

DESIGNERLY, REFLECTIVE AND INSIGHTFUL WAYS OF DESIGNING

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ABSTRACT:

It has been proposed that there are designerly ways of knowing, thinking and acting that may be regarded as the natural intelligence of design. Recognised designerly ways include cognitive strategies such as solution-focusing and prestructuring. Exploring and learning about a problem, by producing tentative solutions, are also recognised designerly acts. This paper considers the prospect that, while some designerly behaviours could be peculiar to designing, others such as reflection are more general and others may be peculiar to individual practitioners. In a recent study of the conceptual design discoveries of 45 accomplished architects and designers many beliefs, priorities and behaviours, that could be regarded as designerly, were observed. The paper describes these findings and proposes that the natural intelligence of designing may be more fully understood as a native intelligence, or a unique combination of knowledge, discoveries and facets of intelligence, that are natural, native and situated in a designer.

1. INTRODUCTION

In a recent book Nigel Cross advocates a *catholic* approach to design research, in order to construct a way of conversing about design that is both interdisciplinary and disciplined, with domain-independent approaches to theory and research in design. (Cross 2006). The focus of the research, as Cross proposes below, are forms of knowledge *peculiar* to the awareness and ability of designers generally.

Just as the other intellectual cultures in the sciences and the arts concentrate on the underlying forms of knowledge peculiar to the scientist or the artist, so we must concentrate on the ‘designerly’ ways of knowing, thinking and acting.

The authors of this paper support Cross's proposition, but query the notion of peculiar to designing. Cognitive strategies such as solution-focusing, or exploring and learning about a problem by producing tentative solutions, and physical acts like sketching, could be peculiar to designing. But others, such as reflection, common among practitioners in a variety of mentally demanding activities, are more catholic. Others still may be vital and peculiar to individuals, but not to designers in general.

A related issue with significant implications is whether designers converge, or diverge, as they approach the best of their capabilities. What if we were to consider designs in this way? Do we appreciate or describe the best designs, by focusing on what they have in common with other designs? If not, is it sensible to regard the creators of the best designs as less richly varied, in effect simpler than their works? What implications are there for education and training of designers, if they are more diverse and divergent than is currently supposed?

Part 2 of the paper begins with a brief description of designerly ways, referred to in earlier design research. Some observations of Donald Schön, which highlight similarities between the reflective practice of architecture and other professions, follow. The recent study of Australian designers and architects, is introduced in Part 3. This is followed by an account of additional behaviours, identified in the study, that could also be interpreted as designerly. In Part 4 the concluding comments are offered.

2. DESIGNERLY WAYS

Over recent decades there has been an accumulation of systematic research into designing, with the aim of identifying designerly ways of knowing, thinking and acting, expert knowledge, and the combinations of knowledge and skills referred to as the natural intelligence of design. Much of this research has been brought together in recent works by Lawson and Cross.

(Lawson 2004, Cross 2006). Lawson has observed that designers make use of *precedent*, stored through *episodic memory*. Cross has identified five aspects of designerly knowing including the association of designing with *ill-defined* problems, problem solving that is *solution-focused*, a *constructive* mode of thinking and use of *codes* to translate abstract requirements into concrete objects, which can be used productively when *read* and *written* in *object languages*. Both authors acknowledge the work of Donald Schön.

Schön's concepts of *reflection-in-action*, and *reflective conversations with the situation* are relevant and useful metaphors that enrich the understanding of designerly acts, such as the interpretation of ill-defined problems, constructive thinking and acts involving codes and object languages. (Schön 1983). Schön studied architects, but also other practitioners, finding significant features of expertise-in-common across professions that are outwardly different. Comparing the conversations of architects and psychotherapists he found that both approached a practice problem as a unique case. In neither domain was the problem given. It was ill-defined. In both domains the practitioners needed to apply a constructive mode of thinking, so as to understand the situation as found and reframe it. In both domains the practitioners experimented via a process of conjectural queries and propositions. Schön also observed that both practitioners, in the course of their discussion, operated in a virtual world, a constructed representation of the real world of practice. For one practitioner, the sketch pad was a medium of reflective practice. The other used the virtual world of talk. (Schön 1983). It was evident that each domain has its object language. The architect's behaviour can be described as designerly, but it is not so peculiar.

