Sketching to learn, learning to sketch

students' ways of sketching in architectural designing

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Statement of Authorship

This thesis is my own writing.

Any help I have received in carrying out this research and in the preparation of this thesis has been acknowledged. All information sources, sketches and literature used are indicated in the thesis.

This thesis has not been previously submitted in whole or in part for a degree in another institution, nor has it been submitted as part of requirements for a degree, except as fully acknowledged within the text.

The sketching and interview data for this research was collected from students at the Faculty of Architecture, Design and Planning, University of Sydney in ways consistent with the terms of the University of Sydney Human Research Ethics Committee approval, Reference No. 8549.

Signed:

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Abstract

Architects when sketching take time to pause, to look, to sketch, to look and sketch again. Described by some as the passing of an idea, a place or an experience from eye to mind to hand, the act of sketching is a means by which architects come to see and to understand the unfolding outcomes of their designing and make sense of aspects of the world. For many practitioners, scholars and eminent architects, sketching is fundamental to their architectural disposition and an integral part of thinking in an architectural way. To become architects, students need to learn this kind of sketching and few students in the early years of their studies are able to sketch in this way. Experience in teaching reveals architecture students are able to produce sketches, yet many struggle to grasp how to use their sketching as an integral part of their thinking and of progressing their designing. Far too rarely is using sketching an explicit focus of teaching and learning in the design studio.

This research is directed towards understanding the different ways students are sketching when designing, on the basis that understanding these ways provides a useful and appropriate basis upon which to found improvements in teaching and learning about sketching in the design studio.

Synergies between architectural sketching, visual thinking and how students learn, give rise to an investigation into the ways students are sketching, its approach, the form and collection of the data, the tools of analysis and means of interpretation founded on what is shared. The phenomenographic perspective on teaching and learning (Marton and Booth 1997) provides a means to analyse students' sketching, its iterative and interwoven cycles of considering, discovering and reinterpreting, suited to making sense of and seeing below the surface of the loose, searching and at times unclear design sketching. The analysis findings identify and describe differences in what and how students are sketching and are synthesized into a visual framework of 'palettes', describing three different and increasingly complex ways students are sketching.

Using the descriptive framework in the studio offers students and teachers, through the understanding it depicts and the language it provides, opportunity to see, to make sense of, to compare, to complement, to improve and to discuss their own sketching and the sketching of others, and in so doing provides a means by which to help bring sketching into being an explicit focus of the day to day exchanges which lie at the core of learning in the design studio. Consideration is given to how teaching and learning in the studio might change were sketching to take this focus.

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Perhaps most importantly I would like to thank my family. Nick my partner, who in addition to offering support to my candidature on a daily basis, as a practicing architect has maintained a clarity in how he sees the work, drawing on this to inform his comments and his willingly provided editorial support. To Anna and Peter, both committed young students in their own right, thank you for seeing the worth in what I was doing and for your undoubting belief in my ability to bring it all together.

Finally and sadly I would like to thank my mother, Jean Rice who in unexpectedly passing away in April this year was unable to see the fulfilment of my focus for the last few years. Her tenacity and determination to see things through meant I had no option but to keep moving forward.

Prologue

This research has its origins in my twenty five years of experience teaching and co-ordinating students' learning in designing and drawing in the design studio. In watching what students do, what teachers do and how teachers and students engage with each other through the exchanges of design learning, it has become apparent that many students, even those well into their architectural studies, struggle to use their sketching as an integral part of their designing. Students produce sketches but they are not necessarily able to engage with their sketching as a means of coming to see, to understand and to progress their designing thinking. Students, it would appear find learning how to go about using their sketching difficult and my observation is that teachers rarely consider using sketching as needing to be an explicit focus of their exchanges with students, assuming students somehow pick it up on the go.

This is surprising because for architects, sketching is fundamental to our thinking, it is part of our architectural disposition and part of the way we take in and engage with the world around us. We find ourselves drawing in our practice, in teaching, in our day to day exchanges with colleagues, clients, team members, students, family and friends. When something needs to be explained, to be explored or understood, it is a natural tendency to pick up a pencil and draw. As teachers we know we are making progress when a student takes the pencil out of our hand to sketch out the point they are making.

Some students more readily grasp what sketching has to offer. For others sketching is so unlike anything they have ever done before they have no idea how to get their thoughts out on paper in visual form. It is apparent that our teaching needs to improve but it is not obvious how to do so. Experience in teaching can let us see the problem and experience in practice might mean we are good at sketching ourselves, but these do not tell us how we might bring sketching into the foreground of our teaching. We need to find ways to explicitly focus on using sketching in design teaching. How do we do this? How might we think about such changes, what might they be and on what basis do we make them? This research hopes to address these questions.

The design studios where I teach in the Faculty of Architecture, Design and Planning, at the University of Sydney, have not only provided the source of these observations but also provide the setting for this investigation. It is the place of study for the student participants and the wider body of students to whom I hope to give something back to through the outcome of this research, the same students who by their keenness to learn, provide me with ongoing inspiration. The studio is also where I hope the findings of

this research will be of particular use and if it proves to be, this research will have met its aim. Although centred on one school of architecture, the issues relating to learning to use sketching in the studio are issues which lie at the heart of becoming an architect, and one might expect these issues to be shared with architectural schools in different parts of the world.

As an architect sketching for me is a fresh, vital and evocative form of expression which lets me see my thinking, gives me a way of working through my designing and reveals new ways of seeing things around me. I recall in my earliest exchanges with my PhD supervisor, Simon Barrie wanting to know whether I could tackle the research ahead through my sketching. His response was a raising of an eyebrow. Over the period of my candidature I have become better at developing a word centred line of thinking and his growing insight into my way of working has led him to suggest I turn at times to drawing, to discover new and different ways of seeing things, some of this sketching becoming the diagrams included in this study. I now notice with a smile Simon's increasing tendency to reach for a pencil to draw his way through the points he is making, the shift in both of us an unforeseen outcome of this candidature.

I have always regarded sketching with a certain wonder and respect for through the act of drawing a sketch, you are able to reveal things unforeseen or previously unintended. So when you sketch the experience of discovering, of coming to see something in a new way is opened to you. Doing this research, looking closely into the sketching of students, working through and making sense of what and how students were sketching felt not unlike the very act of sketching itself, as through the process new understandings have come to light. With a view to sharing this quality of revealing I have included where possible architects' and students' sketches, hoping they offer the reader insight into the very nature of sketching and the opportunities it presents.

Outline of the thesis

The prologue opens the thesis in a voice intended to give the reader an inroad into some of the personal origins of the investigation, the background from which I write and hopefully get an inkling of the sense of enjoyment I take from working with sketching and with students.

The thesis itself is divided into seven chapters. Chapter 1 introduces freehand sketching, the loose and evocative drawing an architect does. Through a series of sketches and quotations from masterful architects, practitioners, scholars and architectural educators, a window is offered into sketching to reveal the significance sketching has for these architects and how closely their sketching is related to

their thinking, to developing their architectural understanding, to their designing and as a means of coming to see things in a new way. Sketching as a form of visual thinking is considered and freehand sketches are positioned within the range of drawing types used in architectural practice. The chapter establishes the interest of this thesis as lying with the act of sketching, as distinct from the sketches themselves, more particularly it lies with how architects use their sketching as a means to develop their architectural understanding.

Sketching, despite its significance to architects is often not an explicit focus of teaching and students find it difficult to learn how to go about sketching. Chapter 2 shifts the focus from architects and on to students and explores issues relating to teaching and learning about sketching. The design studio is introduced as where this learning takes place and students' designing as the immediate setting within which learning about sketching happens. The ways we currently teach and students learn about sketching are described and existing research into sketching, visual thinking and design learning is explored to see what it can offer in relation to learning about sketching. The chapter raises a number of concerns needing to be addressed before sketching can become an explicit focus of teaching and learning, a necessary change if studio teaching is to help students to develop their sketching as a key feature of their emerging architectural disposition.

Chapter 3 explores how research into students' learning about sketching might be approached so as to address these concerns. Our interests position the research across three domains of knowledge: architecture, cognitive psychology and education and a series of aims and intentions are established against the background of these domains. The chapter explores aspects of existing research which have a bearing on how this current investigation might be approached and conducted. Certain synergies emerge between architectural sketching, visual thinking and learning, in particular the view of learning which lies at the foundation of a phenomenographic approach to research. Coupling these synergies with what is understood of the difficulties students face in their learning and how central sketching is for architects, a brief for an investigation is established outlining what is wanting to be achieved and in so doing it also becomes a measure against which the outcomes of the investigation can be tested.

With the brief giving direction, Chapter 4 describes an investigation, the object of which is to identify different ways students are sketching, a way of sketching able to be understood in terms of 'what' students are sketching and 'how' students are sketching and the relationship between. Details of the investigation are described, explaining how and from whom the sketching and the spoken responses were elicited, the nature of the design task and the way the phenomenographic interviews were conducted. Preparation of the data for analysis is explained along with each of the steps and measures

associated with the iterative process of phenomenographic analysis, necessary so as to give a full understanding of how the phenomenographic approach has been adapted to suit working with students' sketching. The researcher's concern with being faithful to students is made explicit and described in relation to the object of study, the orientation, the design, the analysis and the conduct of the investigation.

Chapter 5 presents the findings of the investigation in phenomenographic terms as two outcome spaces. One describes the observed variation in 'what' the participating group of architecture students were sketching, the second describes the observed variation in 'how' they were sketching. The categories of description which comprise each outcome space are described in terms of their defining features, their structural aspects and associated meanings and are illustrated by examples from the students' sketching and the spoken responses. The relationships between categories are explored and an hierarchical order of increasing complexity associated with each of the outcome spaces is described.

Chapter 6 considers relationships between 'what' and 'how' students were sketching, synthesizing the interactions into a descriptive framework. Three 'palettes' are proposed as depicting three interrelated, qualitatively different and increasingly complex ways of sketching. The characteristics of the framework as a whole are explained along with the detail of the features associated with each palette.

Chapter 7 considers and illustrates how an understanding of different ways of sketching as depicted in the framework, might be used by students and teachers in the design studio. It looks at how the framework, through the understanding it depicts and the language it provides, offers students and teachers opportunity to see, to make sense of, to compare, to complement, to improve and to discuss their sketching and the sketching of others, and in so doing, helping to enable sketching to become an explicit focus for teaching and learning in the design studio. The chapter goes on to suggest how teaching and learning in the studio might be different were sketching to take on this focus and closes by stepping back to see how the investigation meets the terms of its brief and how it might lead into subsequent research.

The epilogue draws the thesis to its conclusion and returns to the personal voice opened with in the prologue to reflect on the candidature as a whole and the learning that has been involved, and brings to the fore certain personal discoveries made along the way.

Chapter 1 *Architects and sketching*

How central the use of sketching is for architects

Freehand sketching is highly regarded as a means to think in an architectural way and an integral part of architectural designing. It is a way of coming to see, coming to understand aspects of the world in which we live. Sketching is not merely a tool for making visual representation or a particular skill, rather it is something we do which is fundamental to our practice and part of our architectural disposition.

Architects know of the inseparable relationship between sketching and thinking. Jørn Utzon (1981) in the adjacent sketch Figure 1a expresses this relationship with ease and an economy of lines. Glenn Murcutt (2008) in the opening words of a master class lecture passionately explained to a full theatre of students:

> *The moment you start to connect drawing with thinking, it becomes discovering and architecture is a process of discovery, the discovering of possibilities.* (Murcutt 2008)

In an interview after he was awarded the Pritzker Prize in 2002, when asked about the importance of drawing Murcutt replied:

> *When we lose the ability to draw, we lose a part of our ability to think.* (Murcutt 2002)

The term 'sketching' throughout this thesis is used to mean the act of sketching as distinct from merely the marks on a page and architects use their sketching in different situations, for different purposes, they go about it in different ways, and value sketching for different reasons.
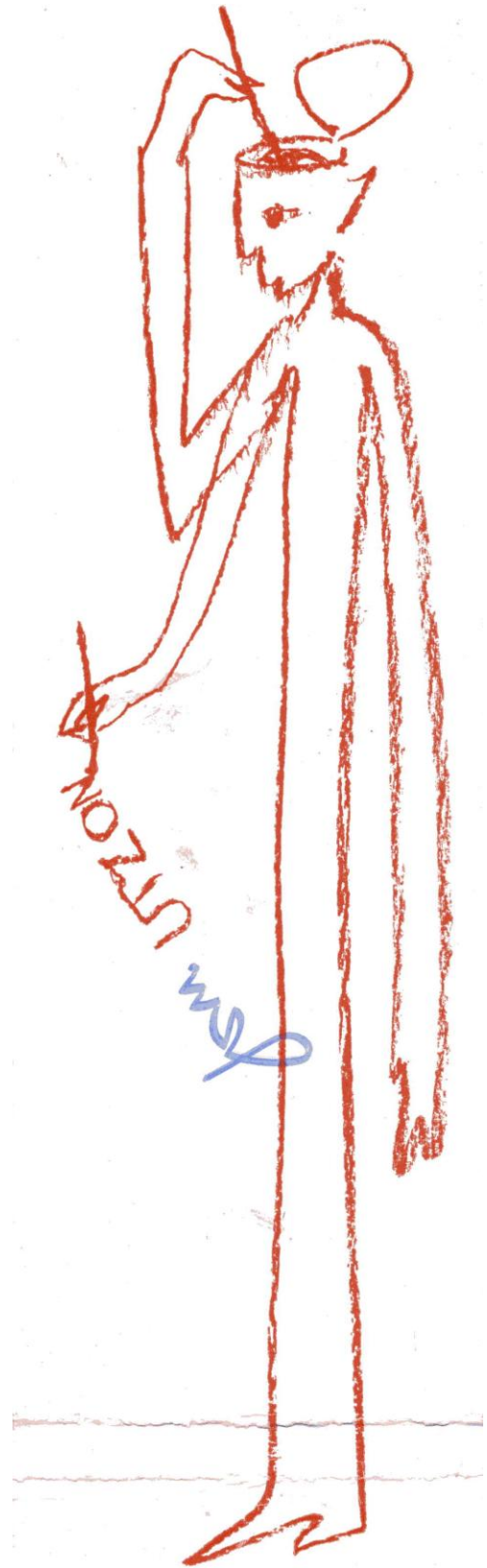
Figure 1a. Utzon's sketch of himself
Source: A personal card sent to the author

To give the reader a feel for the evocative and expressive sort of sketching we are talking about and their differences, the following examples are early design sketches done by a number of eminent architects ranging across fifty years. (Figure 1b)
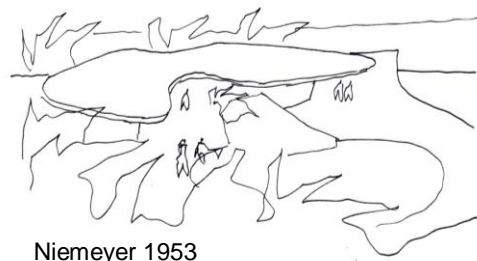
Niemeyer 1953

Aalto c1959
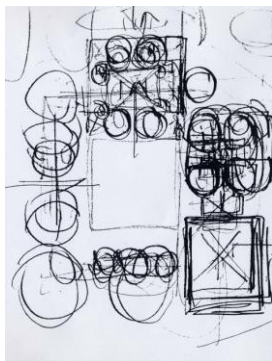
Kahn 1962

Utzon 1973
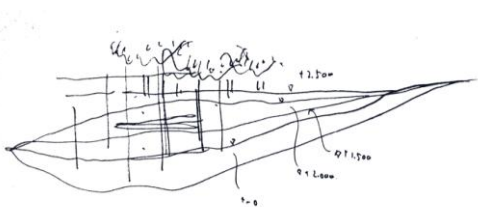
Ando 1986
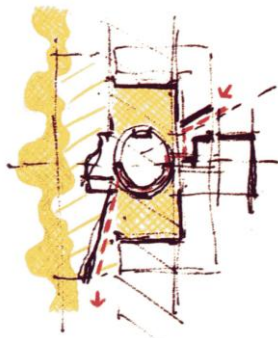
Sterling c1986
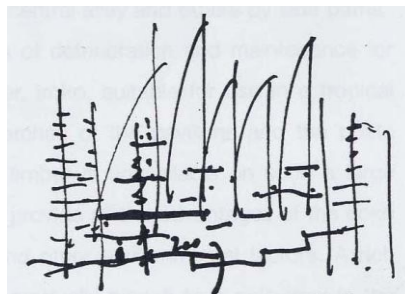
Piano c1997

Gehry c2001

Figure 1b.   Differences in early sketching

Source: multiple sources - see reference list under architect and year.

To more fully appreciate the nature of such sketching and how it is used as an integral part of an architect's thinking, we look into how a number of architects, some eminent, others teachers or scholars see, value, go about and speak of their sketching. The loose, evocative and searching sketching which is the focus of this thesis is one particular form of what architects refer to in general as drawing and the following examples use both terms.

Richard Leplastrier (2000), awarded the Gold Medal of the Royal Australian Institute of Architects in 1999 and internationally recognized through receiving the 2004 Spirit of Nature Wood Architecture Award, Finland, gives us insight as to the importance drawing has for him as a means of coming to understand a place:

> *To appreciate a place one has to draw deeply from it. The word 'appreciate' literally means to take into oneself its preciousness - those qualities that give it its uniqueness. To draw means to pull from, to take from - one draws water from a well for instance, or one draws a conclusion from an ordering or layering of things. To understand the quality of a place one must draw from it in all sorts of ways. One draws from its origins, its history, its patterns, it form, its communities, its inter-connectedness with other places and its precedents. Its sense, or how one feels about it, comes from this drawing upon all its facets.* (Leplastrier 2000)

In an evocative appreciation of place, Leplastrier's (2000) sketch of Sydney harbour's working foreshore (Figure 1c) expresses his understanding of the way the natural sandstone bluffs have through a process of quarrying been reformed in order to construct reclaimed aprons to the bays, which are in turn reformed by way of new rectilinear walls edging them.
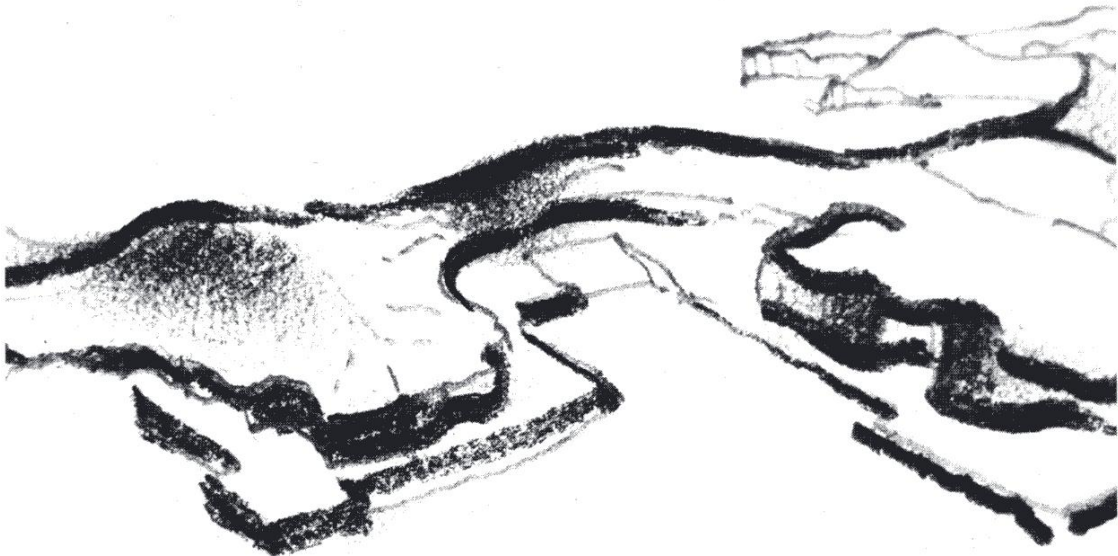
Figure 1c.   Leplastrier's sketch of a Sydney harbour foreshore
Source: LePlastrier 2000

Robert Krier, architect, educator and scholar uses his sketching to help him to read buildings, to come to understand and appreciate them in ways he was not able to do without his drawing of them. In his travel sketch (Figure 1d), you can't help but notice his sense of searching or wanting to piece together what

was going on, in the series of sketches he made of Auxerre Cathedral. He explains his sense of curiosity and discovery associated with his drawing:

