

DISCOVERIES THROUGHOUT CONCEPTUAL DESIGN

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Abstract. This paper describes current progress of an interview study of architects which considers how these individuals design, focusing on breakthroughs and unexpected discoveries made throughout conceptual design. The study considers creative outcomes that occur while these individuals are not intentionally designing, as well as when they are, with the intention of identifying and evaluating evidence of latent creative activity. While not described in this paper, issues of insightfulness, based on a Gestalt perspective, are also considered in the study. The completed interviews described in the paper suggest that, in order to achieve breakthroughs, designers adopt distinctive methods of disengaging from currently unproductive designing. These may be categorized by degree and type of disengagement, or subsequent re-engagement. In general, disengaging, instead of persisting in designing, when apparently stuck, appears to be the rule rather than the exception. Statements by the interviewees suggest that discoveries during, or just after, times when they are not actively designing, referred to as *cold* discoveries, are more important than is currently recognized, which is scarcely at all. Statements describing interviewee experiences of discovery and providing indications of the genesis of discoveries are included in the paper. The paper discusses implications of the wide range of perceptions and experiences of each individual. One interesting finding is that individuals appear to experience and appreciate cold discoveries regardless of differences in key aspects of the way they design, described in the paper. This suggests that the genesis of *cold* discoveries may be as complex as that of discoveries in general.

1. Introduction

Many studies of design thinking have reported designers making unexpected discoveries, or experiencing realisations that have led to design solutions,

while working during single protocol sessions. Some studies have associated sketching and the use of sketches with the making of the discoveries. (Goldschmidt 1991 & 1994, Schon and Wiggins 1992, Goel 1995, Akin & Lin 1996, Suwa, Gero & Purcell 1999) In contrast, another series of protocol studies on blindfolded designers, have prompted an alternative proposal that designers can use their mind's eye as a virtual space, to model spatial ideas and to make visuo-spatial decisions, when prevented from sketching. Athavankar (1999) and Garde et al (2001) The above studies are also discussed in earlier papers (Murty and Purcell 2002, Murty and Purcell 2003)

An important implication of the blindfold research is that, as designers can conceivably use their mind's eye to solve problems at any time, it is possible that in the professional milieu of the designer creative design thinking might occur at any time. A further reason for thinking that creative thinking might occur at other times is the Gestalt theory of creativity, which proposes that solving novel problems involves; a) *insights*, or acts of recognition, typically involving a reinterpretation or reformulation of the problem, called *restructuring*, following the overcoming of; b) *fixations* or mental blocks, which is typically preceded by a period of inactivity; c) known as *incubation*. (Wallas 1926, Duncker 1945, Kaplan & Davidson 1988, Mayer 1995)

Concepts associated with insight, namely *restructuring*, *fixation* and *incubation* have been the subject of interest in both cognitive and design research. (Finke Ward and Smith 1992, Jansson & Smith 1991, Purcell and Gero 1996, Lloyd, Lawson & Scott 1996) However the frequency and significance of design discoveries occurring unexpectedly when, designers are not actively considering the problem, described in this paper as *cold* discoveries, has not been systematically studied.

2. The research

Collectively, the above factors have led the authors to question research which disregards creative activity that may be taking place when designers are not being observed, or when they are apparently idle. To test the question this study focuses on how individuals design and on breakthroughs and discoveries made at any time.

The research involves an interview study of conceptual design activities and discoveries by experienced, highly skilled architects, who regularly carry out conceptual design. The interviews focus on what these individuals are trying to achieve, their actual activities and the conceptual breakthroughs and unexpected discoveries they make, throughout conceptual design, not only when they are working, but also when they are not. The main aim of the

DISCOVERIES THROUGHOUT CONCEPTUAL DESIGN

research is to identify and evaluate evidence of latent creative activity, that takes place while the designers are not actively working.

This paper reports on responses from 33 Sydney architects (18 male:15 female) interviewed from late 2002 to early 2004. The interviewees are either receivers of architectural awards, from their professional body, or have been nominated as impressive practitioners, by the selected interviewees. Many are well known within the profession. Nearly all are currently principles in small to large practices, or senior designers in large practices.

The interviews are audio-recorded structured discussions conducted by the first author. In general the questions are open-ended to elicit pertinent revelations without leading, or inducing particular answers. Questions are grouped into four stages, as briefly summarized below.