3. RECENT RESEARCH ON INSIGHTFULNESS

In a recent interview study of 45 professionally accomplished architects and designers practicing in Sydney, Australia, additional varieties of what could also be regarded as designerly behaviour were observed.

3. 1. SUMMARY OF STUDY

The aim of this study was to assess the extent to which conceptual designing, by accomplished practitioners, is an insightful activity. One-on-one semi-structured interviews focused on how respondents managed their creative activity and on discoveries made throughout conceptual design. Questions were open-ended, progressing from general to particular, through four stages, with each stage focusing on a different aspect of a

respondent's life, thoughts and designing: 1) Introduction: career and personal attributes, 2) Design and designing: philosophy, values and features of how respondents design, 3) Work and discovery: details of designing and recollections of breakthroughs and discoveries, and 4) Wrap-up: to elicit remaining or emerging unstated thoughts. Indicators based on well known problem solving concepts, originating in *Gestalt* theory, were applied to assess insightfulness. These are, *preparation*, *fixation*, *incubation*, *restructuring* and "aha!" response. (Wallas 1926, Duncker 1945, Kaplan & Davidson 1988, Mayer 1995). Individuals received a score for stated indicators of each criterion when describing a discovery, or referring to discoveries generally. A second measure, relative significance of discoveries made during active design sessions (called *hot* discoveries) and at other times (called *cold* discoveries) was evaluated, employing four indicators, frequency, importance and degree of hotness and coldness. A third measure, insightfulness of cold discoveries was based on whether respondents attributed greater insightfulness to cold, than to hot, discoveries.

Most respondents (39/45) affirmed that insights assisted design conceptualisation. A few were unable to recall a particular experience, while two respondents affirmed that their designing was intentionally based on a rational incremental process and that unexpected discoveries and insights were rare. It was also evident that there are different levels of insightfulness and that insightful discoveries are qualitatively different. One aspect of insightful discovery, Latent Preparation is described in 3.2 below. Further details of the insight aspects of the study may be found in the following papers, or by contacting the authors. (Murty and Purcell 2006a, 2006b, 2007).

The respondents also indicated an unexpectedly wide range of beliefs, priorities and behaviours. It was evident that, from the outset of conceptual designing, the respondents proceed in different directions, attempt different things and adopt different strategies and methods of handling the stuff of design. These findings are described in parts 3.3 to 3.5 below.

3.2 LATENT PREPARATION

There is abundant evidence from respondent statements that a little recognised, complex and assertive mental dynamic is an everyday part of the life of many designers. Experiences described by many respondents included aspects of what is commonly referred to as mental *incubation*. However respondents varied markedly in describing mental activities that were variously unplanned, uncontrolled, undirected, unnoticed, or perhaps forgotten, taking place at almost any time and during almost any state of consciousness and attention. What was being described is something different, or more than, unconscious active work, the incubation of

Gestalt theory. The term used to describe this mental activity combines *latent*, meaning hidden or invisible and *preparation*, meaning the initial stages of problem solving, or designing, when an individual learns about a problematic situation and initiates attempts to resolve it. The concept of latent preparation is intended to include Gestalt incubation, and also accommodate other incubation-like mental activities that need not conform to a strict Gestalt definition.

Some respondents recalled events when Gestalt incubation appears to have occurred during sleep. A26 described an incident when he went to bed thinking about his project and later awoke with a concept he could apply. P3, A05, A27 and A31 also described experiences of waking from sleep, with a strong sense of knowing, not evident the night before. A09 proposed that while one has a problem it is retained in the mind, subconsciously. Others referred to a variety of processes, indicating an acceptance of undirected mental activity going on, while they are doing other things. A30 described himself as a great believer in things ticking over in the mind, on a subconscious level. A12 referred to ideas continuing to *tick-over* after leaving work. A21 described himself carrying around several problems at a time, or having them *percolating away*. A23 described liking to chew things over, letting them *float around* for a while before pinning them down. A27 refers to the problem, *going round* in your head. A36 referred to working out a problem *without really thinking*. A37 referred to design thoughts as friends, because they are all *chattering away* in her head.

In being a frequent experience of designers in one location, latent preparation could be regarded as antipodean, or designerly, but like reflection it is not confined to Australians, or designers. For example, Wolfgang Kohler, the pioneer Gestalt psychologist referred to similar experiences in his final public lecture. (Kohler 1969). He described insights occurring while inactive, when taking a bath, or shaving and referred to anecdotal evidence of a physicist in Scotland:

We often talk about the three B's," he said. "The Bus, the Bath, and the Bed. That's where the great discoveries are made in our science.