> *Driven by an all-consuming curiosity, I wanted to read the building in a way it had never been read before.* (Krier 1988)
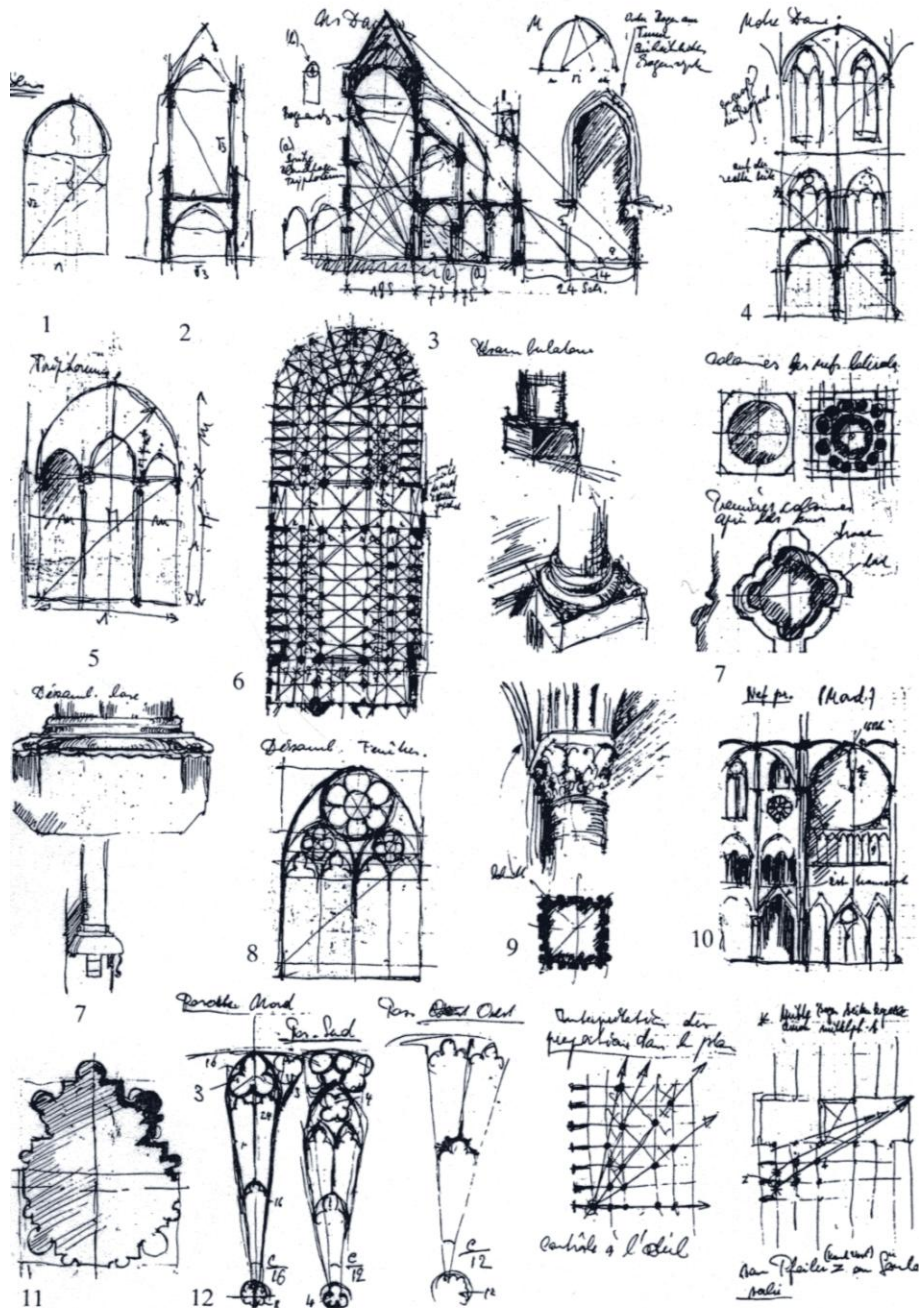
Figure 1d. Extracts from Krier's sketchbooks recording the measuring of Auxerre Cathedral and trips to Paris and Reims.

Source: Krier 1988

If we look at what he is considering within one sketchbook page, there is the overall order of the plan, the sectional proportion of the cathedral in relation to others he has visited, the geometry of the arches,

details of the column bases, their capitals, their fluting and so on, not just as isolated studies but as related parts, parts contributing to Krier's developing understanding of the cathedral as a whole and in its detail, a level of understanding seldom achieved through the taking of photographs.

The architect and educator Bryan Lawson (2004) suggests that most architects, in a similar way as Krier are prolific drawers of the world around them, and like LePlastrier, Lawson sees that by sketching we come to understand a place, be it a natural or a constructed place. He goes further in explaining why this is so, suggesting that through the actual process of drawing, that is being in a place, seeing and sketching, we come to understand the place. He explains that:

> *Passing an idea from eye to mind and then to hand results in a level of understanding not*
> *necessarily achieved when simply looking at or even photographing an object or place.*
> (Lawson 2004)

The curator Eugene Johnson, who in 2000 brought together an exhibition entitled *'On Site: Travel Sketches by Architects'*, shares this view, even using the same expression of passing from *'eye to mind'*, explaining that:

> *Making a drawing affords the architect the leisure to study a site or a detail, to let it pass*
> *through eye to mind in a special way that allows the architect to possess what he or she*
> *has drawn.* (Johnson 2000)

An educator in architectural drawing, Sophia Gruzdys (2002) explains that in the practise or the act of drawing with pen and pencil, the hand, the eye and the brain of the architect are brought together to promote a keener sense of understanding. She makes the point that:

> *Drawing is not just representation; it helps the architect to think ideas through.* (Gruzdys
> 2002)

Architects often carry around small sketchbooks and a favorite pencil, so as to be able to quickly draw a place they happen upon, capture an experience or record a detail they particularly appreciate. Over time these understandings accumulate and expand to serve as an architectural repertoire of different expressions, architectural forms and experiences that the architect might employ in designing buildings. Bill Lacy (1991) architect, scholar and writer, describes the significance of this process:

> *Architects with their sketchbooks as their constant companions are in some respects like*
> *writers who jot down notes of characters and scenes they encounter, which years later*
> *become part of a novel. Similarly architects revisit their sketchbooks and journals and*

discover thoughts and observations that have current design application and which when

viewed from a different perspective in time are themselves different and intriguing. (Lacy

1991)

Renowned architect, Renzo Piano in his designing of the Jean-Marie Tjibaou Cultural Centre in

Noumea, inspired by traditional Kanak structures produced Figure 1e.

Figure 1e.   Piano's early sketch for the
Tjibaou Cultural Centre, Noumea

Source: Smith and Gollings 1998

Piano explains his sketching:

> *I do sketches like that which are midway between writing and sketching. It is a way to*
>
> *remind myself of certain elements of space or a detail. I move very often from a general*
>
> *statement on the relationship of a building to land etc., to small details about a piece. So*
>
> *what we get is nuts and bolts but also a general concept. These sketches are a way of*
>
> *revisiting the idea by working with the mind and the sketch all the time.* (Piano in Robbins
>
> 1997)

He goes on to explain that:

> *Unless you draw something, you do not understand it. It is a mistake to believe that now I understand the problem and now I draft it. Rather right at the time you draw, you realize what the problem is and then you can rethink it.* (Piano in Robbins 1997)

The eminent architect and teacher, Herman Hertzberger (1993) explains in his '*Lessons for Students in Architecture*' that in our own work as architects, everything we find has to come from somewhere. He comments:

> *The source was not your own mind but was supplied by the culture you belong to.*
> (Hertzberger 1993)

He considers it essential for young architects to develop an '*architectural frame of mind*', to understand what is around them and through accumulating such understandings, develop a library of ideas from which to inform and enrich their designing.

> *Everything that is absorbed and registered in your mind adds to the collection of ideas stored in the memory: a sort of library you can consult whenever a problem arises. So, essentially, the more you have seen, experienced and absorbed, the more points of reference you will have to help you decide which direction to take: your frame of reference expands.* (Hertzberger 1993)

Using the following six metre long sketch (Figure 1f) for quite different purposes, Barry Marshall, a highly respected Australian architect, won for his practice, Denton, Corker and Marshall, an international competition for the Stonehenge Visitor's Centre. In a radio interview he explains why he chose to submit such a sketch as the centre piece of their entry:

> *We could have chosen simply to talk about what we thought the approach to the building might have been, but we thought it probably was best if we could like most things, if you can paint more than a verbal picture, as it were, if we could do some sort of sketches that were a little bit evocative, I suppose of the way we were thinking. So hence we did this very simple drawing which really gave some sense of the distance between the Visitor Centre at Stonehenge, which is in fact three kilometers, so it's almost like an aerial view of the site, and just a few strokes on the drawing, which sort of indicated the visitor centre, but I guess it told you something about the way we were thinking about it, that it was a very gentle intervention in the landscape.* (Marshall 2005)
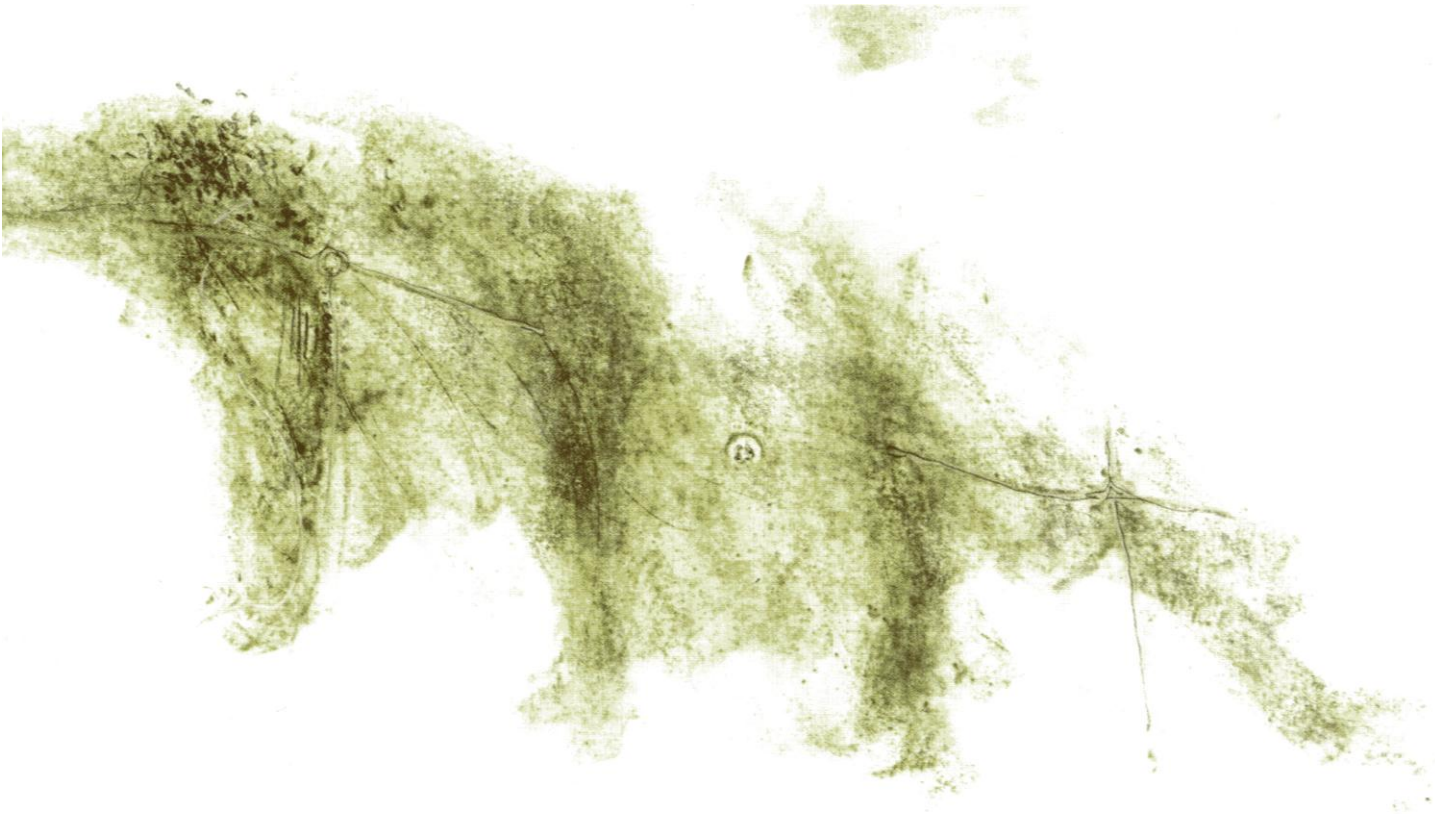
Figure 1f.   Marshall's sketch for the Stonehenge Visitor's Centre.
Source: Styant-Brown 2003

Such a large and what must have been an impressive sketch, presents as both a proposal, with the
Visitors Centre appearing as parallel marks in the top left hand corner, Stonehenge in the centre, and an
evocation of the qualities of an iconic landscape. Its appeal perhaps lies in its ambiguity and its potential
for reinterpretation by each person who considers the sketch. Speaking about the relationship between
drawing, thinking and the process of designing, Marshall explains:

> *The actual process of doing the drawing does definitely help you to design the building.
> It's not as if when you're drawing something it just suddenly pops onto the page that you
> would never would have thought of, but the slowness almost of drawing, makes you think
> about the implications of what you're doing, you think about light and shade and the
> texture and form and things like that, even though they're not necessarily coming out in
> the drawing. You are actually thinking of them as you're doing it. So the medium in a
> sense, the more definitive the medium, the less free the thinking is.* (Marshall 2005)

The masterful Finnish architect Alvar Alto's sketching expressively brings together an early plan and section for his Town Hall in Kiruna. (Figure 1g)

Figure 1g.   Aalto's sketch of the Town Hall in Kiruna c.1958
Source: Schildt 1978

Aalto explains how he uses his drawing as an integral part of his designing:

> *When I personally have to solve an architectural problem I am confronted, almost always, with an obstacle that is difficult to surmount… The cause, I believe, is the complicated and intense pressure of the fact that architectural design operates with innumerable elements that internally stand in opposition to each other…All this becomes a maze that cannot be sorted out in a rational or mechanical manner…In such cases I work – sometimes totally on instinct – in the following manner. For a moment I forget all the maze of problems.*

After I have developed a feel for the program and its innumerable demands that have been engraved in my subconscious, I begin to draw in a manner rather like that of abstract art. Led only by my instincts I draw, not architectural syntheses, but sometimes even childish compositions, and via this route I eventually arrive at an abstract basis to the main concept, a kind of universal substance with whose help the numerous quarreling sub-problems can be brought into harmony.

When I designed the city library at Viipuri for long periods of time I pursued the solution with the help of primitive sketches. From some kind of fantastic mountain landscapes with cliffs lit up by suns in different positions I gradually arrived at the concept for the library building…The childish sketches have only an indirect connection with the architectural conception, but they tied together the section and the plan with each other and created a kind of unity of horizontal and vertical structures. I recount these personal experiences without wanting to make a method out of them. But I actually think that many of my colleagues have experienced something similar in their own struggle with architectural problems. (Aalto 1947)

Goran Schildt (1978), in the forward to his book on the architecture of Alvar Aalto, explains that for Aalto sketching performed a central function in his creative process, not only in the process of designing, as Aalto himself has spoken of above, but also to train his architectural sensibilities.

The landscape sketches and annotations on the buildings of the past are rather a kind of spiritual exercise, a putting into practise of Aalto's basic method: to filter clearly perceived separate entities through the unconscious so that a viable synthesis arises. Just as the singer constantly practises his scales, the athlete keeps himself in training, and the ability to use language in maintained through constant practise, Aalto trains his eye for the complicated interaction of visual form. The goal is not to create artistic sketches or interesting paintings but to train the sensibilities. (Schildt 1978)

The following sketch of Aalto's (Figure 1h) illustrates these thoughts.
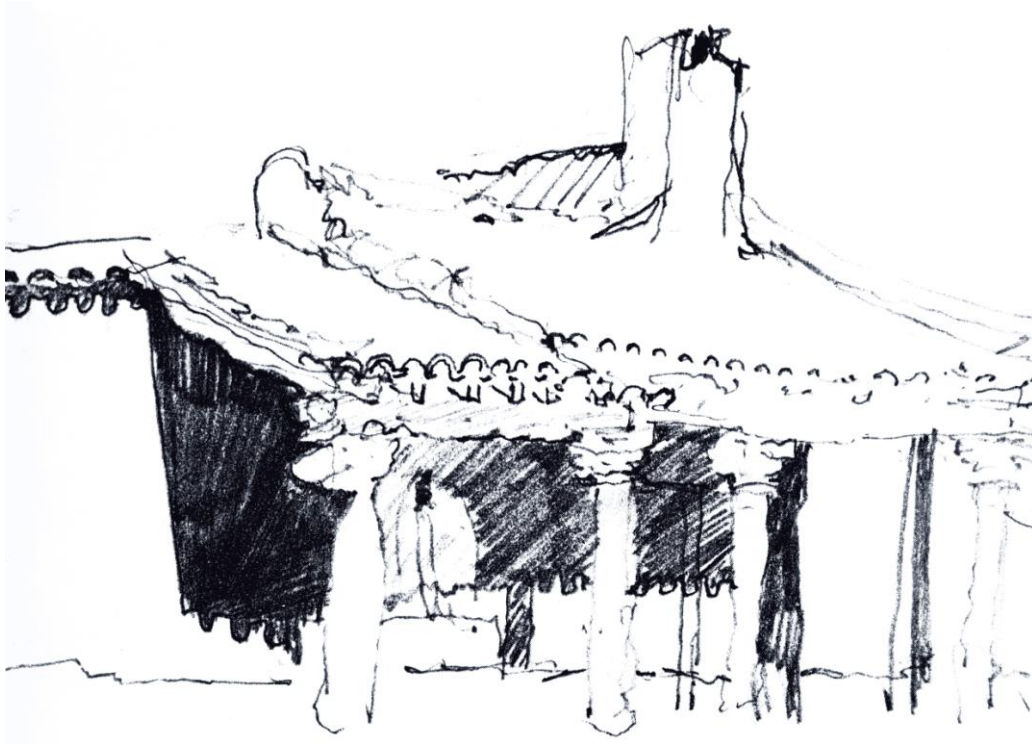
Oscar Niemeyer (2007) in a recent interview spoke of his drawing as a means of having a conversation with himself.

> *I argue with myself. Inside we are at least two people. So when I draw, I have this very clever man who fights with me. He is a great guy. He loves the beach, women and the sea. He says he wants to live a simple life, fishing, but he knows a lot more than me about architecture. Sometimes I talk to him out loud when I'm alone at my drawing board. And somehow we come to conclusions about what a new building wants to be, what it has to be. The drawings appear. I write a text to go with them and read it back to make sure it makes sense, common sense. If not, I have another argument with myself and produce a new drawing. When this reads clearly and simply, there you have the building. This is it. Nothing more.* (Niemeyer 2007)

Figure 1i is one of Niemeyer's sketches and looking at its expression, it would be hard to say it was sketched over fifty years ago.

Figure 1i.   A sketch of Niemeyer's c1953.