1. Introduction. The interviewees are requested to describe career milestones and formative influences, challenges overcome, perceptions of past and current strengths and weaknesses and success attributes.

2. Designing and Designers. Interviewees are first asked to describe their design philosophy, and to name and discuss architects whose work they regard as the most outstanding. They are then queried; 1) generally, on the way people go about designing and differences in their way of designing, compared with others, then 2) specifically, about their way of conceptual design, how much it varies and has varied since commencing practice. A final pair of questions addresses whether the individuals progress steadily through projects, or fluctuate, and why they think this happens.

3. Working and Discovery patterns. A series of questions uses the familiar fictional detective Sherlock Holmes as a reference to elicit particular occupational attributes. Interviewees are asked to: 1) compare themselves, with the always inquiring, perpetual detective? 2) rate themselves, in relation to Holmes abilities, in being both quick on his feet and also reflective and contemplative, and 3) describe things they associate with their creative work. Further questions focus on the designers experiences: 1) getting stuck or being unable to resolve a tricky design problem, 2) when requiring and achieving a breakthrough during conceptual design, and 3) when breakthroughs or discoveries, although welcome, required work to be rethought or abandoned. Recalled events associated with each question are queried in more detail, with interviewees being asked to describe specific and general aspects of their experience.

4. Completion. The interviewees are asked explicitly about design ideas coming unexpectedly at times when not designing. A recalled event is followed by requests to describe specific and general aspects of the experience. Finally the interviewees are asked about anything else that may be important to their work, or which helps to explain 'how they tick', in order

to draw out any crucial unstated thoughts that might have been missed, or may have occurred during the interview.

3. Responses to key questions about designing

A summary of the interviewee responses is presented below and in two tables, located after the Conclusions. The first table charts the responses to the key questions about designing described below, by type of response. Sub-totals for different types of response and totals for each column are in bold text. Table 2 lists the responses to the same questions by all of the interviewees. In both tables the column numbers match the corresponding sub-section heading numbers below. To assist comprehension and table comparisons, negative, or exceptional responses are displayed with inverse text. Table abbreviations are included with sub-headings below.

3.1. CONCEPTUAL APPROACH

Responses to interview questions about design philosophy and how the interviewee and other architects go about designing revealed significant differences of focus. This can be described in terms of both *breadth* and *direction* of focus.

With regard to *breadth*, there was a noticeable division between responses that were general, abstract and broadly focused (24/33) and responses that were specific and concrete, with a particular focus (9/33). The most characteristic feature of the general responses were statements that referred to typical attributes of projects, goals and activities. The most characteristic feature of the specific responses were statements that referred to the particularity or uniqueness, of either the projects, or the approach the architect would take for each project.

With regard to *direction*, the distinction between solution-focused and problem-focused strategies has been observed by Lawson, in a study of architecture students and science students. Lawson described the scientists as having a problem-focused strategy and the architects as having a solution-focused strategy. Lawson (1979) However the degree to which the architecture students, or indeed practicing architects, are solution focused was not addressed in Lawson's study. The evidence of the individuals in this present study shows considerable variation. Most responses (20/33) are oriented towards the architecture, design goals or solutions, but some (3/33) are oriented towards the problem or context and a lot (10/33) address both, by focusing either on the process or the project 'essence'. Nearly all of the architects whose focus was on design process (rather than either solution or problem) also proposed a general focusing strategy (8/10).

DISCOVERIES THROUGHOUT CONCEPTUAL DESIGN

An indication of the range and flavour of statements exemplifying these approaches is presented in the selected response listed below. Note that no claims are being made about how flexible or rigid these individuals are in their designing. In fact the cited statements attributed to individuals were not always exclusive. Some made multiple statements, indicative of a broader perspective, or of a capacity to adopt and adapt different strategies when necessary.