3.3 FOCUSING STRATEGIES

In an early study of architecture students and science students, Lawson observed a distinction between solution-focused and problem-focused strategies. (Lawson 1979). He described the architecture students as having a more solution-focused strategy and the science students as having a more problem-focused strategy. The designers in this study are, like Lawson's architecture students, not problem focused. However, perhaps because these respondents are experienced and accomplished practitioners, there is a richness of variation that may be

less common among students. Three categories of focusing have been identified, namely *orienting*, *scoping* and *framing*.

Focus orienting: refers to the distinction observed in Lawson's study. (Lawson 1979). About half of the respondents in the present study indicated that they are *solution* oriented. While no respondents were identified as *problem* oriented, respondents not identified as solution oriented made statements indicative of a *process* orientation, or a *wholistic* orientation. The former emphasised the way they designed, or affirmed the need for good design to be the outcome of a process. The latter indicated a readiness to consider the totality of design and context, in a broad sense, less as a problem and more as the source of an understanding that leads to a solution.

Focus scoping: the second category, refers to a distinction between statements about designing that are: 1) *generic*, that generalise about projects as a whole, or classes of project, or imply a project is part of a continuum of design activities, or body of work, and responses that, 2) focus on what is *specific* to individual projects, suggesting that each project is regarded as unique. Generic scoping can be viewed as a top-down strategy which simplifies conceptualisation by categorising items into recognisable classes, parameters or models. The alternate bottom-up strategy, specific scoping, is also reductive when associated with what may be interpreted as an audition process, to identify potential design ideas, or generators.

The distribution of focus orientation and scoping, has been examined with regard to gender, RAI award status and years of practice, based on year of commencement, see Figure 1, below. Both respondent numbers and percentages of each subgroup are shown. Note that percents are rounded and do not always add up to exactly 100%.

Orientation > Scope >	Process		Solution		Wholistic	
	Generic	Specific	Generic	Specific	Generic	Specific
Gender						
Male (22)	7 - 32%	1 - 4.5%	6 - 27%	3 - 14%	0	5 - 23%
Female (23)	5 - 22%	3 - 13%	6 - 26%	5 - 22%	0	4 - 17%
Award Status						
Awarded (21)	4 - 19%	2 - 9.5%	6 - 29%	3 - 14%	0	6 - 29%
Other (24)	8 - 33%	2 - 8.3%	6 - 25%	5 - 21%	0	3 - 13%
Commenced practice						
Before 1984 (23)	7 - 30%	0	7 - 30%	5 - 22%	0	4 - 17%
After 1983 (22)	5 - 23%	4 - 18%	5 - 23%	3 - 14%	0	5 - 23%

Figure 1: Design Focus - Orientation and Scope distribution

There are some clear trends in these figures. There is a relationship between focus orientation and scope. As might be expected, wholistic orientation is entirely associated with a specific scope, or the view that each project is unique. In contrast, fewer of the respondents who are process or solution oriented affirmed specific scoping. The influences of gender, award status and degree of experience are evident, but slight. More males than females indicated a generic view of their designing. More award winners than others are wholistic in their orientation, and fewer award winners are process oriented. The mature, before 1984, practitioners, appear more likely to be specific-solution oriented, than specific-process oriented, while the opposite trend applies to the younger, after 1983 group.

Focus framing: Focusing appears to be more finely tuned or framed according to aspects of design, or designing, that individuals regard as high priority, or of interest, which structure, shape and characterise their designs. Other researchers have described framing. Schön has referred to frames as settings, which shape practice. (Schön 1983). Akin refers to frames of reference that restructure a problem in such a way that the creative process is enhanced. (Akin 1996). In contemporary architecture the most evident and dominant of frames is modernism. Few respondents enunciated the label of modernism, to define or characterise their work, but all appear to accept one of many different interpretations of modernism as a given.

3.4 ACTION STYLES

Several characteristics of the way individuals work are referred to as action styles. Action styles were considered likely to be associated with insightfulness, either by invoking discoveries, or as indicators of a pattern of insightful discovery. Three concepts, *progression mode*, *incessancy* and *reactivation*, are described below.