As a final example, Louis Kahn, a great teacher and masterful architect, used his sketching to discover or in his own words '*to realize*' things. In a salient example where he set himself the task of drawing light we see his sketch (Figure 1j) and then his explanation.
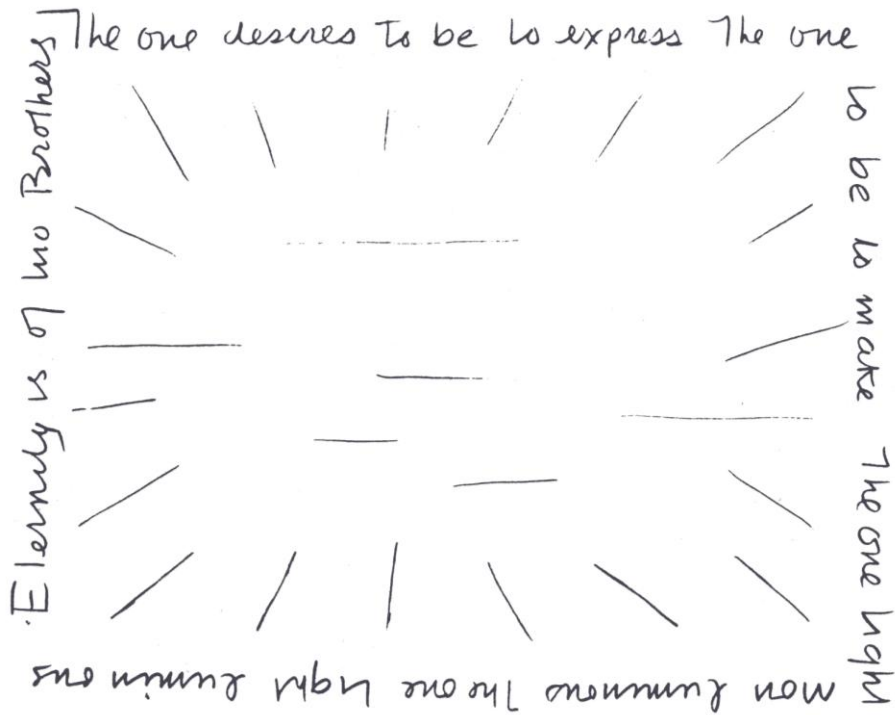
Figure 1j.   Kahn's sketch of light.

I gave myself an assignment: to draw a picture that demonstrates light. Now if you give yourself such an assignment, the first thing you do is escape somewhere, because it is impossible to do. You say that the white piece of paper is the illustration; what else is there to do? But when I put a stroke of ink on the paper, I realized that the black was where the light was not, and then I could really make a drawing, because I could be discerning as to where the light was not, which was where I put the black. Then the picture became absolutely luminous. (Kahn in Lobell 1979)

Through looking at such masterful sketching and appreciating what these architects have to say, we can get a feel for the significance and the value architects place on their sketching. The examples offer us insight into different reasons as to why architects value sketching and we can see their sketching looks different and is likely to having been done in different ways. Recalling what these architects, scholars and educators have expressed, they sketch to come to understand and to appreciate a place, to help them read buildings in new ways, to possess what they have drawn, to capture an experience, to develop an architectural library of ideas from which to inform and enrich their designing, to evoke a feeling, to tell something about the way they are thinking, to help design a building, to think about the implications of what they are doing, to train their architectural sensibilities, to realize architectural possibilities and they sketch as a means to bring into harmony separate identities and as a means of having a conversation with themselves.

Underpinning these purposes and this has been referred to by a number of the architects just quoted, is that when sketching the hand, the eye and the mind are brought together and in so doing, gives rise to a keener and deeper understanding whether it be of something which is in existence, something which lies in the realm of ideas or something unforeseen which emerges during the act of sketching itself. In many of the examples, the architects spoke of the act or the doing of the sketch as being as important if not more important than the sketch itself.

What the examples are not able to tell, although Aalto in his lengthy description of his sketching comes close, is what is going on in an architect's thinking as the person is sketching, for unless you are the person sketching, the related thinking is hard to access. This is where my own experiences of sketching can tell us something of the close association between sketching, thinking and coming to understand.

Reflecting on what I do when I sketch, when I sit in a place to sketch, what I sketch is what I notice. It might be an isolated thing that catches my eye, such as the character of a worn timber floor, perhaps

something more complex, such as a play of light as it enters a room through the splayed sides of a deep window reveal. It could be something less tangible, more analytical such as a series of spatial relationships, for example the way a snug alcove sits to the side of a loftier living space or the realization that when you sit in a certain corner of the room and look out of the opening, the tree in full sun at the far corner of the courtyard comes into view. The sorts of things that could be sketched are endless, but importantly, what I am doing when I sketch is that I am pausing, taking time to notice what is around me, considering what in particular it is about the place or the event which caught my attention. The first lines drawn tend to be the most important aspect which presents, but as the hand moves to draw more, the eye searches to find other aspects, other elements that contribute to the place or the experience. It is through the process of drawing that each aspect of the situation is given relationship to the totality. I come to see the parts that make up the whole and understand the relationships between the parts that together comprise the whole. This is not to say that all drawing is composed of parts or that the process is always methodical. At times the qualities and character of the whole is to the fore, at other times drawings might tease apart the whole to access its parts.

Other sketching can be more concerned with capturing a gesture where the sweep of a horizontal plane or a rising upwards is what is being expressed. Sometimes the concern is the spectacle of a particular happening or a moment, which once over is gone. Whatever the subject or the occasion, it is through the process of sketching, through engaging with and giving expression to what is being experienced, that the person comes to understand the place, the event or the moment and it is this association between sketching and coming to understand, which many architects refer to as 'coming to see', that makes sketching so useful in developing architectural understanding.

Articulating what an architect does when they sketch is not easy to do. In having to describe my sketching, it is difficult to say what in particular is going on between my hand, eye and mind. What ever occurs happens in the background, and having to describe it is not unlike having to describe breathing, in short it simply happens. You take confidence in that it does but you do not think twice about it. However what I can articulate of my own sketching deepens the appreciation we have of what Murcutt (2008) speaks of as '*the thinking hand*'.

To use my own sketching to illustrate how sketching can be associated with 'coming to see', I recall some years ago sketching the entry to the Youth Hostel at Pittwater, an old stone and timber building which sits graciously on a series of north facing terraces in the Sydney bush (Figure 1k). I had always been struck by the friendly and welcoming quality of its entry, a quality well suited to its purpose of being

a youth hostel. It wasn't until I had the opportunity to sketch it that I came to appreciate what it was that gave rise to these feelings.

Figure 1k.   The entry of the Youth Hostel, Towler's Bay

Source: Author's sketch book

Through making this sketch I came to understand the way in which the frangipani contributed to the quality of entry I associated with the hostel. The tree grows out and over the entry path, marking the hostel entry and as you approach you see the angular network of its branches against the regular coursing and solidity of the sandstone walls. The frangipani feels exotic in the bush, its greenness and spreading form standing it apart from the eucalypts, the visitor feels they have arrived at a place. To get to this point your journey has been on foot, up the side of the ridge and along the contours, through tall spotted gums. As you come out into the sun on one of a series of cleared terraces you see the frangipani and are drawn to it; it is the mark of a planted tree set in the bush. The sandstone wall that

had up until this point been a low edge to the path, builds in height, its courses stacking to form the base of a long and graceful building, a building that runs along the contours, along the terrace. But as you approach the frangipani you pause, the sandstone base returns to reveal a series of projecting steps freshly painted, dished by the passage of feet. As you ascend they turn you through ninety degrees, you stand under the spreading roof, leaving the path and the glare behind. On top of the stone base you can't help but turn around to face out and over the way you have come, to look out over the tops of the bush to see the bays of Pittwater laid out before you, Sydney's coastline opening out to the north. All these aspects contribute to an entry welcoming and generous, but had it not been for the process of sketching this entry, taking the time to sketch and in so doing to understand the rich interplay between the frangipani, the bush, the light, the sandstone walls, the steps, the roof, the change in one's step and alignment, the entry would still have been experienced as being welcoming but I would not have understood nor appreciated the complex interplay of elements that give rise to such an experience. As a consequence a frangipani now grows adjacent to the entry of my home.

Sketching the youth hostel entry is sketching a place that exists, a place that you can see. How then do you sketch something you cannot see, something which only exists in an architect's mind? How do you sketch something if you don't know what it looks like, if you have never seen it before? Architects are able to sketch things unseen and indeed it is through their sketching that they are able to bring into existence and hence make seen, things which have only previously existed as thoughts, ideas, insights or understandings and it is this bringing newly into existence which lies at the core of architectural designing. Edward Robbins (1997) explains that:

> *Architects have the capacity to conceptualize completely new and experimental or even completely visionary or fantastic possibilities on paper using only their own time.* (Robbins 1997)

Designing in its initial stages usually involves architects needing to understand their client, establish a brief and come to know the site, and drawings are used for instance to log a meeting, locate a view, record a measurement and to analyse the design givens. But at some indeterminate point the attention shifts from understanding the design situation to initiating a design response, which requires a certain creative inroad to be made, one where the drawing is not associated with being a visual record of the givens but rather becomes sketching which is directed towards initiating the beginnings of an idea, a first impression, a postulation of a certain relationship or a desirable gesture. Through sketching this beginning is examined, developed, tested, questioned, abandoned, reinterpreted and sketched again as the design progresses and the design response comes into being. Underpinning this progression is that

the sketching informs the designing and the designing in turn informs the sketching, the two are close to inseparable. It is this evocative and expressive freehand sketching an architect does to initiate and to progress their way through the early stages of designing which is the particular focus of this thesis.

In the foreword to his book '100 Contemporary Architects, Drawings and Sketches', an extensive compilation of architects' initial sketching, Lacy (1991), himself an architect, describes how such sketching might be done and Kahn's sketch (Figure 1l) offers example. He explains that:

> *You begin by sketching a hypothesis on tracing tissue, testing it by placing another piece of tracing paper over that iteration, correcting, revising and testing further thoughts. Usually this is done many times, as sheets mount into a thick sheaf of ideas that spring from mind to eye onto blank paper. Lesser ideas sink to illegibility as other fresher ones clamor for the top sheet's position of primacy.* (Lacy 1991)
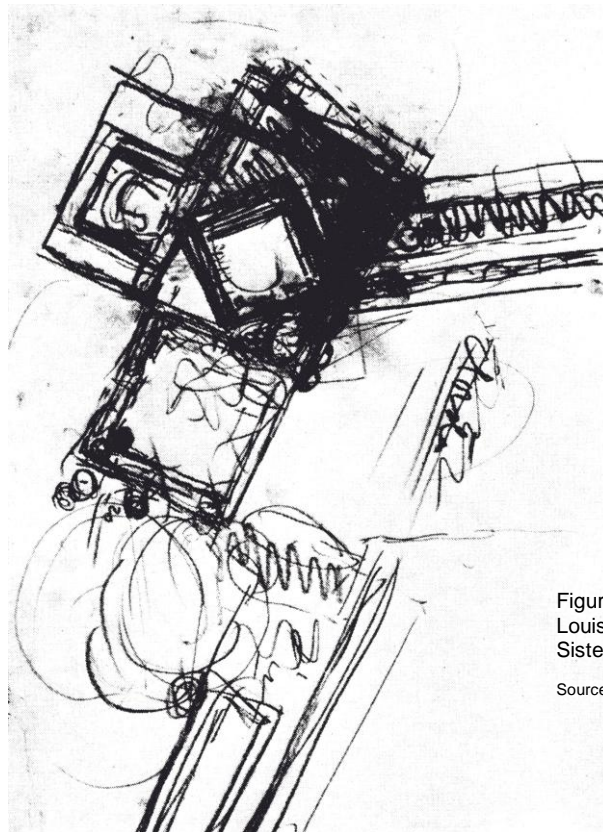
Figure 1l.   Initial sketch of Louis Kahn's for the Dominican Sisters' Convent.

Source: Ronner et all 1977

Lacy admits that he has always been fascinated by the magic of a drawn line and he uses a quote from a eulogy for the architect Eliot Noyes written by John Hersey, which for him expresses the significance of sketching.

Best of all, we've seen those hands explaining an idea on paper. The pad in one hand,

the felt tipped pen skating in the other, and the clarity of the concept jumping out at us as

lines cried out to other lines their conspiracy of meaning - so obvious when the sure hand

has swept them all into place. (Hersey in Lacy 1991)

This sketching Hersey and Lacy speak of and Kahn's sketch illustrates is the sketching an architect does to progress their designing, progress from a scheme's earliest, searching and uncertain beginnings of ideas, principles and opportunities, through its development into architectural form and on towards an emerging building, where the parts of the building and the building as a whole are graspable and understandable as having a presence, a character, materials, structure and substance. This is the sketching this thesis is concerned with, typically loose and expressive, evocative and freehand, often done quickly with keenness and a sense of searching. This is sketching which is particularly associated with the initial, at times uncertain, yet highly creative early stages of designing. Jorge Silvetti (in Robbins 1997), architect and former professor of architecture in the Graduate School of Design at Harvard, sees sketching as representing the most private of architectural thoughts within. He explains:

I do sketch a lot. Everybody has his own way, his own notations for keeping in touch with

ideas, for just scribbling and for testing things. Whatever the case, they are not very

careful drawings; they are not to show except to people who understand these things. I

suppose in the end they are the most expressive drawings and the most pure because

they are not politically compromised or meant to produce anything but my own

clarifications. So I am only compromising with myself. (Silvetti in Robbins 1997)

Wider considerations of sketching

Sketching as a means of giving visual form to ideas, is considered by some, particularly people interested in the thought processes or thinking associated with designing, to be a form of visual thinking. Lacy (1991) makes a connection between sketching and thinking visually. He explains that:

Sketching is a way of expressing and experiencing one's thoughts in imagery rather than

in words...In the non-verbal world of architecture lines on paper play a central role.

Architects' sketches are not the same as those by artists who depict people, places and

objects that already exist. The architect thinks visually about buildings that he sees well

before they exist. (Lacy 1991)

Michael Brawe (2003) is of the view that architects tend to be visual people and visual thinkers, and visual thinking could be considered a characteristic feature of the ways in which architects go about their work. He tells us:

> *Architects are of necessity involved in drawing by some means or other and continually think non-verbally as part of their normal architectural activity.* (Brawe 2003)

He goes on to explain that:

> *Architectural thought is primarily non-verbal thought; a fact of very considerable significance since so much of our everyday thinking is verbal,* (Brawe 2003)

which suggests that those who want to become architects need to be open to learning how to think in a visual way. Sketching seen as a form of visual thinking, has come to be of interest to architectural researchers, particularly for those having a background in cognitivist psychology, largely because it is thought sketching is associated with innovation and creativity (Purcell and Gero, 1998). Bryan Lawson (2004) architect, scholar and educator, explains the visual world designers understand and appreciate is actually one they manipulate directly through their sketching, drawing and modelling and for people used to manipulating thought through language, this might seem strange. He likens architects working directly with visual material to mathematicians manipulating their own symbol systems directly and musicians, able to go straight from a musical score to sound patterns. Do and Gross (2001) speak of architects' drawings using geometric elements or symbols to abstractly represent such things as sound, heat, light, rain and wind, also components such as windows, walls, furniture and doors, and characteristics of human perception and behaviour such as privacy, sight lines and movement as well as rooms and territorial boundaries of space. In their research into how architects think with diagrams in architectural designing (Do and Gross, 2001), they refer to such drawings which use symbols and are concerned with concepts as architectural diagrams, as distinct from a freehand sketch which they describe as being more about spatial form and are characteristically executed with a higher resolution and indicate attributes of shape. This distinction between a diagram and a sketch is a finer one than is necessary for the purposes of this research, which is of the view that architectural diagrams are part of the wide range of things an architect might sketch.

Much of the research into design thinking and/or visual thinking is associated with developing models of design processes as a step towards sophisticated computer based design tools. Computer applications are on the increase in architectural practice, widening the forms of visual representation available to the architect and part of an architect's expertise is to understand the respective roles of these different forms

of representation. Computer aided drafting (CAD) applications are now the dominant means of producing formal presentation and documentation drawings associated with the mid to late stages of the design process and sophisticated digital software has allowed architects to visualize and describe complex geometries quickly and efficiently. Despite the claims by promoters of digital technology over the last thirty years about the applicability of computers to the early stages of designing, their application has remained limited as hand drawing provides a far more direct and immediate connection between ideas and the page. Mo Zell (2008) a practitioner and educator in architectural communications, advises students of architecture in her recent book 'The Architectural Drawing Course', that:

> *Digital programs are tools of design just like the pencil. You need to learn when to use each, what their capabilities and limitations are and determine which tools are best for the task. Knowing the variety of tools you have available allows you to stay in control of them.*
> (Zell 2008)

It would appear to be a commonly held view amongst architectural and drawing educators (Zell 2008, Yee 1997, Gruzdys 2002 and Lawson 2004), that the early conceptual stages of designing are very much the domain of freehand drawing, the later documentation and instruction stages of designing, the domain of computer drawing systems. Seeing the design process as a continuum, Gruzdys, like Yee argues that hand drawing skills are complementary to computer drawing skills and as a consequence:

> *Both drawing by hand and mouse must be taught in our architecture schools, not as antithetical representations, but as integrated elements of a creative process.* (Gruzdys 2002)

Frank Gehry illustrates this complementary nature in the way he designs. Although renowned for his use of sophisticated computer technology, Gehry relies on hand drawing (Figure 1m) early in his designing before using sophisticated software to produce the complex, skewed and wrapped forms so characteristic of his designs. (Ragheb 2001)
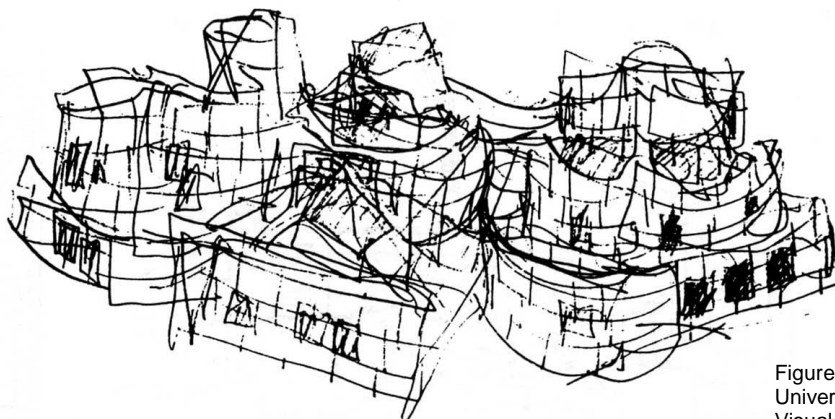
Figure 1m. Gehry's sketch for the University of Toledo's Centre for the Visual Arts, Toledo, Ohio

Source: Yee 1997

Marshall (2005), whose sketch for his Stonehenge Visitors Centre was considered earlier, explains that the specificity or precision of computers is too limiting when he is designing.

I mean nowadays they can pretty well do anything with a computer. But probably I suppose, the best way I can explain it, is that if it were to be done on a computer, what automatically seems to happen is the computer is just too specific, so you find yourself, when you're trying to keep something very general, having to be very specific, and it loses that freedom, I suppose, of a drawing. It becomes just too definitive, and you find yourself actually showing them a building, rather than just an idea. (Marshall 2005)

Murcutt (2002) makes a similar point when asked what will happen when architects can draw only on a monitor and his sketching below shows his sense of searching he associates with designing (Figure 1n).