3.1.1. General / Solution Focus (14/33) - Gen/Soln

- "Understanding that architecture is about idea as much as shelter." (A04)
- "Creating new architecture that is stimulating and challenging, yet relates to the people it's designed for." (A06) (A24) also referred to architecture for people.
- "Doing buildings that are technically well conceived and resolved, but which are interesting in a conceptual way." (A16)
- "Moving forward, being contemporary, using the latest light-weight technology and hands-on passive techniques... where every element does more than one job." (A32)

3.1.2. General / Context Focus (2/33) - Gen/Cntxt

- "I think looking for the parameters is probably my design philosophy...testing them, seeing what they are, seeing how much they can bend.. (A07)
- "Our work is in the city...constrained...We rely on constraints, look at site, get spatial sense of what client wants and work with that. Not very conceptual...If site is freer we will have a go." (A17) This architect also articulated a process orientation, stating; " We don't have a style, but a theoretical approach that is repeatable."

3.1.3. General / Process Focus (8/33) - Gen/Proc

- "Methodical, deterministic, grounded in the historic process, in precedent, in the environment and very much in the requirements of the brief." (A01)
- Research based, analytical...Likes working with artists and other people. (A11)
- "One needs to see design as a process, involving others." (A19)
- "A rational approach to a design problem...methodic and thorough." (A27)

3.1.4. Specific / Solution Focus (6/32) - Spec/Soln

- "There is one right solution, in terms of organic form ... (A02)
- "I approach each design afresh...A good design can be distilled into a simple essence, or clear idea." (A03) Comparable thoughts were expressed by (A15)

- "Our designs are very site specific. In every one we try to seek out an idea which is strong, can be tested, that will drive the project." (A18) Another (A29) also expressed a site specific approach.

3.1.5. Specific / Essence Focus (1/33) - Spec/Essn

- "Try to understand the essence of the project. Designing involves defining that essence and the essential way of realising and expressing that essence. Method involves spending time on site and with the client, in effect an immersion process, combining lots of sketching and contemplation." (A05)

3.1.6. Specific / Process Focus (2/33) - Spec/Proc

- "Try and work with site...and also personalities of clients...Intuitive approach ...Like to treat every job as different so I don't get caught in a rut...Still evolving." (A10)

- "No typical project. Always come back to the program, site and context - mapping it, trying to distill a diagram...use collaborative approach, working as a team...ideas arriving from that, rather than pre-empting...brings additional richness." (A23)

3.2. INCESSANCY

During the interview, subjects are asked: how they would compare themselves as an architect, with a described image of the perpetual detective, who was always on-the- case, Sherlock Holmes. Use of the verbal imagery of Sherlock Holmes was employed, both to help get across a series of questions and as a relief from more direct probing questions that precede and follow. The detective metaphor prompted observations of analogies between detective work and aspects of being an architect, such as analysing the site and working out what the client really wants. That being said, most interviewees responded positively to the incessancy aspect of the question.

3.2.1. Always the architect (24/33) - Always

Most affirmed they were incessant practitioners in one form or another by always either, thinking, conceptualising, processing, enquiring, exploring, investigating, or seeking. Some, like (A05) simply agreed, however the remainder tended to respond to one, or both of the two aspects of incessancy expressed in the wording of the question, namely being the perpetual practitioner, and always being on-the-case.

Being perpetual: Representative responses included:

- "Spot on description...My children are embarrassed by my tapping walls etc. Always enquiring." (A04) There were similar comments, by (A32) and (A09) who concluded succinctly that he was; "Never not an architect."

DISCOVERIES THROUGHOUT CONCEPTUAL DESIGN

- "...always looking at things... the whole gamut of life's things...it's often (the) lateral thinking, divorced from what you are doing, that Sherlock Holmes would suddenly think of. He'd get that spark." (A13)
- " Absolutely the same. The majority of the conversations when we go on holidays are about architectural things." (A30)
- "...always investigative. Drive around looking at buildings and absorbing, seeing how buildings relate." (A08)
 - Being always on the case:* Representative responses included:
 - "Agreed...I am pretty rigorous throughout the process of design... some things work well early on...but other things require more....and so you keep working at it until you get to a satisfactory point. (A06)
 - "We are perpetually looking for the best possible solution..." (A16) Referring to a recent completed design, (A16) added; "we have gone back and re-explored, because we want it to be brilliant. We are not billing the client for this."
 - "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)

3.2.2 Not always (9/33)- No

Some exceptions were also not entirely at odds with the majority :

Visual: One referred to possession of a 'photographic visual spatial memory' which, enabled recollection of previously experienced buildings and permitted designing to occur at any time. (A10)

Situational: One said; "Depends on project...Some...you get excited about...then like Sherlock you think about it often. Other times you need to force yourself." (A22) Similar comments were made by (A26). Another described how disappointments (eg. losing competitions) can reduce zeal and emphasised the need to recover. (A23)

Inhibited by partner: One described her partner as; "the most excited by everything about him that I have ever met...I'm average compared to him. Always looking, talking, insatiable curiosity...It used to be me. I've stopped because he won't stop. (A15)

Advocates of getting away from work. Other interviewees, described positive benefits in not always being on the case.