Progression mode: refers to whether designing progresses in a steady and incremental manner, or fluctuates, not progressing, then suddenly progressing, at different times. During the interviews, reference is made to these alternatives and respondents are asked about their experiences. Relevant expressions of the two responses are: 1) fluctuating - inconsistent, fits and starts, uneven, or getting stuck, or 2) steady - consistent, methodical, incremental. The distribution of responses is as shown in Figure 2, below.

Respondents with a fluctuating progression match those who describe their progression as steady. (16:16). There is an almost equal third group (of 13) whose experiences include both steady and fluctuating progression. Slightly more males, award winners and mature

practitioners are steady, whereas fluctuating progress and a greater tendency to alternate between both modes is more common among females, non-award winners and more recent practitioners. Statements by respondents who described their progression as discontinuous suggested two different perceptions, one a more passive view of discontinuity as a phenomenon, over which the respondent has little control, the second, a more assertive view of discontinuity as an aspect of nature that can be harnessed, or ridden, like surfing a wave.

Progression >	Fluctuate	Both	Steady
Gender			
Male (22)	7 - 32%	7 - 32%	8 - 36%
Female (23)	9 - 39%	9 - 39%	5 - 22%
Award Status			
Awarded (21)	6 - 29%	7 - 33%	8 - 38%
Other (24)	10 - 42%	9 - 38%	5 - 21%
Commenced practice			
Before 1984 (23)	9 - 39%	6 - 26%	8 - 35%
After 1983 (22)	7 - 32%	10 - 46%	5 - 23%

Figure 2 : Action Style - Progression mode distribution

Among the respondents, P2 attributed progress to acquisition of ideas, which come in chunks. Then, following an idea, activity is intensified. A40 made a similar point and distinguished between gathering information and then interpreting. A33 equated getting stuck with writers' block, while A29 and A35 related delays to temperament. For A17 the intermittent process is routine.

... Usually we think about it and talk about it. Put off everything (stall) for as long as possible. A17.

A05 was also more assertive, suggesting that discontinuous progress is a natural outcome of the exploration of ideas:

... you've got to come up against things and then you either test that, you go around it, or you find another way... I do it very quickly... I think it's very much a methodical process, but it's a bit two steps forward one step back, two steps forward one step around... A05.

Nearly one third of the respondents described their progression as varying, sometimes fluctuating and sometimes steady. This group can also be split, in much the same way as the group above. Some respondents said that progression is not under their control for personal reasons, some associate progression with projects and, for some, both factors are involved. A22 exemplifies the perception of variations in progression as personal.

... If left to my own devices, I fluctuate. If structured, more steady. A22.

A32 described the experience of sometimes designing in minutes while spending weeks agonising over something else. A07, A20, A37, P2 and P3 referred to situational factors, typically project related.

... Some ... you can resolve more quickly. Other times you get writers block, so to speak. A07.

- ... Good at delivery on time... But jobs don't gel... Sometimes you know something is not right. You might be hanging the clothes and then a breakthrough. A20.
- ... Have had some projects where we have struggled initially until you have that central idea. A27.
- ... Sometimes it is like, "easy as". Other times I go blind and might be fighting myself ... up against a brick wall. A37.
- ... I experience both. Again it depends on the project. P2.
- ... It depends on how much learning curve you have. P3.

The steady respondents included some who attributed fluctuations to situational factors. A12 describes a steady process where discontinuities, if not intentional are viewed positively.

- ... We fluctuate for external reasons. Jobs go off the boil. Our ideas are always very strong, but can go astray when the client doesn't understand, or share the vision, or doesn't care... generally there's one direction that is pursued and then I'll steadily work on that... sometimes it sits for a little while. I think it needs to. A12.

Many respondents referred to the need to meet the demands of their occupation, including the need to moderate, or attempt to moderate their fluctuations at some times.

- ... When you actually start to work with big projects you end up being tied into constraints which are set by... project managers, by clients... And certain things have to be done. Sometimes that process forces you to make decisions. A01.

A34 also acknowledged a growing recognition of the need to work quickly, while A08, A11, A18, A25 and A28 indicated that their design progression, while not always, was usually incremental.

Incessancy: refers to the respondents' view of themselves as incessant practitioners, in being *always the architect*, or *always on the case*. Respondents were asked to describe the extent to which they feel they are either of these two things. The distribution of responses is as shown in Figure 3, below.