The mouse only makes repetition easier. As my engineer pointed out to me, there is no way I could design on computer because to take a line to go from A to B, you first have to define point B: when you draw, your hand and mind takes it there. It's a totally different process. (Murcutt 2002)
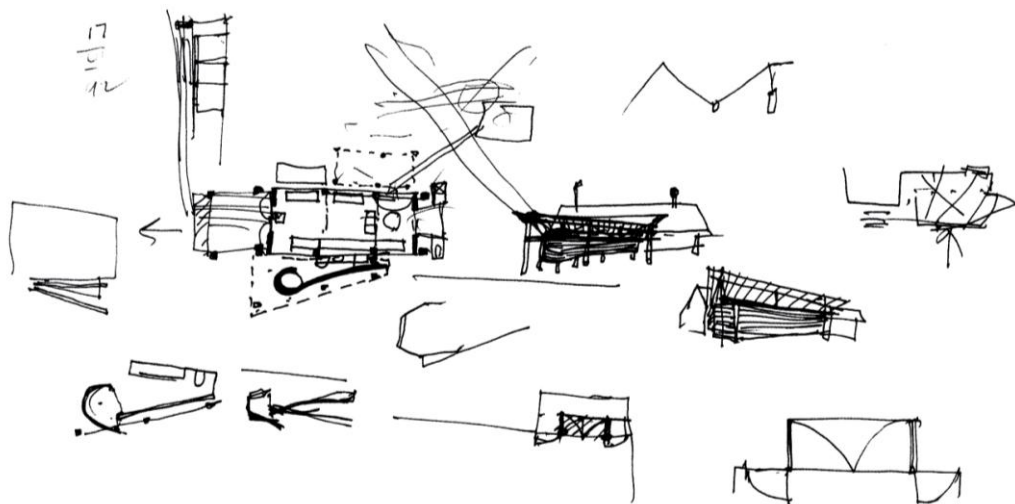
Figure 1n. Murcutt. Early design sketching for the Murcutt guest studio

Source: Beck and Cooper 2006

The following two drawings (Figure 1o) are illustrative of some of the differences talked about between freehand sketching and CAD drawing. The first sketch is one of the author's earliest attempts in a project to establish a workable plan for a house, the second a computer drawn version of the same plan, further along the design process. Although the configuration of the plan is similar in both, the character

and the resolve are quite different, perhaps most noticeable, the sense of searching and trying out of different things associated with the freehand sketch, in contrast to the neat and more finished quality of the CAD plan.
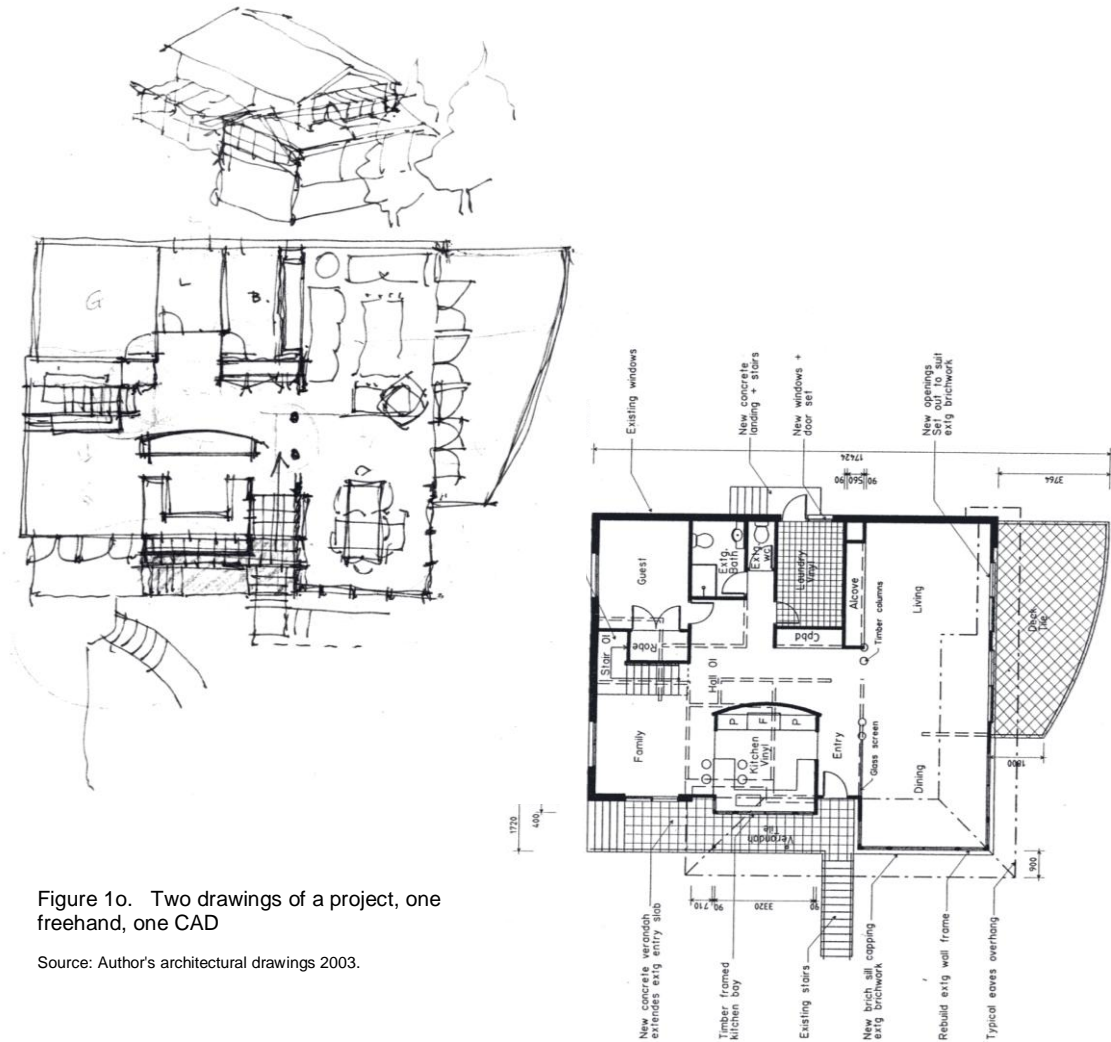
Figure 1o.   Two drawings of a project, one freehand, one CAD

Source: Author's architectural drawings 2003.

Gruzdys (2002) makes the point that five years ago the future of architectural education seemed clear, the paperless studio was the way to go, paperless in the sense of pencils and paper being replaced by monitors and mouse. She explains this has not happened, rather there is a revival in the awareness of the importance of freehand drawing.

> *To be sure, schools continue to devote space exclusively to this course of study, but today students and professors are beginning to reassess the advantages of drawing and thinking by hand. In the age of Form Z and Maya computer programs, the awareness that hand drawing helps architects to think and to create is being revived.* (Gruzdys 2002)

What this means for architecture students learning to design in the studio, is that they now have more choice between different tools of architectural representation and for design teachers, helping students make an informed choice between these different means is an important aspect of their design teaching. In learning how to deal with these choices students need to be aware of how architects use different forms of drawing in designing and a key part of this is to understand how architects use their sketching when designing.

Practicing architects as well as educators are likely to see sketching as one of a number of drawing types, both freehand and computer based which they need to be able to competently and confidently use, be able to read and to produce as part of their progression through the complex, involved and often lengthy process of designing, from the earliest stages of the project through to the final handover of a constructed building and designing lies at the core of what architects do. Silvetti (in Robbins 1997) explains:

> *Architects never build buildings, they do drawings that are built by someone else. When we look at the actual concrete tasks of an architect, he draws. Drawings are for me the language of architecture; how you create your ideas, how you evaluate them, and how you develop them.* (Silvetti in Robbins 1997)

For architecture students, drawing is of no less importance, and it could be argued that for students it takes on additional importance as they, using the words of Silvetti, need to learn the '*language of architecture*', a language in which drawing is associated with creating, evaluating and developing. In terms of freehand sketching in particular, when sketching is considered a means by which architects come to understand, then for students it is also a means by which they learn. In this way sketching is not only something which they need to learn how to use but it is also a means by which they can go about their architectural learning.

With the close association between sketching, thinking and designing, and the designing of buildings and places being principally what architects do, to better understand early freehand sketching, the particular sketching this thesis is concerned with, it is helpful to know something more of what is involved in designing, bearing in mind that architects go about designing in different ways and they usually find it difficult to define what designing is (Lawson 2006). Architectural researchers, Linda Groat and David Wang (2002) attempt to define designing and of note is their inclusion of drawing as an integral part of their description:

By design we mean what architects do every day: conceiving of built forms by responding to clients, programs, budgets and other real world factors. These are intermingled with the designers' conceptions and visions and ultimately translated into graphic representations that increase in detail until they become the guiding images used to construct the actual project. (Groat and Wang 2002)

Design is a lengthy process which is seen by practitioners to consist of three stages. These are termed sketch design, design development and construction documentation respectively, each stage requiring different drawings types and techniques, freehand and/or computer based, suited to resolving the issues at hand. Progression through the stages can be characterised as moving from the general to the particular or from proposition to resolution and it is difficult to say exactly where and when one stage begins and another ends. The diagram Figure 1p representing the design process as a whole, relates different types of drawing to each of the stages and identifies where early freehand sketching fits into the larger process.

The focus of this research

SKETCH DESIGN

General, proposition

Drawings which are loose, evocative, un-structured and freehand

DESIGN DEVELOPMENT

Drawings which are structured, scaled, precise and detailed

CONSTRUCTION DOCUMENTATION

Particular, resolution

Drawings which are highly resolved, multiple scaled and employ technical conventions
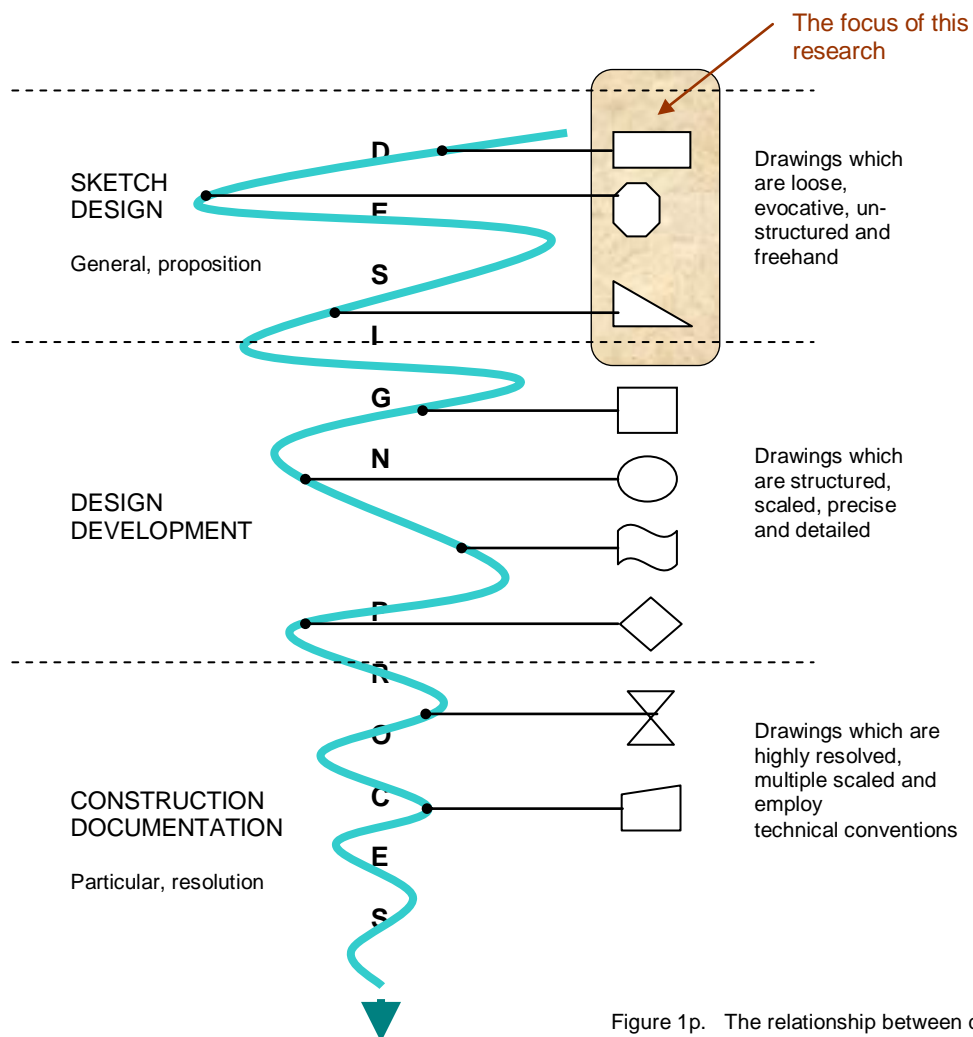
Figure 1p.   The relationship between drawing types and stages of the design process

Source: Author's diagram

To describe very simply the sorts of drawing associated with each stage, sketch design as the term suggests, is where architects direct their exploratory and expressive freehand sketching principally towards initiating a scheme. More structured, scaled and detailed drawings are associated with design development, for as the term suggests the focus is on developing the resolve, the measure and the detail of a scheme. Construction documentation involves the preparation of highly resolved technical drawings which use a specialized language of architectural drawing conventions, the intention being for the documents to give direction to all people associated with constructing the building.

Lawson (2004) has researched and identified a series of drawing types associated with designing, each type described in terms of the characteristics of the drawings and their associated purposes. He identifies eight different types; presentation drawings, instruction drawings, consultation drawings, experiential drawings, diagrams, fabulous drawings, proposition drawings and calculation drawings. If we take the loose evocative freehand sketching which we have said to be the focus of our concern, and relate it to Lawson's types, our concern appears to lie across experiential, diagrammatic, fabulous and proposition drawings, suggesting that the sketches we are concerned with are probably best described and understood not in terms of any one particular type of drawing but more appropriately in terms which relate to the act, that is the sketching which produces them.

Using sketching, the focus of this thesis

With our concern lying with the act of sketching, we can sharpen the focus further and say that the concern of this thesis lies with not just in the act alone but more particularly in how sketching is used by architects, not just used for showing to others or to establish the physical presence of an idea but used in the fullest sense, as a means by which architects think.

Learning how to think in an architectural way is something students need to develop as part of their becoming practicing architects and this chapter has revealed the central role sketching has in architectural thinking. But we have also suggested that it is difficult to describe what architects actually do as they sketch and in a similar way it is difficult to articulate how architects think. What we do know, by way of recalling the architects', scholars' and educators' sketches and words in the opening of this chapter, is that these people use their sketching in many and different ways. They sketch to understand, to appreciate, to help, to possess, to capture, to develop, to inform, to evoke, to tell, to think, to train, to realize, to bring into harmony and to have a conversation and if we turned to other architects I am sure the list would keep expanding.

On the surface, sketching is certainly different things for different architects but at a deeper level our sketching is closely and inseparably related to our architectural thinking. Using the phrasing of an insightful architecture student which we turn to on a number of occasions, learning to think through our sketching and sketch through our thinking is an important part of becoming an architect and learning about sketching is the principal concern of this thesis. The following chapter looks into issues associated with this learning.

Chapter 2 *Learning about sketching*

Learning about sketching

Introduction

Sketching, despite its significance to architects, is often not an explicit focus of teaching and students find it difficult to learn how to go about sketching. This chapter explores issues relating to the teaching and learning about sketching. It introduces the design studio as where learning to sketch takes place and students' designing as the immediate context within which sketching is used. The ways we currently teach and students learn about sketching are described and existing research into sketching, visual thinking and design learning are explored to see what they can offer in terms of learning about sketching. The chapter raises a series of interrelated concerns which need to be addressed if sketching is to become an explicit focus of teaching and learning, a necessary change if studio teaching is to meet the needs of our students.

The studio

The design studio where learning about sketching occurs is also the setting for this thesis. It is however, more than a setting, the studio is suggestive of certain ways of teaching and learning centred on doing and exchange, it is where students do their sketching, they use it, talk over it and put forward their sketching for others to see. As a consequence, for the findings of this research to be of worth then it is in the forum of the studio where they will need to be of use.

The design studio is the hub of architectural students' studies and it is where students learn to design. More than just a place it is how students come to learn; learning associated with giving architectural form to emerging ideas, how to think in an architectural way, how to engage with peers, how to find inspiration in what is around them, how to model, to make and to craft designs responsive to their landscape, their purpose and their client, and how to use their sketching as both a means of coming to understand their designs and a means by which designing can progress. Studio learning has to cover a wide range of concerns, consistent with the complex nature of designing. It is in the studio, where students through the development of their design projects, that is, through the process of doing or the act of designing, learn to bring together and make sense of these architectural concerns.

Lawson (2004) explains, that design education looks different to much else of what goes on in universities, commenting in relation to design learning that:

> *There seems to be a certain kind of knowledge and understanding that is very hard to*
> *attain in any way other than by actually designing seriously. All those schools of design*

understand this too and use methods of learning by doing in the 'studio' format as their
primary educational tool. (Lawson 2004)

Learning to design involves learning to synthesize an unknown design response taking into account the wide ranging known aspects of the design situation. Lawson (1997) describes the design process as one of '*interwoven analysis and synthesis*'. Learning to analyse can be seen in terms of helping students to understand the constituent parts or aspects of something but learning to synthesize cannot be learnt by simply adding these parts. Synthesis involves seeing a design response as an emerging and initially poorly defined whole, coming to be understand the parts and bringing them one into relationship with another and with the emerging whole. The whole, the parts and the relationships between become more known as the design response comes into being. Sketching is an architect's means of doing this. It is through our sketching, undifferentiated wholes and their emergent parts can be expressed and seen, each in relation to the other and the parts and wholes can be consciously brought into new relationship. Sketching is also a means to describe and hence communicate a design response or a design scheme to the person doing the sketch and to others. Underlying these uses is that sketching, in being so closely associated with our thinking, is central to our designing. As such, students need to learn to sketch to understand their design thinking, to progress their designing and to express and communicate their design scheme. It is both a means and an outcome, an important aspect of designing in the teaching and learning studio and more broadly an integral part of developing an architectural disposition. One third year student, aware of the association between sketching, thinking and becoming an architect speaks of his aspiration:

> *To be a better designer and start to think through my drawing and draw through my*
> *thinking.* (Stephen, 2nd Year Design Review 2002)

Hare (2002), whose background is landscape architecture, is of the view that sketching is not only a means to communicate but a means by which we transform our understandings and in an architectural setting this makes particular sense because it is through our designing that we give architectural form to our understandings. He explains that:

> *Sketching is a means of extending and simultaneously transforming our understanding*
> *rather than simply a means to let others know what we think or even ways of revealing to*
> *ourselves what we think. It is not unreasonable to suggest that those who sketch are*
> *thinking and acting differently (even when not actively sketching) from those who don't.*
> (Hare 2002)

Hare sees that through learning to sketch students can begin to engage with the complex world of designing. Preparing students for handling new situations in an informed way is an important role for universities and it is with a view to helping prepare our students to not only engage with, but to be able to make sense of, deal with and confidently contribute to architectural practice that we should direct our teaching and learning. Bowden and Marton (1998) explain that as teachers:

> *We have to prepare them (students) for the unknown by means of the known.* (Bowden and Marton 1998)

The design studio is an environment for learning, a way of learning where students actively engage in designing and learn through exchange, working on their design responses through sketching and modeling alongside their fellow students, under the guidance of teaching architects. At a glance students can be seen at times sketching alone at their boards heads down, sometimes working in small groups, reading models around a table with a teacher, grouped around drawings on a wall, visiting, working on a group site model, sitting across a board deep in discussion over their sketching with a teacher, pinning up, walking around, comparing schemes, talking over coffee. At its best the studio is humming with the noise and activity of work taking place. Large windows bring in good light, drawing boards are spread with drawings and models, paper and cardboard and there are always students in the studio. If you had to describe it in one phrase, you would say it is a place of doing.

Experienced design teachers, usually practicing architects, become part of the workings of the studio. A teacher might be engaging with a student, working towards seeing another, looking over a shoulder of a third to see what they is doing. At times they might pull a small group together to discuss a common concern, perhaps call someone over to look at a complementary piece of work, sit down to sketch through exchanges with students, cut pieces off models and look to find tentative sketches at the bottom of buried pages. There is a sense that the teachers are in there working with the students and for a person looking into the studio it would be difficult to distinguish who were the teachers and who were the students. The studio is energizing to be part of and from my own teaching viewpoint, contributing to the studio is part of the delight of design teaching. However, studio teaching requires architects to work with students in ways which are quite different to how they might work in architectural practice and my observations suggest that design teachers vary significantly in what they teach students and how they go about their teaching.

