-action*. This is the kind of thinking required, for example, while riding a bike, typing, working with a computer program or to play a musical instrument when you are skilled in doing so. What he calls *reflection-in-action* is where you are making design decisions in the here-and-now, in the act of designing (what Schön refers to as "having a dialogue with" the drawing or with the design as it unfolds). Both these kinds of thinking are

thinking *in the present*. What he calls *reflecting on reflection-in-action* can occur in the present, also, but is quite likely to be a little retrospective. Let's agree to call these kinds of levels of thinking, **Thinking-in-Action**. Catching such Thinking in Action is difficult – particularly as stopping doing it to take note of it means that you have shifted to a retrospective, analytic mode of thinking.

Protocol studies of designing taking place attempt to catch this kind of thinking, studies that try to capture design thinking as it happens. Peter G Rowe (1987) is referring to interview-sourced protocols of three students working through their proposals. Schön (1983) is referring to discussions, recorded in detail, between a design tutor and a student working through issues she is having with her developing proposal.

For designers, then, there are at least three levels of thinking: thinking about the project, the task (= Task thinking), reflection-in-action or thinking *as you are designing* about how to tackle the project (= *Reflective* thinking) and thinking about that design thinking, itself (= *Reflexive* thinking). But, in the heat of the action, in the absorption of designing, we don't usually stop to examine our actions like this. These kinds of thinking are usually all retrospective thinking, thinking that is about what has already happened, thinking about matters *in the past*. This is why I can call it **Analytic Thinking**. Catching such thinking might be difficult but not impossible as the work itself, documented in notes, sketches, drawings, models and reports (especially those that include arguments for the proposals), provides much of the evidence.

Now, neither Analytic Thinking nor Thinking-in-Action are quite what designing actually and necessarily frequently and crucially entails – thinking that is both proactive and involves evaluation of outcomes. This kind of thinking has been called deliberative thinking. That is, neither past-orientated Analytic Thinking nor present-orientated Thinking-in-Action quite capture thinking in designing.

So, as you will have guessed, I think we should recognize that there is **Future-orientated** thinking and that it can be quite carefully conducted and controlled by you, as designers. It is *prospective*, about what is possible – in terms of the task, in terms of design approaches and in terms of one's own thinking (those same three levels, again: Task, Reflective and Reflexive thinking). But, I think it is much better described as **Proactive and Evaluative Thinking**. At the level of Thinking about the Task, Proactive and Evaluative Thinking entails making proposals that test out options and explore the territory of possibilities on the assumption that the particular shortcomings revealed will tell you very much more about that territory and how to make better, more focused proposals next time. Proactive and Evaluative Thinking is concerned very much not with immediate success but with personal learning – at each of the three levels, and with continual improvement of proposals.

At the level of thinking about the task itself, various design tactics or motifs or, better, *design conjectures* can be employed Proactively and Evaluatively. Here, I have in mind the kind of procedure claimed as characteristic of science in Popper (1972). Faced with a growing design scheme, often a designer trials a series of alternative continuations, testing various constraints, the client's actual wishes or, simply, formal options.

At the level of Reflective Thinking, Proactive and Evaluative Thinking can employ any number of useful *heuristic strategies* and that is why it is so very powerful. Here, the designer is choosing *Design Approaches and Design Methods*. Design Approaches have to do with what you are trying to achieve under a Frame. Design Methods have to do with how to get where you want to get.

At the level of Reflexive Thinking, of thinking about one's own design thinking, Proactive and Evaluative Thinking entails *Designing your Designing*.

So, to summarize, these are the kinds of thinking that I think are involved in designing (see **Figure 6**, below). Nine kinds of thinking. I recognize that this seems to complicate matters but I think it should make your actual designing practice more comprehensible and easier to report on.

		APPLIED TO ...		
		PAST	PRESENT	FUTURE
LEVELS OF THINKING	Reflexive Thinking	Thinking about your own design thinking	Reflection on Reflection-in-action	DESIGNING YOUR DESIGNING
	Reflective Thinking	Thinking about design strategy + tactics	Reflection-in-action	Choosing Design Approaches + Methods
	Task Thinking	Thinking about the task	Knowing-in-action	Making Design Conjectures
Problem Solving >		Analytic thinking	Thinking in Action	Deliberative Thinking:
			SCHÖN'S TYPES	PROACTIVE + EVALUATIVE

**Figure 6.** Thinking in Designing

Source: Author (2017)

## Designing Your Designing

Now, what is entailed in Designing Your Designing?

The first level of thinking is the highest level of thinking, the level of Designing, generally. At the level of **DESIGNING YOUR DESIGNING**, design thinking involves Choosing / Developing / Recognizing your own FRAME(s), remembering that Frames are nested structures, covering matters at a number of scales.

Mind you, I am well aware that some designers engage with different Frames at different scales of consideration in their designing, probably unaware that they are doing so. Further, there are Frames appropriate to particular and different scales of designing.

At the level of **THE DESIGN**, itself, a designer who is Designing Their Designing is primarily choosing **Design Approaches and Methods** (Heuristics) that follow from and/or support the Frame (and, so, are not working against their own grain).

At the level of **THE IMMEDIATE TASK** a designer who is Designing Their Designing is primarily making **Design Conjectures** and evaluating the results.

But, the detail of each of these levels, how to do it, has to wait for another opportunity for me to discuss it.

## CONCLUSION

Readers may have noticed that, in this essay, the only place where I refer to problem solving in respect to designing is in **Figure 6**, in the very bottom left, as a subset of Task Thinking. Talk of ‘problems’ and ‘solutions’ belongs in medicine and engineering. However, it would be unfair to blame the terminology entirely on the popularity of Gyorgy Polya’s (1957) book or the adoption of its jargon by various engineers writing on design methods. Given my views on designers being *Future Curious*, and that designerly thinking occurs at at least three scales, I find the characterization of designing as being essentially problem-solving as misleading, backward-looking and an impoverished understanding of what designing really entails. Designing has always been and is very much more than mere high school mathematics exercises.

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