Incessancy >	No	Sometimes	Always
Gender			
Male (22)	1 - 4.5%	3 - 14%	18 - 82%
Female (23)	3 - 13%	3 - 13%	17 - 74%
Award Status			
Awarded (21)	3 - 14%	2 - 9.5%	16 - 76%
Other (24)	1 - 4.2%	4 - 17%	19 - 79%
Commenced practice			
Before 1984 (23)	2 - 8.7%	2 - 8.7%	19 - 83%
After 1983 (22)	2 - 9.1%	4 - 18%	16 - 73%

Figure 3 Incessancy distribution

Most clear is the fact that nearly 80% regard themselves as incessant practitioners. Incessancy appears more likely to be found among male practitioners and those practicing before 1984.

Responses affirming the first sense, of being always the architect or designer included;

- ... never, not an architect. A09.
- ... One of the joys and one of the frustrations of being a designer is that you are constantly observing, correcting... and that's just the way you'll always be. P2.
- ... My children are embarrassed by my tapping walls etc. Always enquiring. A04.
- ... always looking at things... often lateral thinking, divorced from what you are doing. A13.
- ... I am on the go all the time. My mind is constantly going. A34.
- ... Perpetual is part of the explanation... without perpetual, you have static answers. A39.
- ... constantly looking at all things... looking for clues. It goes on all the time. A40.

Responses affirming the second sense, of being always on the case, included;

- ... Agreed... some things work well early on... but other things require more... so you keep working at it until you get to a satisfactory point. A06.
- ... We are perpetually looking for the best possible solution... we have gone back and re-explored, because we want it to be brilliant. We are not billing the client for this. A16.
- ... When I get a new job I don't stop thinking about it until I have worked it out. It might take 4 hours or 4 weeks. A17.

Reactivation: Respondents were asked how they cope with getting stuck, or being unable to resolve a tricky design problem. About 10% opted to keep working, if they got stuck, until a solution was reached. But for 90%, disengaging from designing and doing something else, or re-engaging with the project in a different way were affirmed. Re-engaging, involves disengaging momentarily, and then approaching the problem again, but in a different way. While 10% would choose to either disengage or re-engage, depending on circumstance, about 80% preferred one or the other. The distribution of reactivation preferences is as shown in Figure 4, below.

Reactivation >	Disengage	Either	Re-engage	Persist
Gender				
Male (22)	10 - 46%	0	8 - 36%	4 - 18%
Female (23)	11 - 48%	4 - 17%	7 - 30%	1 - 4.3%
Award Status				
Awarded (21)	12 - 57%	3 - 14%	4 - 19%	2 - 9.5%
Other (24)	9 - 38%	1 - 4.2%	11 - 46%	3 - 13%
Commenced practice				
Before 1984 (23)	14 - 61%	1 - 4.3%	4 - 17%	4 - 17%
After 1983 (22)	7 - 32%	3 - 14%	11 - 50%	1 - 4.5%

Figure 4 Reactivation distribution

The table shows that similar numbers of male and female respondents customarily Disengage or Re-engage. However among both genders there is a similar sized minority who either Persist, if they are males, or choose to either Disengage, or Re-engage, if they are females. The numbers are small, but this suggests that males who keep working when they get stuck are either more persistent, or less flexible than females, who may be more willing to try different options.

When RAI Award winners are compared with Others the largest distinction between the two sub-groups is associated with Re-engagement. The numbers suggest that Award winners mostly Disengage when stuck, whereas more of the Others will re-engage. This suggests that Award winners are more confident in their ability to come up with a solution, after a break. When respondents practicing before 1984 are compared with the After 1983 group, the differentiation noted in relation to Award Status is also present. The Before 1984 group look a lot like the Award winners, possibly for the same reasons and partly as a result of a higher proportion of award winners among the more mature group 12/23 v 9/22. The sense of these terms is easier to appreciate after reading the respondent's descriptions of what they do, below.

Disengage - About half of all respondents exhibited confidence in their capacity to solve problems, when they were stuck, by disengaging from the project in one or more of several ways, ranging from resting, getting away from the workplace, physical activities such as swimming or going for a walk, non-work-related creative activities such as painting, or working, but on different tasks.