How learning to sketch happens in the studio

Underpinning learning to design is that students develop capacities essential to becoming an architect and drawing in general and sketching in particular are fundamental to this. Quoting from the University of Sydney 2008 Design Practice 3A Aims and Objectives, it is explained to students that:

> *The capacity to think in an architectural way is essential to develop as an architectural designer. This means to have the capacity to use inquiry to inform your design work and the ability to use diagrams, drawings and models as ways of thinking architecturally in order to develop and progress your project....On the successful completion of this unit you will have demonstrated an ability to actively explore and progress your design through drawing and modeling.* (Rice and Sodersten 2008)

Learning to develop a design response, learning to draw and learning to sketch are all closely related and it is difficult to speak of one without the other. Making apparent their differences, students learn to generate a 'design response' through working on a design project, and they learn to develop their responses so their schemes can take on architectural form, have parts, character, expression, materials and so on. They learn to 'draw' in ways suited to presenting their schemes and they are expected to progress their designing through their 'sketching' and use these sketches as a basis upon which to discuss their schemes with their teachers and their peers. Seen in these terms 'sketching' is very much concerned with a student's design thinking or using the words of Sergio Loss, architect, scholar and writer, sketching is *'drawing intended as thought'*. Los (1993), reflects on his time learning from the masterful architect, Carlo Scarpa:

> *I came to realise that his drawings were very individual, a long way from simple utilitarian representations of existing or projected buildings. His teaching aimed at a form of drawing intended as thought. Thus, drawings were for him creative reflections, deliberations to explain something, or arguments which might be right or wrong and were thus far more than merely realistic depictions.* (Los1993)

From a psychological perspective this kind of sketching is associated with a particular type of visual thinking. Goldschmidt (1994) and Purcell and Gero (1998) both note that visual thinking receives little attention from the mainstream of psychology and has popularly been considered juvenile or primitive, something children do before mastering language. This neglect foreshadows and is consistent with a lack of attention also being given to sketching as thinking in the teaching and learning studio. Gabriella Goldschmidt in a series of papers authored in 1991, 1992 and 1994 establishes a compelling case for

visual thinking to receive the level of attention verbal thinking receives. She notes visual thinking as being linked to creativity not just in architecture but in many fields, explaining:

> *We agree with the position that visual thinking is the production of thought via visual imagery. We also agree that it is found more frequently in creative thinking or in problem solving of the type which requires insight, normally due to the novelty of a task. But we do not think that it should be looked for only in exceptional circumstances. In fact it is quite common in all brands of thinking where one is expected to create something new.*
> (Goldschmidt 1994)

The neglect of visual thinking in favour of verbal thinking is a reminder that learning to design in the design studio presents for many architecture students a long, slow and potentially difficult shift away from the verbal thinking which has in all likelihood been the focus of their learning up until the beginning of architectural studies, to the visual thinking associated with becoming an architect. If sketching is something which precedes language then our students may be needing to rediscover something they have lost. I am sure most of us at some point have appreciated the fresh and frank expression often present in children's drawing.

Learning in the studio takes place through the process of exchange centred on the designing a student is doing or has prepared for the studio session. Exchanges are between teachers and students and between students and other students and, as the students are expected to progress their designing through sketching, it is mostly over sketches and models these exchanges take place. Developing the ability to progress their designing through their sketching, progress seen in terms of moving from the knowns of the design brief to the unknowns of their design response or *'getting from problem to solution'* (Lawson 2004) is expected of each student but seldom explicitly taught. Student projects typically culminate in a presentation of design proposals, and it is through producing presentation drawings, drawings intended to read as a confident and complete representation of their schemes that students learn to draw. This drawing is quite different to the sketching associated with developing their design thinking, the sketching Goldschmidt (2004) refers to which:

> *Gives rise to ideas and helps bring about the creation of form in design.* (Goldschmidt 1994)

Stepping back to designing, learning to design can be seen in terms of two areas of concern, learning what to design, and learning how to go about designing. Learning what to design or what the design might be is concerned with the constraints and opportunities of the site, the needs of the client, functions

and regulations, what the building is made of, how does it keep the weather out, what is its character, how is it constructed, what are the rooms like to be in, how do you move through the scheme and so on. These are the tangible components of architecture, the aspects students readily sketch, see for example Figure 2a.
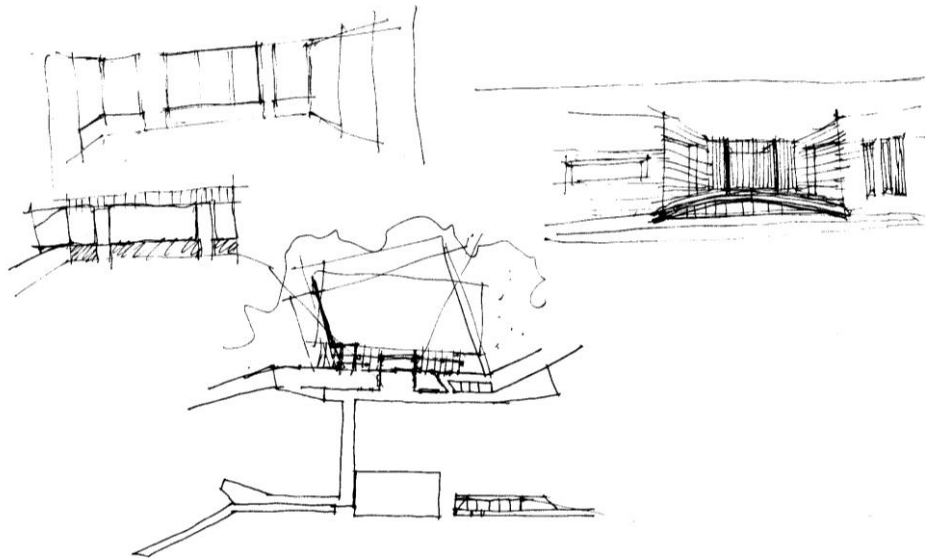
Figure 2a.   A 2nd year student's early sketch for
a design project at Middle Head

Source: GB's sketch c2003, held by the author

Considerable learning and teaching emphasis is given to these aspects of designing and students supplement what they come to understand in the studio through their growing awareness of the built environment around them and what they take forward from an extensive array of publications on architectural works.

The second area of concern lies with learning how to go about designing, learning which focuses on developing ways to progress design thinking productively from problem to solution, or from design situation to design response. It is in the development of design thinking where sketching takes central place because through the act of sketching, sketching which is directed towards seeing and understanding, a student is able to move their designing forward. As such, learning to progress designing involves learning to use sketching. Goldschmidt (1994) makes the distinction between the act of sketching which she associates with visual thinking and the sketches themselves, which she refers to as visual representation, explaining that even though the sketches themselves are important, it is the act of sketching which gives rise to the creation of ideas:

Visual representation in two or three dimensions, which is made for the purpose of

communication (with clients, colleagues or other interested parties) or to facilitate

evaluation, as important and as relevant to design as it may be is not what we mean by visual thinking. It is the production of ideas, the reasoning that gives rise to ideas and helps bring about the creation of form in design (as opposed to its rendering) that is of interest here. (Goldschmidt 1994)

Relating Goldschmidt's distinctions to the terms being used in this thesis, 'sketching' means the doing or the act of sketching, where the act is inseparable from the thinking associated with it while 'sketches' are the visual expressions or the representations of the thinking. In a similar way 'designing' relates to the act or the doing of designing, as distinct from 'a design' which is commonly used in the studio when referring to a design response or a scheme and the term 'design' which refers to the name of a subject area.

How then do students learn to use their sketching? It is easy to look in the studio to see this happening but it is difficult to know how best to teach it, mainly because it is hard to access how a person uses their sketching. It is hard to know what a person is doing when they sketch a certain thing in a particular way and how it might lead on to another sketch and in turn on to a line of thinking. It is hard to read in a sketch how a person has used it to inform their designing. In a similar way, when we go into a building we can see what has been designed; we can see its architectural composition, its walls, its openings, the rhythms of the facade as well as the details that give rise to its character, but, we cannot tell how the architect went about its designing, how they developed the lines of thinking which gave rise to the building. We simply cannot read this in our experience of being there. The best way we have to access the thinking processes of an architect; the loops, the turns, the testing of ideas, the alternatives rejected and worked through as they have developed a scheme, short of speaking with them, is to closely consider the architect's detailed sequences of sketching produced through the course of a building's design, understanding for instance how in one sketch something has been tried which leads on to another possibility and on to another, or how a particular room might develop. So to understand how to use sketching we need to understand how an architect has been designing and in turn, to understand the architect's designing we look to their sketching, each informs the other.

There are books, films, archives and exhibitions which enable us to access both the sketching and designing of architects, but they require students to have the ability and time to piece together the individual sketches so as to get to the underlying thinking involved. Heinz Ronner (1977) in the preface to an extensive compilation of Louis Kahn's design process sketches compiled by his former students, explains:

As a rule, architects and, for that matter publications of their work, show us the finished

product; notes and preliminary sketches and plans are looked upon as chips fallen off the

workbench to be swept up and thrown away. But is it not these very chips which allow us

to study the nature of the creative process itself, from which we can draw conclusions

about the forces that determine an architect to accept one possibility and reject another.

(Ronner, Jhaveri and Vasella 1977)

Other publications offering similar opportunities include books such as 'Carlo Scarpa, the Complete Works' (Dal Co and Mazzariol 1984), Le Corbusier Sketchbooks Volumes 1-4 (Franclieu 1981),'Renzo Piano Building Workshop: complete works' (Buchanan 1995), and 'Ando: Complete Works' (Jodidio 2007) to name a few. Film is also proving to be a useful medium, easier to access, with two recently released films on Frank Gehry (Pollack 2005) and Loius Kahn (Klein 2003) offering ways into understanding design thinking through their length, sheer volume of visual material and inclusion of extended interviews with the architects as they are designing. Recently collections of architects working drawings relating to certain projects have become available on the internet. For example there is a technical archive of over six hundred and fifty of Carlo Scarpa's hand done drawings for the Museo di Castelvecchio available at *www.archiviocarloscarpa.it/web/disegni.php?lingua*. Further opportunities are offered by competition exhibitions and architectural displays of process drawings and sketch books. The exhibition 'Shaping Space: Drawings by Harry Seidler (Faculty of Architecture, The University of Sydney August 2005) included a wide range of Seidler's original sketches and 'The Studio of Joern Utzon, Creating the Sydney Opera House' (Museum of Sydney Dec 2004 - May 2005) included sketches and models previously unseen by the public.
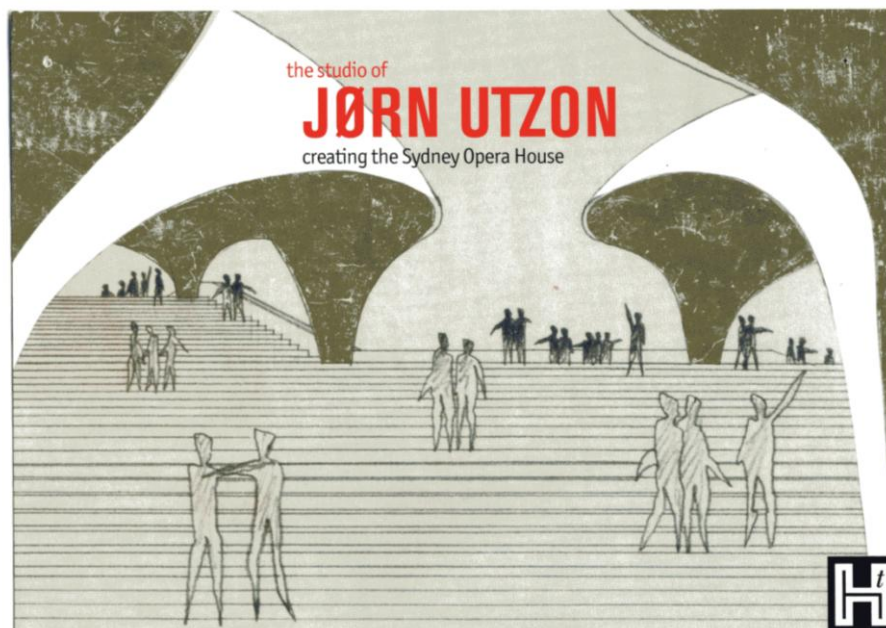
Figure 2b.   Utzon's competition sketch for the Sydney Opera House, 1956.

Source: Utzon 1956

As an aside, its invitation (Figure 2b) displays one of Utzon's original competition sketches for the Opera House (1956) and depicts an open quality to the space between the major and the minor halls leading out to the harbour, a quality never realized, lost to the public through conflicts associated with the development of the building. (Indyk and Rice 1981)

Architectural publications are reconsidering their usual emphasis on tastefully photographed representations of completed works and are now including more design sketches. Figure 2c shows a page from Architectural Record (1998) of Renzo Piano's Tjibaou Centre, illustrating this shift. These examples, associated with how masterful architects use their sketching, although being one step removed in books and displays and requiring of extensive piecing together, serve as a model towards which students might aim and it is important for students to see sketching held in such high regard.
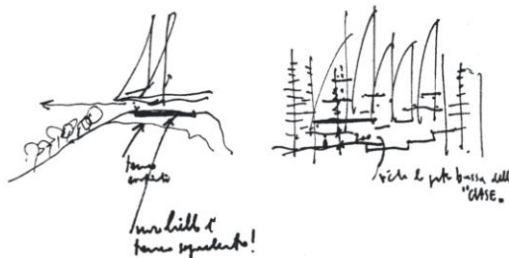
Figure 2c. A page from the publication Architectural Record showing the inclusion of working sketches as part of the project description

Source: Smith and Gollings 1998

Research has been done which examines differences between how experts and students use their sketching, for example Katz (1994), 'Coping with the complexity of design: Avoiding conflicts and

prioritising constraints' and Goldschmidt, (1991) 'The dialectics of Sketching' which reveals that both experts and students alike utilise a cycle of sketching, then thinking about what they have sketched, then sketching again, a cycle they refer to as drawing and reinterpretation. Where they differ however is in the depth and interconnectedness of the knowledge they bring to this cycle. Their research reveals the knowledge generated through their sketching is different for different architects and characterises their designing. Louis Kahn and Alvar Aalto (see Chapter 1) do distinctive sketching, develop distinctive kinds of knowledge through their sketching and design distinctive buildings and because of these differences it would not be possible for Aalto to design a Kahnian building or vice versa.

Using sketching sequences to access thinking is also of interest to researchers in psychology, particularly those with a cognitive background. As a consequence the sketching of architects' is a field of developing interest and psychologists see them as:

> *Offering a kind of window into the designer's mind and consequently into the designer's knowledge system and method of mental representation.* (Lawson 2004)

Hare (2002) explains that over recent years designing is:

> *Attracting the attention of psychologists, intent on unlocking the secret workings of the creative mind of designers, and inevitably sketching has been a key puzzle to them.* (Hare 2002)

One of their concerns has been to find ways to describe the processes associated with visual thinking and as part of this to explain how sketching might be associated with triggering new knowledge. Purcell and Gero (1998) in reviewing a body of research by Goldschmidt, Schön and Wiggins and Goel, Sewa and Tversky into sketching and the cognitive processes associated with its use in designing, find agreement that sketches and sketching are associated with 'emergence' and 'reinterpretation' of figures and that through these processes which give rise to new readings of the sketching, new knowledge relevant to a design can be created. This knowledge, Purcell and Gero explain is generally qualitative in nature and is knowledge which allows the designer to move towards giving a physical form to abstract concepts and is associated with progressing designing.

Emergence is a concept derived from Gestalt theory which describes the differentiation of new figures in a sketch arising out of newly perceived relationships between other figures and their respective grounds, while reinterpretation is the giving of meaning to this newly perceived figure. Schön and Wiggins (1992) explain that in an architectural design context, as a person progresses their thinking they move back and forth between emergence and reinterpretation, the two-way nature of this described as:

A reflective 'conversation' with the materials of a design situation. A designer sees, moves and sees again. Working in some visual medium – drawing in our examples – the designer sees what is 'there' in some representation of a site, draws in relation to it and sees what has been drawn, therefore informing further designing. (Schön and Wiggins 1992)

In this way designing progressed through sketching is a cyclical process, driven by way of drawing and reinterpretation, producing new knowledge which stimulates further drawing and reinterpretation, producing further design knowledge or understanding. Schön and Wiggins (1992) call these cycles '*move experiments*'. Goldschmidt (1991) also seeing designing as cyclical, refers to a cycle of moves and arguments where the arguments are either of a '*seeing as*' or '*seeing that*' modality. Purcell and Gero explain that:

This cycling is a mechanism that allows two fundamental characteristics of design problems to be addressed. The bringing in of new knowledge, brought about by reinterpretation, is a process that progressively reduces the ill-defined nature of design problems. In addition, where this knowledge is perceptual in character it allows the designer to move towards a physical object. This overcomes the problem associated with the fact that abstract, conceptual knowledge does not in itself specify the physical attributes of a designed artefact. (Purcell and Gero 1998)

Students often find the cyclical and iterative nature of designing, which Schön and Wiggins' (1992) speak of as a 'reflective conversation', difficult to grasp as they are not necessarily able to see that progressing designing might involve looking back and reflecting upon their sketching. One student who has come to see this conversational nature of designing and the role that sketching can take in it explains:

I learnt that through drawings the design starts to tell a story to be read and that by getting things out the scheme starts to tell things back to you that you may or may not have intended. (Anon participant WSS 2007)

Another student when asked to identify things he had learnt in a particular studio which were helpful, referred to his new found understanding of progress in designing as cyclical as distinct from linear movement between his initial ideas and final response, and succinctly expresses this diagrammatically in Figure 2d.

Suggestion of good architectural practice → idea lll → final
and progress.   instead of
                                                    idea ──────→ final.
                                                        (linear)
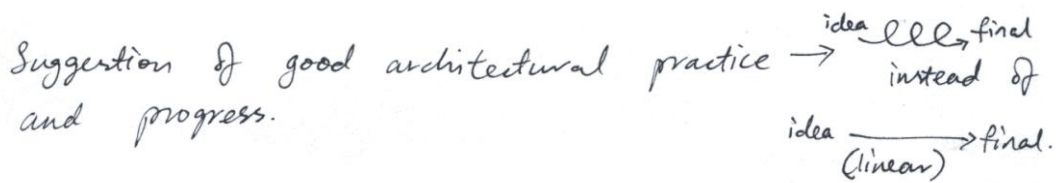
Figure 2d. Anon. WSS participant, 2004

Purcell and Gero (1998) explain that emergence and reinterpretation are considered to provide a key to understanding the remarkably opportunistic nature of visual thinking processes in designing and this opportunism is illustrated by Goldschmidt (1994) in the example of Larry the architecture student who by way of contemplating the curves and loops of his signature, develops the germ of his design for a kindergarten.

Unfortunately for architecture students, much of the research into design thinking and/or visual thinking aims to develop models of design processes as a step towards more sophisticated computer based design tools and frame their findings in ways primarily relevant to computer applications and to students who study such applications. Do, Gross, Neiman and Zimring (2000) in a paper entitled '*Intentions in and relations among design drawings*' which by its title you might expect to be of interest to architecture students, explain that:

> *We wish to understand the roles that diagrams and sketches play in designing, with the goal of building computational environments that better support designing than those in current use.* (Do, Gross, Neiman and Zimring 2000)

Because of the nature of such findings and the ways they are expressed, research into sketching which has an underlying computational focus is of little help to architectural students learning about sketching in the studio.

A far more immediate way to learn about sketching in relation to designing is to learn from practicing architects, practitioners teaching in the studio who have a working knowledge and an awareness of the role sketching has for architects and how it can be used as an integral part of designing, and it is this learning from practitioners which forms the backbone to studio learning and one we will expand on later in this chapter.

Before moving on to do so there is another quite different form of learning at times associated with sketching. Instruction in drawing forms part of the curriculum in most schools of architecture and,

although there is little agreement on how to do this (Bradshaw 2002), my experience is that it is the technical aspects of how to get the lines down on paper so as to produce a particular kind of representation which is the focus of these courses. Bradshaw (2002) considers how and what type of drawing should be taught to graphic designers to support students in developing an understanding of the design process and at the same time meeting the visualization skills required of graduates in professional practice. Bradshaw quotes Schenk (1998) saying:

> *The history of curriculum planning for drawing tuition for designers indicates a sustained debate about how drawing should be taught. Although the complexity of the design process has now been well established, the most appropriate forms of drawing to support each aspect of this process have still to be generally agreed. In addition, the changes due to pressures, technological development and the shifts in philosophical emphasis that designers are required to take into account add further to this complexity.* (Schenk 1998)

Although both Schenk and Bradshaw are referring to designers in general as distinct from architects, the issues they raise about the complex nature of the design process requiring different forms of drawing and the uncertainty of changing technologies are just as relevant to learning about architectural drawing and present a challenge to somebody working out which type of drawing should be taught and how best to do it. My experience of teaching drawing, as distinct from design studio teaching, is that it is usually the technical aspects of producing a range of different drawing types which is expected. The primary concern is instruction in how to get the lines down on paper and produce a particular type of representation. This teaching usually takes place outside of the students own designing by way of lectures, lecture related tutorials or in the field. In these situations the emphasis is on instructing students as to how to produce a drawing by either following a series of specific instructions or by seeing examples and drawing like them.