- One, with diverse responsibilities, accustomed to switching from one activity to another, spoke of frequently receiving ideas when not thinking about work. (A20)
- One, who described architecture as an intuitive process involving reflection, stated; "Architecture is such an intense profession, but it is important to not always be on the case...we've got to be careful to pull back from it." (A21)
- One, referred to the subconscious and ideas emerging in one's sleep, stating about designing; "Sometimes you have to leave it...Don't stay on the one thing all the time." (A31)

Finally, (A18) stated; "not always on the case" but didn't elaborate.

3.3. STATEMENTS ABOUT REACTIVATION, WHEN STUCK

Interviewees are asked: "If you do get stuck or can't resolve a tricky design problem, how do you deal with it?" The question of how one copes with getting stuck drew a variety of answers. In general, disengaging from designing by various degrees, instead of persisting when apparently stuck, appears to be the rule rather than the exception. The interviewees' responses may be categorized by type of disengagement, as described below.

3.3.1. *Disengage* (14/33)

More than one third of the interviewees exhibited confidence in their capacity to solve problems, when they were stuck, by disengaging from the project in one or more of several ways. Methods range 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 on other tasks.

Disengage/Passive - Diseng/Passive: Seven recommended disengaging from designing when stuck and ignoring work for a time, without suggesting any particular alternative activity. Examples include:

- "Put it away for a while...No regular procedure...Not so frequent. (A10)
- "Forget about it." (A21)
- "Put it aside and come back to it later." (A22)
- "Put it aside ... The best way is to try to ignore it. The cliché is you think of it on waking or driving. That's what I call intuitive." (A30)

Disengage/Get-away - Diseng/G'away: Five recommended getting away from the place of work. Examples include:

- "You've just got to get away and clear your mind and then suddenly, you know you ... might get the idea." (A08)
- "I would leave and not worry about it and come back tomorrow morning." (A14)
- While it was not nominated as a first choice when stuck, some described travel, especially air travel or train journeys as conducive to problem solving.

Disengage/Active - Diseng/Active: Many of the interviewees also recommended physical activities like kayaking, swimming, walking or bicycling as being conducive to quiet reflection or allowing the subconscious to function. Many also spoke of having a significant artistic interest, mostly painting or drawing, which they could turn to as a form of creative recovery and stimulation. However only two nominated another activity as a first choice. Both of these nominated other tasks.

- One described a significant breakthrough that followed a period working on other office tasks. (A11)

- One described a pattern of working on tedious routine tasks when stuck for an answer, stating; "You get everything else done and your brain can actually think about something else." (A20)

3.3.2. *Re-engage (14/33)*

An equally large number of interviewees 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:

- Change from output activity (ie. trying to conceptualise) to input activity,
- Re-represent the task differently
- Re-consider the task differently

The term 'task' is used here in a general way to mean any large or small subset of a project, that the designer may get stuck on.

Re-engage/Output to input - Re-eng/O'Input : Changing from an output activity to an input activity typically involved browsing through magazines and looking at earlier sketches and drawings.

- Looking at related precedents was proposed by (A01).
- 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.

Re-engage/Re-represent - Re-eng/Re-repr: This category includes representing the task in a different medium, different scale, level of abstraction or degree of detail.

- Making a model, enabling a different view and testing of ideas. (A02)
- "Change the medium I am using to explore the problem, going from drafting to freehand, or from drawing to model and then back again," was proposed as one of several actions by (A04).

Re-engage/Re-consider - Re-eng/Re-con: This category typically includes re-representation of the task, but more importantly, involves a more dynamic, active and free ranging interrogation of the main concerns. Methods nominated by the interviewees included.