A variable group recommended disengaging from designing when stuck and ignoring work for a time, without suggesting any particular alternative activity. Actions advocated by these respondents include:

- ... Forget about it. A21.
- ... Put it aside and come back to it later. A22.
- ... try to ignore it. The cliché is, you think of it on waking, or driving. That's what I call intuitive. A30.
- ... Take time out. Need to stop. Go do something else. Maybe look at related precedents. A01.
- ... Have a melt-down, go to the movies... I lose it. I call on people. I often need that feedback. A29.

Another group were clearer about distancing themselves from the problem, more decisively by leaving the place, or situation, of their frustration. Examples of their responses include.

- ... You've just got to get away and clear your mind and then suddenly, you... might get the idea. A08.
- ... I would leave and not worry about it and come back tomorrow morning. A14.
- ... I always find that it happens after you've walked away from the job... For me the breakthrough is usually through distance... I believe there's an incubating process... P2.

Some respondents described travel, especially air travel or train journeys as conducive to problem solving. Several recommended physical activities like kayaking, swimming, walking or bicycling as being conducive to quiet reflection or allowing the subconscious to function. Many referred to a significant artistic interest, mostly painting or drawing, which they could turn to as a form of creative recovery and stimulation.

Several respondents, who clearly had demanding workloads, indicated that diverting their attention to other work is an effective problem solving strategy when stuck. A11 described a

significant breakthrough that followed a period working on other office tasks. A20 described a pattern of working on tedious routine tasks when stuck for an answer. P1 takes a break when he gets stuck, by changing from one job to another. In his words:

... I usually have a half dozen jobs going at the same time, so as soon as I am stuck on one I go to the next... Sometimes one fertilises another... gives me a space to work on another one subconsciously... Quite often when I swap jobs I can come up with an improvement or a better result... P1.

Re-engage - One third of the respondents (15/45) stated that, when stuck, they would adopt an alternative means of engagement with the project in one or more of several ways. Methods nominated included changing from an output activity (ie. trying to conceptualise) to an input activity (eg. reading a magazine), re-representing the task differently, re-considering the task differently, or collaborating with others. Changing from an output activity to an input activity typically involved browsing through magazines and looking at earlier sketches and drawings. A01 proposed, looking at related precedents. A creativity invoking approach was described by A05 and A06. A06 described two types of looking activity, searching for precedents and exploring, with the intention to get excited and inspired and thereby invoke creative activity.

Representing the task in a different medium, different scale, level of abstraction, or degree of detail, was also advocated. P5 stated that discoveries often come when she is not working, that the process is unpredictable, but is influenced by what she is doing. P5 has employed a variety of methods to enhance her creativity and has successfully used changes of scale and medium as well as avoidance of routine as set breakers. A02, A04 and A05 also advocated changes of medium.

Re-engaging typically includes re-representation of the task, but more importantly, involves a more dynamic, active and free ranging interrogation of the main concerns of the project and intentionally taking a different approach. Such activities could be conducted alone, in conversations with colleagues, or by *workshopping*.

P4 described two examples of breakthroughs on major projects, made as a result of stepping back from the problem by abstracting it. He stated:

That's my basic way of relating to the world, to actually step back from it and abstract ... if that doesn't work you have to say to yourself... "I've just got the wrong model, I'll have to go away and wait until another model emerges, in my head" ... That's how I do things... I do have to be peaceful ...very rarely will an idea occur to me on the run. P4.

A04 and A07 described self interrogation and re-considering actions.

... ask myself, "why can't this be solved ... what is stopping a problem from being solved? ... what constraint is preventing resolution? ... what element can be removed?" A04.

... talk about it and sometimes, just to myself, I vocalise it out loud. I draw it about a thousand times. I go for a walk. I try to take myself out of the familiar. A07.

Several respondents clearly prefer to work collaboratively and to resolve problems by talking about them, or collaborating with others.

- ... Talk to others...Verbalising and getting feedback are both useful. A09.
- ... Generally it wouldn't be one person's problem in the first place. We would have all understood there was a problem, and there would be 2 or 3 people who would be involved. A12, A24.
- ... We work closely together. If it's a conceptual issue... we'll bat ideas back and forth on an hourly basis. We work in parallel and cross over and compare and contrast what we are thinking. A16, A15.

Either - Four respondents, A03, A23, A40 and P5 were inclined to choose between disengaging or re-engaging.