Learning and understanding the conventions associated with different types of drawing are an important part of architectural education. There is also much to be gained, and many architectural drawing teachers do this, by taking students out of the studio and getting them to draw what they see around them in personal journals, a practice which not only contributes to developing their drawing skills but expands their library of architectural experiences and possibilities from which to inform their designing. For some these journals become a timeless resource often returned to. Another form of journal recognized as educationally supportive of learning is the learning journal or logbook. Although these might not necessarily include the same sketching as associated with architectural designing, the drawings they might include are visual representations of a student's thinking through the process of

their learning, made either at the time or upon reflection. Jill Franz (2003), speaking in particular about logbooks being kept in relation to design learning explains that:

> *The process of externalizing the reflection process, as well as the design process, through the medium of graphic representation, extends (for the teacher and the student) the number and types of opportunities available for enhancing the quality of design learning and doing.* (Franz 1993)

In the school of architecture where I teach, we also highly regard the process of getting students to reflect on their own design learning, and although not asking students to keep logbooks, we do ask them to submit reflections on their design learning as part of their end of project submission and because of the insights these reflections offer into students' understandings, this thesis makes a number of references to them.

Alan Davies (2002), the director of the Centre for Learning and Teaching in Art and Design (CLTAD) comments that:

> *Learning journals are increasingly being recognized as a more reliable means of establishing whether students understand what they are doing than the finished artefacts such as paintings, ceramics and even essays.* (Davies 2002)

This is an interesting link, because the sort of learning journals Davies speaks of, although on the surface sounding similar to the sort of logbooks architecture students might keep, are probably more akin to the many sketching sequences our students make through the process of their designing, which we refer to as the students' design process record. We find in a similar way as Davies, that the sketching process records, often offer a more reliable means to know whether a student is understanding what they are doing than the students' finished works and across the early years of our architectural degree design process records are used as part of assessment.

Returning to students learning the skill of drawing, in addition to what they might learn from lectures, exercises and keeping logbooks, the technical aspects are well covered in numerous publications outlining architectural drawing techniques and step by step methods. Such titles include 'Architectural Drawing, a Visual Compendium of Types and Methods' (Yee 1997), 'Design Drawing' (Ching 1997) and 'Design Drawing Experiences' (Lockard 2000) and some of these make efforts to explain the sorts of sketching architects might do as part of their designing. For example Mo Zell (2008), in her book '*The Architectural Drawing Course*' calls her second chapter '*Learning to see: sketching*' and goes on to explain:

This chapter will demonstrate different ways to facilitate your ability to observe and record ideas and visual data in the world around you, it will teach you to demonstrate the ideas in your mind on paper. (Zell 2008)

She sets up a series of lessons which look at sketching types, sketching techniques, sketching media and sketching the line, all of which as technical aspects are useful to know, but her lessons do not deal with what she has called her chapter, namely '*learning to see*' because doing so requires sketching not to be taught as a skill but rather as a means of understanding. However developing skill in drawing is useful for students and as Lawson, who has wide experience of different schools of architecture, across a number of countries, explains:

So important has drawing become in the design process that virtually every contemporary design curriculum places considerable emphasis on the acquisition of skills in drawing. (Lawson 2004)

Purcell and Gero (1998), in their review of research into sketching and the cognitive processes associated with the use of sketching in designing, pointed out that in a research setting, as in architectural education, sketching has been treated primarily as a skill rather than as an essential part of design thinking and like Goldschmidt they comment on the lack of attention given to considering the ways sketching might be useful in designing.

Little attention has been paid until recently to the function that such representations have during design and the cognitive processes that are involved in their use. In effect the process of developing pictorial and diagrammatic representations has traditionally been treated as a skill rather than an essential part of the process of thinking about a design problem and developing a design solution. (Purcell and Gero 1998)

The learning to draw which teaches students how to produce a competent, accurate and perhaps beautiful representation of their design scheme, may have a bearing on but is not directly helping students understand how to progress their designing through use of the often unfinished, evocative and searching sort of sketching they are able to do, the sketches being the product of their equally unformed and uncertain thinking. Studio teaching experience suggests this learning is really best tackled by students repeatedly using their sketching to progress their own designing and if this can be supported and guided by architect teachers knowledgeable in the use of sketching, then all the better.

Learning to sketch through their designing, students learn to associate the act of putting down the lines with their design thinking and for some, the sketching and thinking become merged and inseparable.

Once it happens it seems effortless yet it would appear that teachers find the association between sketching, thinking and designing not necessarily easy to articulate and that sketching is rarely an explicit focus of their teaching. As a consequence there is a noticeable lack of attention given in the studio to helping students develop their sketching as a means by which they are able to progress their designing. Hare (2002) suggests that one reason for a lack of focus on teaching sketching could be that:

> *Perhaps tutors assume that everyone simply knows that sketching is important and why, and perhaps students are often simply expected to know this too.* (Hare 2002)

What is noticed about current teaching and learning

I have repeatedly observed design teachers to be more inclined to comment on aspects of a student's designing they can see. For instance they will comment on the planning of a scheme, its built form, choice of materials, orientation, structural order, expression and so on. These are the things that stand out and can be pointed to in the students' sketches and not surprisingly they are the sorts of things sketches themselves are good at explaining. It is easy to see, even from a distance, the outline of a building, its form and its shape, its character and configuration in plan and in section. If we look more closely, we can see details of rooms, stairways, openings, columns and furniture. It is likely that because these aspects are tangible or identifiable, they attract teachers' attention and, being aspects of a design scheme, the students' design response becomes the dominant focus of exchange in the studio. The teacher is able to comment on architectural issues they are practised and comfortable dealing with and some students who rely on their teacher to direct their learning appreciate these comments on particular aspects of their scheme because they feel able to respond to the specifics of the teachers' opinions. Other students, perhaps ones more inclined to direct their own learning, are aware that commenting on their scheme alone does not necessarily help them improve their designing. One student giving feedback on her design tutors teaching explains:

> *We need to know how to progress in certain stages. Helpful criticism is always given except suggestions on how to move on.* (Anon A. Student feedback on design tutor's teaching S2 2004)

Another gives feedback on a different teacher saying:

She could also give a lot more suggestions as to what can help our designing instead of just telling us what needs improvement. (Anon B. Student feedback on design tutor's teaching S2 2004)

Another suggests his teacher might:

Instead of providing crits, it'd be helpful if ideas or suggestions on what to do or how to improve would be great. (Anon C. Student feedback on design tutor's teaching S2 2004)

These students asking their teachers to help them learn how to go about designing, have different needs to students looking for inputs on their schemes. Responding to their needs requires a teacher to be able to see below the surface of students sketching, beyond the tangible aspects represented in the sketches themselves to what the sketching reveals about how the student is progressing their designing and what role the sketching is taking in this progress. This requires a different sort of reading. With a student's designing in mind, as distinct from the student's design response, the teacher needs to read the sketching so as to intentionally seek out how one sketch links to or leads into another sketch. Teachers need to look for the relationships between plans, sections, views and diagrams, looking with an architectural eye to find connections and consistencies, for parts coming together to form coherent wholes and for emerging wholes. Only once a teacher can see beyond the surface of their sketching to their thinking can a teacher comment on a student's designing. In effect these three students just quoted are asking for their teachers to direct their attention to such issues as how they might initiate a scheme, how to improve one, how to move from one thought to another, how can a plan be sketched so as to give order to its component parts, how to a change direction or test an idea, how to locate a scheme in a landscape, how to decide which direction is more appropriate to take than another or how through their sketching might they come to see something in a different way and so on. These issues in lying below the surface of the students' sketching are harder to see and it is sensible to consider whether teachers may need some assistance because the issues needing to be seen have as much to do with learning as with architecture.

Teaching focused on how students use their sketching requires time, effort and a willingness on the teachers' behalf to place themselves as close as they can to the students' sketching and by necessity to the students' thinking. Teachers are often hesitant to do this. When asked to comment in a teaching workshop on what could be done so as to help direct their teaching towards students' progressing, the majority of the participants thought it was principally an issue of needing more time with individual students, a response commonly given to a number of problems, as studio teaching always seems to be under pressure of time. But my experiences suggest it is more an issue of where the teacher directs

their attention, for if they continue to direct their attention to what is sketched of a scheme, emphasis will remain with the design response. If they direct their attention to how students use their sketching as a means of thinking, emphasis can be given to helping students to progress their designing, and this is something our students repeatedly voice their need for and we should be responding to.

It is understandable architect teachers are hesitant to make this shift in emphasis, for to focus on students' thinking through their sketching and sketching though their thinking, lies to the side of their architectural practice, and it is primarily for their practice experience that architects are engaged to teach in the design studio. Studio teachers tend to consider themselves architects who teach as distinct from teachers who are architects and few unless they become full time academics would go on to spend more than ten years in the studio. Unlikely to have any formal teaching education, the design teachers, in a manner not dissimilar to their students, are learning to teach design through doing. Their role is to help students learn to design and as practicing architects they bring to their teaching either explicitly or implicitly, the breadth and depth of their own experiences, their own ways of designing and their underlying architectural viewpoint. In terms of their teaching, experienced studio teachers are likely to call upon what they have observed has worked well for students in their groups and their exchanges with other teachers and year coordinators. With regard to novice teachers, some tend to teach along the same lines they were taught and remain surprisingly loyal to these, irrespective of the quality of the experience or how long ago it was, whilst others pick it up on the go. Few teachers unless asked, are conscious of how they go about their teaching, and even fewer would have an understanding or an awareness of how students might learn, preferring to use their architectural understandings, in particular their understanding of architectural designing as the foundation upon which to inform their teaching in the studio. It has always been an underlying assumption of the studio culture that by coming into contact with, experiencing and to varying degrees understanding different approaches to architectural designing, students will develop their own approach to designing.

From a research viewpoint Salama and Wilkinson (2007) refer to a lack of research on design studio pedagogy. They explain:

> *There are continuous attempts to massage and modify design studio teaching practices, to re-configure the structure of studio content and the way in which knowledge is delivered and experienced. However, consensus is lacking on the issue of what changes and developments in studio pedagogy will best meet the needs of design professions while supporting the aspirations of contemporary societies.* (Salama and Wilkinson 2007)

Davies' (2002) research into design in general as distinct from architectural design has revealed that:

There are significant qualitative differences amongst teachers as well as students as to
what design is. This has an impact on the quality of the outcomes of learning design.
(Davies 2002)

He goes on to suggest, and this is a point we will pick up on again later, that students who have a limited conception of what design is will have a correspondingly limited set of expectations of what they need to learn and on the strength of this and supported by what I have observed in the studio, teachers who have a limited understanding of designing have a correspondingly limited understanding of what it is they need to teach. To ask studio teachers to firstly see a need to and secondly go on to find ways to explicitly focus on students' sketching takes them away from what they are used to dealing with and expects them to be able to articulate issues they may not have previously needed to consider and most probably asks them to teach in ways quite different to what they have experienced before. Watching exchanges between teachers and students in the studio suggests both teachers and students are unfamiliar with and at times uncomfortable discussing how a student is thinking in relation to their designing. It could be that talking about thinking is uncomfortably personal. It could be that neither has an appropriate language or terms to express what is going on in their thinking or that one or both do not see the sketching before them as an expression of a student's thinking. If we are to redirect studio attention onto how students progress their designing we must find ways to enable students and teachers to talk freely and openly about design thinking.

As with thinking, the way an architect sketches when they are designing is also considered quite a personal thing, something they just do in their own way and without need to be conscious of nor to articulate. Yet if a teacher is going to teach students how to sketch, how to go about using their sketching when designing, they need to become aware of how they actually go about it themselves and how others might go about it. Again we come up against the problem that without a language to talk about sketching or terms by which we can make sense of our sketching and the thinking associated with it, we are hard pressed to be aware of, be able to articulate and go on to teach one of the very things as architects we find fundamental to our architectural disposition.

Moving our concern away from teachers and on to students, the lack of studio teaching explicitly focused on how students can use their sketching to progress their designing, means students are left to pick up their own ways of sketching on the go. For some it is beyond them and these are the students who sketch simply because it is something architecture students are expected to do. Other students develop, largely under their own initiative, ways of sketching which work for them, learning from their experiences in past projects, from each other and to varying degrees from their teachers. For some this

development is a conscious thing. However, from what I have come to understand in the studio, for most it is not, the development of their sketching happens in the background. If something appears to work they might keep doing it, and if it doesn't, they may or may not change. In not being aware of their sketching, it remains isolated from their designing and it is likely they will struggle to progress their designing on any informed basis. These are the students who are likely to see their designing as something they do in their head. It doesn't occur to them to sketch their thoughts. One student, who even knowing his lack of sketching is problematic explains:

> *Another bad habit I have been having when designing is to do most of my designing in my head, while I am walking, on the subway, sitting in the studio, eating and so on. I do not design as much on paper as I perhaps should. If I encounter a problematic issue, I'll rather sit there and design and redesign my building mentally. I feel I can design a lot quicker and more efficiently in my head. I'll just sit back and let the ideas flow, try to compile them and put them into a working design. Of course, this can cause many problems in my design process.* (MS Reflective design review, Design Practice 3A 2002)

Knowing his lack of sketching causes problems, MS still considers designing in his head to be quicker and more efficient and it is certainly quicker, because in not sketching he has not had to take time to give his ideas substance and in this undeveloped form he thinks it is simply a mater of compiling his ideas into a *'working design'*. MS's belief in the efficiency of designing in his head and his unwillingness to sketch are common to many students.

The example above raises another concern. MS appears to have a somewhat limited or partial understanding of designing where he sees a working design in terms of compiling or adding ideas and whilst ever he holds this understanding he is not able to see that designing also involves synthesizing a coherent whole, one in which the whole relates to the parts and the parts relate to the whole. He simply cannot see it. If MS is to start to use his sketching to synthesize as distinct from compiling a design response, he needs to change his understanding of what designing is and what it involves. MS in going about his designing in ways which directly relate to what he thinks designing is echoes findings of phenomenographic research into students' learning, which reveal that students go about learning in qualitatively different ways and that the way they go about learning is directly related to what they think learning is. In a paper Alan Davies co-authored with Anna Reid, '*Uncovering problematics in design education - learning and the design entity*' (2000), Davies explains that some students see learning about designing as being concerned with acquiring specific skills and crafts associated with employment in their area of design. Others see design as a process or set of procedures which embrace a range of

skills in the act of communication and are aware that users of a design play a part in the process of design. Finally there are students who see design as:

> *Offering a transformational experience through which their world view is developed. For them, skills, meanings and communication are important factors in design but they also see design as a platform from which to explore their own perceptions of a complex world and modify them in the light of new experiences.* (Davies and Reid 2000)

This supports Hare's (2002) view that in learning to sketch, students develop a means of engaging with a complex world. Davies and Reid go on to suggest that students who have a limited conception of what design is will have a correspondingly limited set of expectations of what they need to learn, an insight which sheds light on MS's difficulties and one we will return to.

Some students are more aware of the association between sketching and thinking than others. Although finding it difficult to articulate what specifically the relationship might be, again a matter of not having a language, they are aware that sketching is part of and informs their designing. Three third year students, participants in the later investigation associated with this thesis when asked to explain how they use their sketching in their designing, explain:

> *Um, I dunno, I guess I just...it's just jotting down ideas. Really it's just...., I mean it's hard to answer how.* (PH Interview)

Another:

> *Sketches are kind of the first ideas, the first kind of thinking and then joining those thoughts simultaneously.* (FK Interview)

A third:

> *Yeah..., like if I am thinking about the start of a design or trying to get a feel for it I'll start drawing to help me clarify what I am thinking about because usually it's a lot of things at once. Sometimes sketching just gets me thinking. Like I might be stuck, I don't know what I am doing, but if I start drawing something then the ideas come easier...When I start thinking about something I have to start drawing it to see if anything comes to mind.* (LH Interview)

All speak of the association they make between their sketching and their thinking but they also illustrate the difficulty they experience in articulating this association. Finding it difficult, they are less inclined to

speak to their friends, their design group and/or their teachers. This suggests again that if the findings of this research are in some ways going to contribute towards making sketching an explicit focus of the studio we need to tackle this absence of a language, a means to discuss the very thing we are trying to bring into focus.

Many students are aware there is a lack of teaching emphasis given to helping them learn to progress their designing, a concern which was raised earlier. They know this because working at home on their boards, away from the support of their tutors, and I use 'tutors' here because it is the term students use for their studio teachers, they get stuck. Their designing stalls to the extent they are often unable to get it moving again. Not seeing the connection between sketching and progressing they don't sketch and in not sketching beyond the point at which they got stuck, they have little or nothing for either themselves or their teachers to see, except their obvious concern. Unable to progress, and with few if any sketches to work from, they are hard pressed to develop their designing and they fall behind the required progress. Each week they come into the studio with the expectation their teacher will help them to move forward, and in not knowing how to progress their own designing they find themselves dependent on the inputs of their tutor and being repeatedly in this situation they lose design confidence. One student spoke of this dependence:

> I used to just listen to my tutor, go home do my model and drawing at home and see the
> tutor to get his feedback, do another round.

The same student on his coming close to failing design, attributes his loss of creativity to becoming too dependent on his tutor:

> I think I followed my tutor too much last semester, lost my creativities... It's creating an
> understand[ing] not just do[ing] what the tutor likes you to do. (Anon participant WSS
> 2006)

Another student, also identified as being at risk of failing design, makes a connection between following his tutor too closely and becoming disappointed with his scheme:

> I don't really understand where I went wrong during the semester, because for the whole
> semester I have followed with the tutor but the result end(s) up out of my expectation,
> somehow it disappointed me. (Anon participant WSS 2006)

The more difficult students find it to progress their work, the more dependent they become on their tutors. The more the tutors give the students answers and many feel it is their role to do so, more

dependent yet again the student becomes. Designing for students in this situation becomes largely a process of trying to carry out their tutors' directions and once away from the studio in trying to do so but without seeing a role for sketching, they find they cannot act on the directions they were given. One student tells of being in this situation:

> *I didn't know how to make it better, in what ways to improve it even though my tutor had already given me advice.* (Anon 3rd year student, Evaluation of Designing, 2002)

Concerns needing to be addressed

Having considered some of what has been observed over many years of watching, teaching and making sense of what students and teachers are doing in the studio, some patterns start to emerge. We begin to repeatedly come up against particular concerns when we consider how students learn and how teachers teach about sketching. If we are to improve the ways we teach and students learn about sketching these interconnected concerns need to be addressed. To bring these into the foreground,

- there is a lack of attention given to helping students learn to progress their designing

- helping students learn to use their sketching as part of their designing is not often an explicit focus of studio teaching

- students are unsure as to how to go about their sketching and are not aware of the ways it can be used to inform their designing

- teaching sketching as a skill is quite different to helping students learn how to use their sketching

- students and teachers are not necessarily seeing that sketching can offer a way into accessing how students are thinking and in turn designing

- help is needed to see below the surface of sketching to get to the underlying thinking associated with it

- there is a hesitancy to openly discuss the thinking associated with students' sketching

- students and teachers do not have a language and an associated terminology to articulate, discuss and make sense of how sketching is being used, therefore limiting exchanges amongst students and between students and teachers

□ without a language to articulate and a means to make sense of how students are using their sketching, it is unable to become an explicit focus of the teaching and learning studio.

These concerns suggest that our current teaching is out of alignment with what students are needing to learn and likely to limit students further along the path of their architectural studies. Limit in the sense that if students have not been able to consciously develop using their sketching as an integral part of their designing, their sketching is likely to remain isolated from their thinking. In not associating sketching with developing an architectural understanding, for these students sketching will not be a contributor to their emerging architectural disposition, which in the light of the significance architects place on sketching, would be a considerable shortcoming.

Our studio teaching should be able to do better than this and it would seem there is need to change our teaching and learning practices, if we are to better meet the needs of our students. Over the course of this chapter we have considered how students learn to sketch in the studio. We have observed our teaching focuses on what is readily noticed, our teachers are not appreciating the need, neither do they have ways to see beyond the surface of students' sketching to get to the underlying thinking and we have turned to wider research to see if particular findings might tell us more about these concerns. But we keep meeting the same and I suspect central issue, that is without a language to articulate the ways we use our sketching as part of our designing we are without an understanding of and a means to make explicit what is fundamental to our architectural outlook. We need to find ways to bring an explicit focus on sketching into design teaching. How do we do this? How might we think about such changes, what might they be and on what basis do we make them?

This thesis is directed towards addressing these concerns. The following chapter explores how through research we might approach doing so.