- Talking about the task or whole project
- Querying the project
- Taking a completely different approach

These activities may be conducted alone or in conversations with colleagues or 'workshopping.'

- "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)

- "Generate a solution that is completely weird, to get your mind out of this place and get it somewhere else." (A03)

Re-engage/Collaborate - Re-eng/Collab: Several interviewees clearly prefer to work collaboratively and to resolve problems by talking or working 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)

- "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)

3.3.3. *Persist* (3/33) - **Persist**

Some individuals stated they would persist when stuck.

- "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)

- "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)

3.4. EXPERIENCE OF *COLD* DISCOVERY

The majority (28 of 33) interviewees, apparently regardless of the way they design as described in the earlier sections, affirmed that *cold* discoveries, when they are not actually working on their design, are a factor in their designing.

They were asked: "How often do you find design ideas come to you unexpectedly at times when you are not designing? The answers to this question were mostly clear cut and brief. Statements such as; "a fair amount," "reasonably often," "quite often," "very often," "lots," "always," or "all the time," are shown in column 4.4 of Tables 1 and 2 as "often." In both tables, "infrequent," unclear and unrecorded responses are shown with inverse text.

Illustrative examples of responses are listed below.

3.4.1. *Frequent cold discoveries* (25/33) - Frequent

Those who responded positively, were often very enthusiastic about this aspect of their intelligence.

DISCOVERIES THROUGHOUT CONCEPTUAL DESIGN

- "Very much so. That's when most of my design ideas come, when I am actually not concentrating on that project." (A02)
- "A fair amount, because I spend a lot of time not actually designing. Often at those times ideas will come up." (A03)
- "Oh often...you know. Often it's not when you design, it's when you are in the shower ... actually I do a lot of thinking in the shower." (A05)
- "They always come to me unexpectedly when I am not designing. I find that it's when you stop thinking about a problem that you are most likely to come to some understanding of how to resolve it." (A06)
- "Most of the time. Unexpected in their timing but not unexpected." (A09)
- "Quite often...I find that a lot of things come to me when I am in a relaxed state of mind and thinking about something entirely unrelated." (A16)
- "Very often...I solve more problems when I am drawing, but...some of the best things... come when I am not working at the drawing board." (A20)
- "All the time. Sometimes in the middle of the night...I love that part of the brain." (A29) "It happens all the time," was also stated by (A32) and (A33).

3.4.2. *Infrequent cold discoveries (3/33)* - *Infrequent*

These included:

- "Occasionally, but not often." (A18) The interviewee did not elaborate.
- "Every now and then...driving along, or I will see something." (A25)
- "Wouldn't happen too much for me." Interviewee described driving as a good time to think and spoke of design ideas occurring unexpectedly, but stated these were not a frequent experience. (A26)
- Three interviewees who did not answer the question in a simple yes-no manner, have also been classed as infrequent. (A11, A21, A22)

3.5. ATTITUDE TO *COLD* DISCOVERY

Many of the interviewees differentiated *cold* discoveries positively, using terms such as; "stronger", "potent" and "innovative," and those that come while working, as; "more controlled," "practical" and "predictable." Like the reported experiences of *cold* discovery, reporting of this perception does not appear to be related to recorded aspects of way the individuals design.

Abbreviated statements by the interviewees are shown in column 4.5 of Tables 1 and 2. In both tables, unclear and unrecorded responses are displayed with inverse text. Qualified positive responses are shown with grey text. Illustrative examples of responses are listed below.

3.5.1. *Clearly Positive* - Clear +ve

Clearly positive remarks described three broad aspects of *cold* discoveries.

their quality, their content and their utility.

Quality: Many descriptions emphasised clarity power or potency of *cold* discoveries. For example:

- Clearer: "You get the sense of bits clicking together in a simpler way, because it's happening in your head. All things are possible. There's a clarity..." (A04) Another, (A17) said; "The break helps to clarify."
- Stronger: "Stronger, better, but need testing...I don't know if I really get the strong ideas at the board. I don't think it happens that way." (A05) Another, (A16) said; "Stronger when not trying to come up with something."
- More resolvable: "I don't think there is much difference in the initial sense, but... when I get the idea down onto paper I find the (non work) ideas are a lot more resolvable than the ideas that I have been struggling with at my desk." (A07)
- Essential: "Sometimes they don't translate in detail, but the gist will work. The guts will be there. Because your not constrained by scale. Maybe thinking of the visual. Thinking of the essence a bit more." (A13)
- "More insight. I think a lot of ideas, or clarity of thinking probably comes when you are not trying." (A23)

Content - Some descriptions focused on what the discoveries were about.