- ... Generate a solution that is completely weird, to get your mind out of this place and get it somewhere else... If that doesn't work I will leave it for a minute and go and do something else, and then come back to it, when my mind has been able to ease out of that place, by being somewhere else. A03.
- ... I think you're much better off to just leave it and just let it float around and attack it again from a fresh perspective and... ask yourself, well, what's not working? Why is it not working? A23.
- ... I just leave it. I can't keep grinding on... I mean you work on it, but you know, you sort of look at it... and maybe you go back and you revisit the site and you might look at the information that you've already got again. A40.

P5 described how changing scale had been effective, for herself and others, and acknowledged leaving her work in a prominent place, after disengaging.

- ... You see it by chance...the more you grapple with it the further away you get from solving it. You can only solve it unselfconsciously. P5.

Persist. Some individuals stated they would persist when stuck. Both A17 and A26 were frank and pragmatic;

- ... Just fob the clients off until I do. A17.
- ... Generally I keep going till I find something ... If time ran out I would just build it, as it was. Because, in the end... people can't wait forever. A26.

A32 and A39 are more difficult to categorise. A32 is a visualiser who, from his statements, is entirely at ease designing while lying in bed, or driving and he can retain his thoughts. His is a different kind of persistence to the designer slaving at the board.

- ... One house I am working on has a problem that prevents it being a great house. I can't bring myself to just move on. I need to resolve it. I find it hard to put it aside and come back later. I keep thinking about it. A32.

A39 described a deeper form of persistence, satisfied by applying different strategies.

- ... keep going till you get it... you've got to learn to know it, when you get it... you get very close to your work. So you're always looking for some sort of... mental break, that might channel your thoughts in a different way... talk to friends, go for a walk, leave it for two weeks, all sorts of things, and no one strategy. And you change your strategies according to how you're dealing with it... A39.

3.5 OTHER DESIGNERLY VARIABLES

In the course of the study several other variables were observed to be items of importance, but not yet analysed in detail, as they were not critical within the limited context of the initial

study. They include *representation preferences*, *quick versus reflective* decision making, *rational versus intuitive* designing and *creative catalysts*.

Representation preferences, are associated with, what Cross describes as, the use of *codes* to translate abstract requirements into concrete objects which can be used in object *languages*, referred to earlier. (Cross 2006). Although not systematically studied in the current research this appears to be an important action style variable. Extensive differences were found among the respondents.

Quick versus Reflective. The extent to which respondents considered themselves to be differently, or equally adept, when their work required decisions on the run, or a deeper and more considered approach, is another attribute that varied greatly. Like representation preferences, this variable appears to be worthy of systematic investigation.

Rational - intuitive. Respondents were not asked whether they are rational or intuitive, but many stated either, that: 1) they are rational or intuitive people, or 2) their designing involves a rational or intuitive process, or 3) they, or their designing, includes both rational and intuitive characteristics. This variable is interesting if only because, while intuition and insight are commonly associated, an association was not evident in the interview data. It is proposed that investigation into the connection between rational-intuitive as a measurable psychological attribute and the rational-intuitive variables that have emerged in this study is a sensible next step.

Creative catalysts. Respondents were asked if they have a favourite place, time, or activity which they associate with their creative work. This question was aimed at encouraging statements that may indicate insightfulness. A wide range of relevant responses were offered, also warranting future study.

4. CONCLUSIONS

Descriptions of expert designers can give a convergent impression of an ideal designer that could mislead and perhaps discourage students and aspiring designers, who don't view themselves as fitting a prescribed model. The evidence of this research is that designers diverge and converge. They choose or invent a range of designerly options, including focusing strategies and action styles. Many develop modes of latent preparation, as they gain skills and knowledge, of designing and of themselves. Becoming an expert designer involves self discoveries that accompany, and can be compared with, the realisation of designs. The

personal process of self realisation, like designing, involves many realisations and both gender and years of experience may lead apparently equally talented designers in different directions.

Schön's view, of designing being situated, (Schön 1983) is applicable to the task of becoming a designer. Just as designs are unique and situated, so are designers, each with his or her designerly intelligence, developing in practice. The natural intelligence of designing may be interpreted as the combination of components and facets of intelligence that are most natural, or native, situated in a particular individual. Such intelligence is complex, but it is not necessary for teachers or mentors to understand the subtleties of every individual in order to help them grow. This is the ongoing task for every aspiring designer. However teachers and mentors can guide students and aspirants to this realisation sooner and augment personal discovery processes, if they are more aware of the extent and nature of designerly variation.

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