Chapter 3 *An orientation*

Introduction

This chapter explores how research into students' learning about sketching might be approached so as the findings help enable sketching to become an explicit focus of teaching and learning in the design studio. The research is positioned across three domains of knowledge: architecture, cognitive psychology and education and this chapter looks across these domains to establish a series of aims and intentions. Aspects come to the fore through a consideration of what research into sketching and learning has to offer and when seen in relation to each other give rise to a series of synergies which provide a basis upon which a brief for an investigation is established.

Positioning the research and its aims

Research into architecture students' ways of sketching involves three domains of knowledge. Sketching when designing is associated with the domain of architecture. Sketching in its relationship to thinking is associated with cognitive psychology while students and their learning lies within the domain of education. Each has associated with it a body of knowledge, related research, key findings and methodologies, as well as their own affordances, limits, shortcomings and opportunities. Depicting this positioning graphically (Figure 3a) we can see the research topic taking its place where one domain overlays on the other.

sketching in relation to thinking

COGNITIVE PSYCHOLOGY thinking processes

ARCHITECTURE design sketching

six primary concerns

learning in relation to thinking

EDUCATION students and learning

learning in relation to sketching
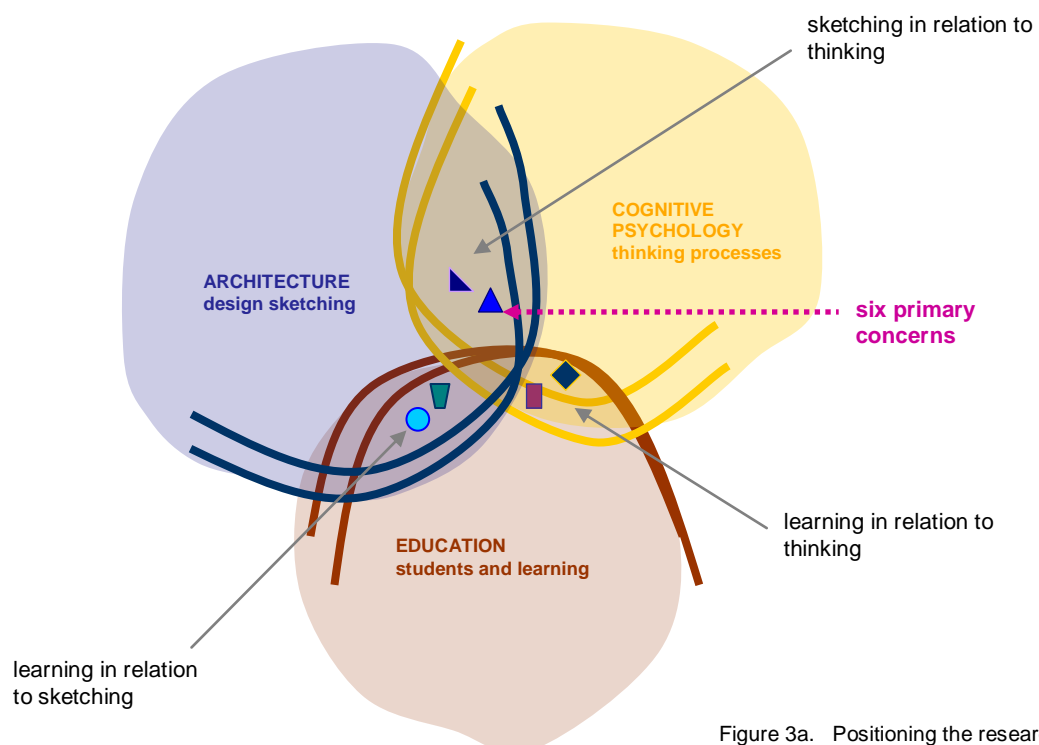
Figure 3a.   Positioning the research

Source: Author's diagram

When sketching is seen in relation to thinking, thinking in relation to learning and learning in relation to sketching, the locus of this research can be seen to be interrelated fields of knowledge from which this research is able to draw and to which it hopes to contribute.

In the light of Linda Groat's view that:

> *Some of the most innovative research in architecture will be interdisciplinary, requiring*
> *atypical or unexpected combinations of methods,* (Groat and Wang 2002)

Fig 3a suggests there is potential in this study for innovation and a unique contribution to knowledge. The diagram also brings to mind a need to establish clarity and order in the way the three domains meet, so as not to overly complicate or obscure what is potentially shared. Six primary concerns have come to light through a combination of what practice tells us about the different ways architects consider sketching, outlined in Chapter 1 and what teaching experience reveals of the difficulties students and teachers face in their learning to sketch outlined in Chapter 2. These concerns serve as anchors around which the related and shifting inputs of the three associated domains can be gathered. This research aims to:

→ recognize and build upon the understanding that sketching is fundamental to thinking in an architectural way and that architects go about sketching in different ways

→ focus on students' sketching

→ understand how students are using their sketching when they are designing

→ make explicit the ways students are using their sketching

→ be useful and meaningful to students and teachers in the design studio.

→ improve students' learning.

Architects sketch in different ways and go about their designing in different ways. This diversity in practice has caused much concern for researchers into the design process. Attempts to describe designing as a series of determinate steps or design methodologies, although being a focus of research particularly in the 1960s and 1970s, have been largely unsuccessful due to a concern to describe designing in terms of fixed relationships between the design problem and its solution. These fixed relationships did not adequately recognise the complex, open-ended and often poorly defined nature of design problems, nor the reality that different architects go about their designing in different ways (Lawson 2004). Turning these difficulties into strengths, my research aims to work with an appreciation

of the different ways students go about sketching as distinct from attempting to render diversity into a common methodology of repeatable steps and measures.

The absence of prescriptive design methodologies presents a challenge to teaching and learning and is one of the reasons why designing is generally learned through doing and is taught by teachers who are designers and know that designing is demanding, challenging and inspiring, an integrative process of discovery and a joy to experience. The same can be said about sketching. In fact the very nature of sketching, understood and taught in the context of designing presents a challenge for researchers as there is no agreed sketching methodology nor established language for describing this use of sketching. To undertake this research the researcher needs to understand sketching and designing, an understanding only likely to be held by a person who is both an architect and a teacher.

Lawson (2004) is of the opinion that practicing architects generally do not make good researchers essentially because the practice of architecture and the research of architecture require very different understandings and capabilities. He claims that the *'integrative, holistic and prescriptive thinking skills'* important to architectural designers are of relatively little use to researchers who generally need to *'analyse, deconstruct and develop descriptions and explanations'* (Lawson 2004). However this researcher is of the view that there is the possibility that integration might complement deconstruction and the holistic might complement the analytical, an appealing prospect, the partnership having the potential for productive outcomes.

When architects explain about designing, Lawson points out they cannot help but reveal something of their connectedness with their practice:

> *Whenever I hear someone deliver a lecture or I read a paper on the design process,*
> *somehow I can usually tell whether or not that speaker or author is actually a designer.*
> *There seems to be a certain kind of knowledge and understanding that is very hard to*
> *attain in any way other than by actually designing seriously.* (Lawson 2004)

Using my own connection with practice to describe sketching from the inside as a practised and valued, lived experience is one way in which the outcomes of this research can be made accessible to students in their learning.

Groat and Wang (2002) in considering what an architectural outlook can bring to research take it one step further. They are of the opinion that architectural research has much in common with architectural design but they make the point they are not one and the same thing. In their view the process of design is indeterminate and as such cannot be fully captured by determinate descriptions and yet is within the

domain of reason. The outcomes of design, usually associated with a built form are in contrast to the outcomes of research which are the development of insight and knowledge. Although different, they believe the outcomes of research can and should aid and enhance the outcomes of designing, which makes you consider whether the outcomes of designing could enhance the outcomes of research, a possibility this research hopes to realize.

Some architects involved in research share the cognitivists' interest in how designers think and are interested in sketching as offering a window into architects' thinking. Studies such as Gabriella Goldschmidt's '*On Visual Design Thinking: The Vis Kids of Architecture*' (Goldschmidt 1994) are of particular note as giving attention to understanding the role of sketching in relation to design thinking and the design process. With some exceptions, cognitive research usually centres on the mental activities associated with designing and often the language used to describe the complex sequences of thought processes is difficult for architecture students to apply to their learning about designing. This is not surprising as much of the research is allied to the development of computational models associated with the design process, potentially useful to students whose study interest is design computing, but sitting far off to the side for students of architecture.

Designing, that is the act of designing, is the setting for this research into students' sketching. Designing, in the way the term is used in this thesis, focuses on the person doing the act and is different to the design process, where the focus tends to lie more with the method or procedures associated with designing. Despite this distinction it is worth looking at various ways in which research into the design process has been carried out. Think-aloud protocols have often been used as well as retrospective analysis of design behaviour. Both typically involve an expert designer recorded going about their designing under controlled conditions. In a think-aloud protocol the participant is asked to talk their way through their thinking as they draw. The drawings they produce, coupled with the words become the data. The designing usually runs over a short time frame and information provided to the designer about the site and or the client is limited to a simplistic design situation. The ensuing analysis process breaks the verbal and graphic data into increasingly smaller parts, either based on units of time or thought events or as Lawson (2004) describes them '*design process atoms*', in an attempt to uncover the smallest component of a design protocol that may be meaningful to examine. With these parts identified, the analysis typically attempts to account for relationships, correlations or reproducible segments which are used to identify and describe patterns in design thinking.

To illustrate the disconnect between cognitive analysis and experience it is worth relating an experience of a few months ago. I walked into a seminar room and recognized my hands over a metre in size

projected on a wall, doing a drawing I had contributed to a researcher's study. After presenting a lengthy and detailed break down of my thought processes he explained that in my mind a vast number of things had taken place in a certain sequence to let me arrive at my drawing. This presentation was a memorable experience because the difference between what I had experienced at the time and what was being described could not have been greater. If these things had taken place, I was not aware of them. This atomised thought process revealed little to me of how I was going about my designing and it became clear that if the findings of research are to be useful to students and teachers, the findings and their description need to relate to the experiences of students and teachers and use language and expression appropriate to their day to day grappling with learning to design in the studio.

Cross (1996) and Dorst (1995) both raise a concern with think aloud protocols commonly in use. They are of the opinion that getting a person to talk their way through their thinking as they are drawing, may well affect what is being drawn, causing side effects or accounting for incomplete or non-typical designing activities. In other words:

Verbal reasoning interferes with visual reasoning. (Schooler and Engstler-Schooler 1990)

This was born out when a colleague and I participated in another think-aloud protocol study as expert designers. We were briefed on the project requirements, given pencils and paper and asked to come up with a design response in forty-five minutes, more specifically we were asked to draw a plan. We were also asked to talk through our thinking as we drew, something we were not accustomed to doing and it surprised me how hard it was. Talking and drawing simultaneously, the talking became the object and led the drawing rather than my drawing being the focus, leading my thinking. I was designing in a way unlike I had ever done before. Together with being asked to draw a plan, when typically I might have started with a section, the data bore little resemblance to my regular designing. My colleague had a similar response and he dealt with it by saying he could not talk and simply kept on drawing his plan. Goldschmidt makes the point that visual and verbal thinking are different and bound by different conventions (Goldschmidt 1994) and my experience confirms the dangers of mixing the two.

These experiences tell a number of things. Firstly if we are to keep the focus squarely on student sketching when they are designing, the sketching needs to be done without interruption, the confusion or the distortion of having to speak. Secondly, if sketching is the object of research it needs to come out of a design process which is as close as possible to the students' normal way of going about their designing, not a way of designing which is skewed by the way the data is collected. Finally, if we want sketching which arises out of an authentic design process the participant needs to be able to draw what they want to, not what the researcher asks them to draw.

Suwa and Tversky (1996) and others in their research efforts have recognized the limitations of using think aloud protocols and have used a technique of retrospective interviewing, where the designer goes about their designing uninterrupted and after watching videos of themselves designing, reflect on what they had been thinking at the time of drawing. While the verbal component is one step removed from the design process this approach is likely to result in more normal designing and less distorted data. It should be noted though that architects are well versed in persuasive post-rationalisation and as such there is the concern that retrospective explanations may be quite different to what was actually done at the time. Goldschmidt (1994) illustrates this by explaining how Larry, previously referred to, after having developed his design out of the loops of his signature, when describing his design to others:

> *No mention was made of the signature. Larry himself did not think it was relevant; for him the process started at a later phase and he explained that he wanted his kindergarten to have smooth rolling lines, because it was meant for such tender gentle souls for whom straight lines and angles might be too aggressive.* (Goldschmidt 1994)

This suggests that students' reflections on their sketching might express certain aspects of their sketching which are quite different to the sketches themselves, aspects the students become aware of when looking back on their sketching.

Sketching can be seen as a means by which we can access a person's design process, what Do, Gross, Neiman and Zimring refer to as:

> *External evidence of an internal thinking process.* (Do, Gross, Neiman and Zimring 2000)

Offering this opportunity to access design thinking, it is important that the sketching being researched arises out of a student's response to an architectural design problem, a problem both framed and responded to in ways which are as close as possible to what students usually deal with and what they normally produce. Over-simplification will distort the data. This suggests that all of the sketches a student makes as part of their design response need to be subjected to analysis, each one considered a contributor to a sequential design process and that the position of each sketch in the sequence may be significant. We will need to find means to read, analyse and interpret the sketches which respect and take into consideration their distinctive, uncertain, searching and at times unclear nature. While previous research has generally focussed on the clearer, more emphatic and directed sketching of experts the primary focus of this research is students and their sketching so students' sketching and possibly their reflections on their sketching will constitute the data.

In considering research into teaching and learning about sketching, again carried out by researchers into design from a cognitivist perspective, the major concern has been the development of pedagogical approaches that directly address the teaching of design thinking. These researchers did not have an architectural background and have focused their research on design in general as distinct from architectural design. General design findings are certainly relevant to architects and students of architecture but it is important to recognize that architectural design is closely related to and concerned with the specific architectural issues including architectural expression, architectural language, structure, construction, making of places and so on and necessitates research outcomes which are specifically architectural in their content and approach to be useful to architects and architecture students. It is critical that the way we approach this research, the data we use, its methods of analysis, its findings and its applications are understandable and therefore useful to students of architecture.

Bryan Lawson's research work is of particular note here. What is most noticeable is that his work is easy to understand. He uses language familiar to architecture students and he frames his research in such a way that it feels ready to use and you feel encouraged to put it into use when next designing. As a practicing architect with a background in psychology and a teacher (Dean of the Faculty of Architectural Studies at Sheffield University), his architectural viewpoint is fundamental to what he has to say. In '*What Designers Know*' (Lawson 2004), he has provided students of architectural design with a most useful resource which offers insight into the nature of designing and what is involved in going about it by repeatedly applying his knowledge of design to the situation of designing. The clarity and usefulness of his work is attributable to his ability to weave together the three domains which background this research, education, cognitive psychology and architecture.

Lawson is of the opinion that a common problem for schools of architecture is that students show little or no understanding of how to apply the technical or theoretical knowledge taught in other subjects to their designing. He comments:

> *The real problem here seems to be that this knowledge has been taught in such a way*
> *that it is not 'designerly' to reuse Nigel Cross's delightful phrase.* (Lawson 2004)

Linking this to a point made in Chapter 2 when sketching is taught as a skill or as a technical ability students find it difficult to make a connection between their sketching and their designing. Lawson sees the solution in teaching sketching in a 'designerly' way. Could it be that, if students are to make a connection between the outcomes of this research and their designing, we will need to approach this research in a designerly way? This challenge will have a bearing on all aspects of this research.

In very general terms, educational research is based on theories of learning and perspectives of knowledge. One relatively new research approach, which has as its foundation an outlook on learning has proved helpful in the context of learning and teaching in universities. Known as 'phenomenography', this approach has as its object of interest the differences in experiences of phenomena. This approach appears to offer opportunity to recognize and build upon the observation that architects go about sketching in different ways, and to explore this variation is one of the aims of this research.

Phenomenography had its origins in Gothenburg, Sweden in the mid-70s with the work of Ference Marton, Lennart Svennson, Rojer Saljo and Lars-Owe Dahlgren who investigated learning from the students' perspective. The work was exploratory and attempted to formulate an alternative to the abstract and empirically unverifiable conceptual frameworks of the time. Their work investigated students' conceptions and understandings of phenomena. Svennson explains this focus and of note is his reference to drawing upon Gestalt traditions:

> *This view of subjective knowledge as the object of research was developed in contrast to the positivist and objectivistic views dominant in educational and psychological research and with inspiration from older traditions of psychology of thought and especially Gestalt psychology.* (Svennson 1997)

In 1981 Marton proposed that the study of variation in conceptions of phenomena be a research specialization in its own right and the term 'phenomenography' began to appear in literature. The phenomenographic approach with its characteristic interest in the nature and description of variation, open-ended approach to data collection and interpretative nature of its data analysis, has become particularly popular in Australia, the UK and Hong Kong (Åkerlind 2003).

In the ensuing thirty years, phenomenographic research has developed as an educational research approach providing useful insights into teaching and learning and has avoided many of the limitations that beset educational research in the past. Research has been along the lines of two different purposes, each with their own set of research findings and literature. The first purpose is as a research tool to explain the nature of human awareness. The second is as an educational tool to improve teaching and learning (Åkerlind 2003) and it is in this second area that it has produced insights which are of particular interest to this research. These insights include:-

1. a phenomenon can be experienced in a limited number of qualitatively different but related ways

2. learning about a phenomenon can be approached in qualitatively different ways

3. a student's approach to learning is logically and empirically related to the complexity of their way of experiencing a phenomenon

4. teaching about a phenomenon can be approached in qualitatively different ways and these are influential forces in shaping students' experiences of the curriculum.

As a research approach, phenomenography's explicit recognition and valuing of differences, differences in the ways people experience things, the ways students learn and the ways teachers teach, appears to have much to offer an exploration into students sketching as sketching at first glance, is an act no two students seem to go about in the same way. The 'Founding Synergies' section of this chapter considers what a phenomenographic outlook has to offer this research, in particular with regard to its interest in the nature and description of different ways of experiencing aspects of our everyday world, its open explorative form of data collection and its interpretative form of data analysis.

Initial intentions

At this point we can give more specific direction to this investigation into students' sketching through a series of intentions drawn from what we know from architectural and teaching experience (Chapters 1 and 2), from what research associated with the background domains of architecture, cognitive psychology and education can tell us and our aims to undertake research which is useful to students in their learning, draws upon diversity and is approached in a designerly way. These intentions help shift the focus from the research in general to the design and execution of a particular investigation.

This investigation intends to

→ identify and describe how students are going about their sketching when designing

→ engage with the full range of students' sketching whether it is tentative or certain, searching or clear, straight forward or evocative, and use this sketching as the basis upon which to centre the investigation

→ focus on students' sketching which has arisen directly out of a student's normal way of designing within a typical design situation

→ articulate findings in ways appropriate and useful in the architectural design studio

→   be conducted from an architectural viewpoint with the researcher's architectural disposition utilised in reading and understanding the students' sketching in the context of designing

→   engage with students' sketching, its collection as data, analysis and interpretation from a viewpoint which brings together knowledge of architectural sketching, how students learn and visual thinking.

Founding synergies

The following pages build a description of synergies between a number of fundamental principles of architecture, notions of visual thinking and key concerns of a phenomenographic outlook on learning. These synergies when seen in relation to each other, establish a basis upon which to found the development of this research into a particular investigation.

In describing these synergies a common terminology has emerged, attributable to architecture and phenomenography holding certain terms and more broadly certain notions in common. Terms we come across in a phenomenographic setting such as the 'architecture of the variation', 'framework', 'part', 'whole', 'whole/parts and whole/whole relationships', 'differentiation', 'people's experiences', 'iterative processes', 'seeing in a new way', 'analysis', 'synthesis', 'conception' and so on, have particular meanings in an architectural setting. The Gestalt notion of the whole being different to the sum of the parts and Gestalt terms associated with visual thinking, for example 'figure' and 'ground' are commonly used in architecture and also accord closely with particular phenomenographic terms, most likely due to phenomenography drawing upon Gestalt psychology. One of the challenges of this research is to bring the particular meanings within each domain together into one voice, a voice which enables the domains to speak to each other on the basis of what they share.