- More specific. One interviewee said ideas that happened when not working tend to be quite specific, 'bug fixes' for example, whereas; "Big concepts, you have to work on." (A09)
- "Generally it would be that you had worked on the problem without resolving it, so it's ticking in your mind." (A12)
- Improvements: "They might be something completely different, like thinking about it from another, totally different way of thinking, almost like turning the whole thing around the other way.' <and that they> 'might make an existing idea better or more exciting, rather than something completely new." (A10)
- "Tend to be ideas about components, that lead to ideas." (A27)
- Key things. "When you are working you are attacking the big strategies which require certain key things in order to work. It is the key things that you mull over, that make it different that need to be solved. They are the things that make this thing different ... maybe a junction. Often it is the practical things that make the design work ." (A31)
- "The ones that come to you when you are not seeking for ideas are not necessarily related to any project, they are just something that crossed your mind, something nice to try." (A24)

Utility - Some descriptions focused on emotional or qualitative aspects of *cold* discoveries

- One individual characterized some *cold* discoveries as; "feelings about ideas," stating: "I tend to know if they are the right idea or not, only after not looking...and thinking about the way they feel." (A02)

DISCOVERIES THROUGHOUT CONCEPTUAL DESIGN

- "It opens up the corridors. It takes you out of the groove you are in. You need to break the pattern." (A19)
- "The ideas from outside are gentle and push the boundaries. The ideas in here are more conservative." (A33)
- One individual didn't like to spend office time conceptualising; "I feel guilty sitting at my desk designing. I feel I am time wasting, paying for child care for two children." (A15)

3.5.2. *Qualified Positive* (7/33)- *Qualified +ve*

Some interviewees were happy to make *cold* discoveries, but were less prone to attribute exceptional positive features to them. Responses included:

- "Lots of ideas come floating through, possibilities, but sometimes a chimera... seem to have substance but may not. (A01)
- Ideas might be more general, less specific than other types of breakthroughs. (A06)
- Unconstrained...sometimes the enthusiasm wanes after that initial moment (A26)
- "Normally minor." (A11) "Peripheral things or components." (A25)
- "These ideas are sometimes deficient when analysed." (A28)

3.5.3. *Unclear* (5/33) - **Unclear**

Some interviewees did not attribute any distinguishing features to *cold* discoveries.

- "It is more dependant on other things as to when those design ideas will emerge ...they are equally likely or equally potent." (A03) "Interchangeable." (A20)
- No difference. One individual (A32) who does most of his designing in his head before drawing, stated that breakthroughs came to him in the same way whether he was at his practice or elsewhere.
- Difficult to compare. (A30) The distinction for this individual was that *cold* discoveries were solitary while, at work, discoveries were typically made with other people. Both were enriching.

- Can't recall or nothing to describe. (A08 and A18)

The first statement, suggesting other situational factors may be more critical than the timing of the discovery, points to an issue of the extent to which *cold* discoveries are the result of ongoing mental activity or are prompted, perhaps arbitrarily, by one's surroundings.

4. Conclusions

The evidence of the thirty three architects interviewed so far strongly indicates that experienced, highly skilled designers adopt a range of different methods of achieving design breakthroughs when they get stuck while designing. Over 80% of the interviewed practitioners employ a variety of methods of disengaging or changing their mode of engagement with unsolved problems. Positive descriptions of *cold* discoveries by most interviewees suggests their faith, that disengaging from active designing is sometimes more fruitful than persisting with designing, is well founded. Both the reported frequency of these discoveries and the expressions of their value suggest that *cold* discoveries are more important than is currently recognized. One interesting finding is that individuals appear to experience cold discoveries regardless of their conceptual approach to designing, incessancy and methods of reactivation. This suggests that the genesis of *cold* discoveries is complex, perhaps as complex as that of discoveries in general.

Further interviews are currently in progress. A second interview with each practitioner is also being planned, to confirm what has already emerged, to further explore relationships between designers' conceptual approaches, modes of incessancy and reactivation, additional factors and subsequent discovery outcomes and to prepare for deeper qualitative and statistical analysis. This will be the subject of future papers.

TABLE 1 - Responses to Key Questions about Designing - By Type of Response

3.1 Conceptual Approach	3.2 Incessancy	3.3 Reactivation	3.4 Experience <i>cold</i> discov	3.5 Attitude to <i>cold</i> discov
Gen/Solutn 14	Always 24	Diseng/Passive 7	Frequent 25	Clear +ve 18
Gen/Contxt 2	No 9	Diseng/G'away 5	Infrequent 8	Qualif. +ve 7
Gen/Procss 8		Diseng/Active 2		No diff 3
24		14		Unclear 5
		Re-eng/O'Input 2		
Spec/Solutn 6		Re-eng/Re-repr 1		
Spec/Essnce 1		Re-eng/Re-con 4		
Spec/Procss 2		Re-eng/Collab 7		
9		14		
		Diseng+Re-eng 2		
		Persist 3		
Total 33	Total 33	Total 33	Total 33	Total 33

DISCOVERIES THROUGHOUT CONCEPTUAL DESIGN

TABLE 2 - Responses to Key Questions about Designing - By All Interviewees

ID	3.1. Conceptual Approach	3.2. Incessancy	3.3. Reactivation	3.4 Experience <i>cold disc.</i>	3.5. Attitude to <i>cold disc.</i>
A01	Gen/Proc	Always	Diseng/Passive	Infreqnt	Qualified +ve
A02	Spec/Soln	Always	Re-eng/Re-repr	Often	Most creative
A03	Spec/Soln	Always	Diseng+Re-eng	Often	No difference
A04	Gen/Soln	Always	Re-eng/Re-con	Often	There's a clarity
A05	Spec/Essn	Always	Re-eng/O'Input	Often	Better
A06	Gen/Soln	Always	Re-eng/O'Input	Infreqnt	Qualified +ve
A07	Gen/Cntxt	Always	Re-eng/Re-con	Often	Resolveable
A08	Gen/Soln	Always	Diseng/G'away	Often	Unclear
A09	Gen/Proc	Always	Re-eng/Collab	Often	More specific
A10	Spec/Proc	No	Diseng/Passive	Often	Improvement
A11	Gen/Proc	Always	Diseng/Active	Unclear	Qualified +ve
A12	Gen/Soln	Always	Re-eng/Collab	Often	Problem solutn
A13	Gen/Soln	Always	Diseng/Passive	Often	Have essence
A14	Gen/Soln	Always	Diseng/G'away	Often	Resolve details
A15	Spec/Soln	No	Re-eng/Collab	Often	Time effective
A16	Gen/Soln	Always	Re-eng/Collab	Often	Stronger
A17	Gen/Cntxt	Always	Persist	Often	Helps clarify
A18	Spec/Soln	No	Diseng/G'away	Infreqnt	Unclear
A19	Gen/Proc	Always	Diseng/G'away	Often	Opens corridors
A20	Gen/Soln	No	Diseng/Active	Often	No difference
A21	Gen/Soln	No	Diseng/Passive	Unclear	No difference
A22	Spec/Soln	No	Diseng/Passive	Unclear	Unclear
A23	Spec/Proc	No	Diseng+Re-eng	Often	More insight
A24	Gen/Soln	Always	Diseng/G'away	Often	Nice to try
A25	Gen/Soln	Always	Re-eng/Re-con	Infreqnt	Qualified +ve
A26	Gen/Soln	No	Persist	Infreqnt	Qualified +ve
A27	Gen/Proc	Always	Re-eng/Collab	Often	Leads to ideas
A28	Gen/Proc	Always	Re-eng/Collab	Often	Qualified +ve
A29	Spec/Soln	Always	Diseng/Passive	Often	Qualified +ve
A30	Gen/Proc	Always	Diseng/Passive	Often	Unclear
A31	Gen/Proc	No	Re-eng/Re-con	Often	Key things
A32	Gen/Soln	Always	Persist	Often	Unclear
A33	Gen/Soln	Always	Re-eng/Collab	Often	Push boundaries

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