A consideration of these synergies, what they involve and the meaning each might have for this investigation follows.

Experience lies central

Experience lies at the core of architectural understanding and designing and at the core of the phenomenographic outlook.

The architectural scholar Edward Bacon explains the role of the architect is not to create facades or architectural mass but to create:

An all-encompassing experience, to engender involvement. (Bacon 1978)

Experiencing a place, a room, an event or a street for example are day to day occurrences and it is through the multiplicity of our experiences we become aware of and engage with the environment we live in. Christian Norberg-Schulz, an architectural phenomenologist who has made significant contributions to architectural theory considers human experience fundamental to architecture.

Man dwells when he can orientate himself within and identify himself with an environment or in short when he experiences the environment as meaningful. (Norberg-Schulz 1980)

Eminent architect, Steen Eiler Rasmussen in his book '*Experiencing Architecture*' also speaks of the fundamental relationship between architecture and experience.

Understanding architecture, therefore, is not the same as being able to determine the style of a building by certain external features. It is not enough to see architecture; you must experience it. You must observe how it was designed for a special purpose and how it was attuned to the entire concept and rhythm of a specific era. You must dwell in the rooms, feel how they close about you, observe how you are naturally led from one to the other. You must be aware of the textural effects, discover why just those colours were used, how the choice depended on the orientation of the rooms in relation to windows and the sun. Two apartments, one above the other, with rooms of exactly the same dimensions and with the same openings, can be entirely different simply because of curtains, wallpaper and furniture. You must experience the great difference acoustics make in your conception of space; the way sound acts in an enormous cathedral, with its echoes and long-toned reverberations, as compared to a small paneled room well padded with hangings, rugs and cushions. (Rasmussen 1959)

Understanding the ways in which people experience places and what it is about a place which gives rise to a particular experience are important aspects of designing. For instance, when designing a terrace for a cafe, its character, shaping and detailing might be intentionally designed so as you experience the place as being friendly, a place well suited to a relaxed meeting. By contrast, a terrace in front of a courthouse might be designed with the intent of imparting a sense of authority or importance, even though like the cafe terrace, it too functions as a place of meeting. Because of the different experiences you intend, you will design the places accordingly. Before entering the courthouse you experience the

terrace as a place to pause, to collect your thoughts before moving on. Because of the way it is detailed you might feel small; humbled by the presence of the court, perhaps close to what the architect intended or you could feel defiant of the court, passing across it in a blur of preoccupation. Herman Hertzberger in his Lessons for Students of Architecture speaks of the interdependent nature of the relationship between architectural form and experience when he explains:

> *Form not only determines both usage and experience but that it is equally determined by them.* (Hertzberger 1991)

Jørn Utzon speaks of experiencing a building the way the architect intended.

> *If you look at architecture in yet another way - evaluating a building purely from the sensation of joy it gives you - you experience the building with your senses only and you become a user of the building in the way the architect had conceived it.* (Utzon 1984)

Utzon's description, both in sketches (Figure 3b) and words of his design for his family vacation house in Spain, gives us insight as to how he framed his intentions in terms of how someone would experience the house.
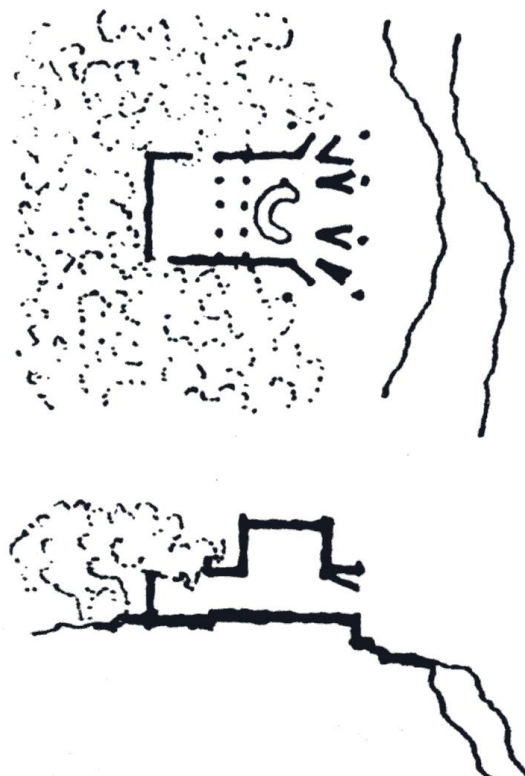
Figure 3b.
Utzon's sketch for his family home in Spain.

Source: Utzon 1984

Quoting his description:

*It is a sandstone house on the edge of the cliffs twenty metres above the Mediterranean, built with stones cut out of the cliffs. It houses only one single room, totally dominated by one big, curved couch which embraces the whole family. The deep window-wall softens the glare from the sun and the sea. The window frames are outside - invisible from the inside - so you are alone with sandstone, sky and sea. A narrow slot in the west wall invites the sun for a visit to the south wall for a few minutes every day, making you aware of the passing of time. (*Utzon 1984)*

Bacon is of a similar view but explains it through a negative case making the comment that when architects fail to project themselves into the mind and the spirit of the people who experience his or her designs, much of the *'staccato feeling'* (Bacon 1975) of contemporary architecture arises.

Hertzberger goes on to explain as we have already mentioned in the opening chapter, the importance of architects accumulating a library of experiences from which they can inform and enrich their designing, citing drawing as one of the most useful ways of doing this.

So essentially, the more you have seen, experienced and absorbed, the more points of reference you will have to help you decide which direction to take: your frame of reference expands. (Hertzberger 1993)

Louis Barragan (1980), in accepting the 1980 Pritzker Prize, poetically describes this quality of taking forward lessons and inspirations from his experiences:

The lessons to be learned from the unassuming architecture of the village and provincial towns of my country have been a permanent source of inspiration. Such, for instance, the whitewashed walls; the peace to be found in patios and orchards; the colorful streets; the humble majesty of the village squares surrounded by shady open corridors. And as there is a deep historical link between these teachings and those of the North African and Moroccan Villages, they too have enriched my perception of beauty in architectural simplicity.

Being a catholic, I have frequently visited with reverence the now empty monumental monastic buildings that we inherited from the powerful religious faith and architectural genius of our colonial ancestors, and I have always been deeply moved by the peace and wellbeing to be experienced in those uninhabited cloisters and solitary courts. How I have wished that these feelings may leave their mark on my work. (Barragan 1980)

In a similar way Alvar Aalto through his sketching comes to understand the Moroccan Village of Sidi Bou in the Atlas Mountains, perhaps the same villages Barragan was speaking of (Figure 3c).

Figure 3c   Travel sketch. Alvar Aalto 1951
Source: Schildt (1978)

These examples illustrate the fundamental relationship between architecture and experience, a relationship which works across many levels. Architects design so as to bring about certain experiences, they frame and describe their schemes in terms of experience, they accumulate libraries of experiences from which to draw and they take forward understanding and inspiration from their experiences. In short through experience the world comes to us and we come to the world: engaging with, becoming aware of and interacting with the richness of the environment within which we live. Phenomenography shares this fundamental concern with experience and is particularly concerned with describing the different ways people experience things around them. In phenomenographic terms, when a person experiences something in a certain way the experience is constituted by the relationship between the person and the thing or in architectural terms, a person and the place. The sum total of our experiences form our individual awareness of the world and our engagement with the world. As our experiences change so too does our awareness and our engagement. Marton and Booth (1997) explain the richness of our

world is constituted in the different ways people experience aspects of it and by understanding these different ways we come to make sense of the world.

> *At the root of phenomenography lies an interest in describing the phenomena in the world as others see them and in revealing and describing the variation therein.* (Marton and Booth 1997 p111)

Phenomenography's concern with describing experience is quite different from the cognitivist concern with describing the mental representations, memory and thought processes which guide acts and are essentially hidden or inferred things that go on in our heads. The difference between an interest in ways of experiencing and an interest in thinking leads to significantly different outcomes.

> *Describing experience is, however, something other than describing what is happening in the nervous system or describing what a person is doing. It is an autonomous level of description that cannot be reduced to the other levels of description, and it depicts how the world appears to people.* (Marton and Booth 1997 p114)

Phenomenography has as the object of its research, human experience and awareness and it shares this object with 'phenomenology', however phenomenology has the program of developing a single theory of experience by using a particular philosophical method where researchers engage in investigating their own experience. For instance Silvers (2002) conducted a phenomenological study using childrens' drawings entitled 'Sources: From the light of childrens' art' exploring how an essential meaning could be distilled through his interpretation of childrens' drawings.

Marton and Booth (1997) explain that in contrast, phenomenographers adopt an empirical orientation, studying the experiences of others:

> *Not to find the singular essence but the variation and the architecture of this variation in terms of the different aspects that define the phenomena.* (Marton and Booth 1997 p111)

It is through giving value and finding meaning in the different aspects that define the phenomena we come to see and to understand the richness of our everyday world. To illustrate this there is a phenomenographic study entitled '*Death Studies*', which like Silver's also involves using childrens' drawings, but in this case investigates conceptions of death. Tamm and Granqvist (1995) instead of looking for an essential concept, investigate the qualitative differences in childrens' concepts of death as reflected in their drawings.

That experience is fundamental to both architecture and phenomenography and phenomenography's particularly concern is describing the different ways people experience a certain thing suggests that a phenomenographic approach would be appropriate to exploring the different ways students go about their sketching. This exploration would lead to identifying a number of different ways students are sketching which would in turn realize one of the aims of this research, that of building upon the observation that architects go about their sketching in a wide range of ways.

Describing different experiences

Phenomenography explores the qualitative variation in peoples experience, perception and understanding of the world around them. Architecture strives to create variation in the experience of places.

Bacon suggests one of the prime purposes of architecture is to intentionally give rise to different experiences, to *'heighten the drama of living'* (Bacon 1978). He explains in creating spaces which are tuned to different activities architecture is able to influence how we interact and how we feel about doing what has to be done. For example, positioning a window to catch the first morning light will have a bearing on how someone rises. In this way architecture informs our activities through our experience. Bacon (1978) explains that:

Architecture must provide differentiated spaces for different activities and it must articulate them

in such a way that the emotional content of the particular act of living which takes place in them

is re-informed. (Bacon 1978)

Hertzberger (1991) explains the need for architects in their designing to aim towards widening the range of experiences for people:

> *The more levels of experience are taken into account in our design the more associations can be*
>
> *made and therefore the wider the range of experiences for different people in different situations,*
>
> *each with his or her perceptions.* (Hertzberger 1991 p236)

He sees places as being designed so as to evoke as many associations or experiences as possible. The more offered, the more people will be able to respond to them and the more chance there is the associations evoked will be of specific relevance to the user in a given situation. To give an example (see Figure 3d), consider the design for a window bay for reading; it is wide, perhaps 600mm, wide
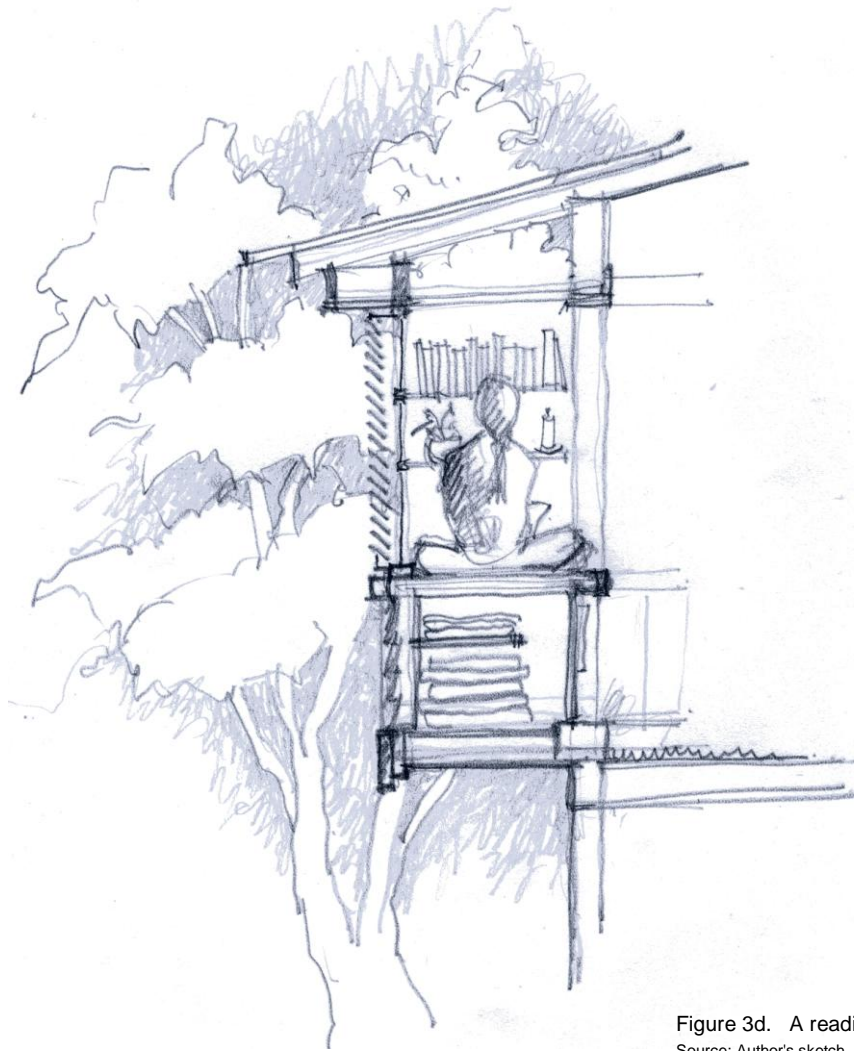
Figure 3d.   A reading bay
Source: Author's sketch

enough to take a vase of flowers, the flowers shown in the brightness of the sunlight that comes through the opening, yet the depth of the opening also softens the light on its way into the room. If the sill is wide enough it might take a cushion, provide a place to sit, to read in good light, perhaps cupboards below to stow blankets or books. The windows could be screened, offering the person in the window the chance of seeing what takes place outside but not to be seen by others in their need for privacy. In these ways the design of the sill becomes rich and the possibilities could keep extending, limited only by the considerations of the architect.

The richness of our everyday world is enhanced by the way different people come to experience the same place in different ways. Take for example the two sketches shown in Figure 3e, both are sketches of a womens' dance at the nasara, Hal Hal Village, Ambrym, Vanuatu. The top sketch (Ewald 2002) captures and gives emphasis to the circular gathering of the women around a ceremonial tam tam, or slit drum and it is the nature of the gathering which comes to the fore.
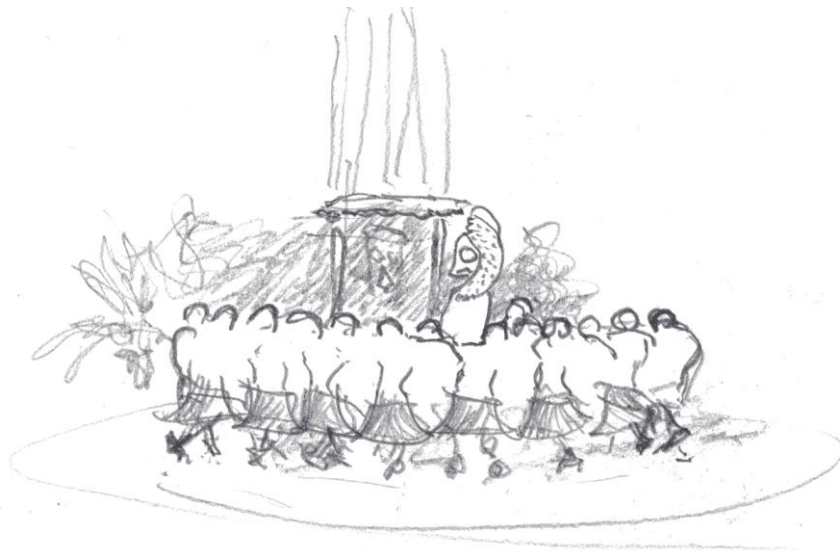
Figure 3e. Two travel sketches depicting different experiences of the one event.

Sources: Ewald (2002) top sketch. Rice (2002) bottom sketch

The one below (Rice 2002) sketched at the same time, sitting in the same place and also with an architectural eye, depicts the women in their grass skirts, most noticeable is that they are almost one and the same with the lush jungle growth behind. Being able to experience phenomenon in different ways, as these two sketches portray, not only contributes to the richness and variety of our everyday engagement with the world, but when explored and understood from a phenomenographic viewpoint, provides a means by which we can further our understanding of the phenomenon.

Phenomenographic research through describing and finding the meaning which underlies different ways of experiencing a phenomenon, comes to not only understand the experiences but also to understand on the strength of these experiences, the phenomenon. It seeks to make explicit the variation in ways of experiencing and to describe the main characteristics of this variation, what Marton and Booth (1997) speak of as the architecture of the variation. No attempts are made to formulate general principles about these experiences, as is the case with phenomenology, rather the focus is on exploring the meaning of the variation between different experiences. Phenomenographic research does not make statements about the thing itself nor does it attempt to describe individuals' understandings. The description reached is a description of variation on a collective level, the voice of the individual is not heard. In this way:

> *Individuals are seen as the bearers of different ways of experiencing a phenomenon and as the bearers of fragments of differing ways of experiencing that phenomenon.* (Marton and Booth 1997 p114)

The unit of phenomenographic research is *'a way of experiencing something'* and the object of the research is *'the variation in ways of experiencing phenomena'* (Marton and Booth 1997 p111). Using a phenomenographic viewpoint to consider students' sketching, the unit of the investigation would be a way of experiencing, understanding or going about sketching and the object of the research, the variation in ways of going about sketching.

Taking a form in line with this approach, Simon Barrie's (2003) phenomenographic investigation '*Conceptions of Generic Graduate Attributes*' has as its object the variation in academics' understandings of generic graduate attributes in the context of contemporary university courses and teaching. Through his investigation Barrie was attempting to get to the underlying nature of graduate attributes.

Chris Cope (2000) in his thesis '*Educationally critical aspects of the experience of learning about the concept of an information system*' similarly has as its object the variation in conceptions of information

systems but be takes this object a step further. In examining the differences between students' understandings of information systems and comparing these with a scholarly understanding he is able to constitute what it is that is critical to understand about information systems. This is an outcome useful to students in their learning and teachers in their teaching. His study shows that through the way a study is designed that the findings can take a form which is directly useful and applicable to students and teachers. Cope's study raises the question for this investigation as to whether the sketching of masterful architects should be explored and in turn compared to students' sketching. The decision not to was made on the basis that masters' sketching in the context of beginning a design are almost impossible to access first hand and the sketches which may have been available in books or even directly from such architects would be lacking their true sequence and context.

Taking a phenomenographic approach to this research and focusing it on students' sketching it seems, in the light of other phenomenographic investigations, possible to design an investigation in which the outcomes explicitly describe the variation in ways students experience sketching and the main characteristics of these different ways. This is an outcome which would certainly be useful to students. Particularly useful if the findings could be described in a language which is simple and directly applicable to students designing in the studio.

Sketching is an expression of an experience

Looking at the sketching of others offers a way into seeing a phenomenon through the eyes of the person sketching.

Phenomenographic research focuses on other peoples' experiences of the world as distinct from a first order perspective which seeks to make statements about aspects of the world. It takes a second order perspective, where the researcher is trying to see the phenomenon through the respondent's eyes. At every stage of a phenomenographic project:

> *The researcher has to step back from his or her own experience of the phenomenon and*
> *use it only to illuminate the ways in which others are talking of it, handling it, experiencing*
> *it and understanding it.* (Marton and Booth 1997 p121)

Architects use sketching as a way of coming to understand aspects of the world around us. In the words of the architect Carlo Scarpa:

> *I draw because I want to see.* (Scarpa in Los 1993)

When we look at others' sketching we see how they see aspects of their world. This suggests sketching could be of particular interest to phenomenographers. Yet surprisingly few studies engage directly with sketching. The only one found is a study already mentioned by Tamm and Granqvist (1995) entitled '*Death Studies*', which uses children's drawings to investigate conceptions of death. This investigation takes this engagement further and uses sketching as an immediate and expressive primary representation of a person's experience.

Architects often draw as a means to explore the experience of a place they are designing. When an architect sketches a room they are designing, such as in Glenn Murcutt's sketch Figure 3f,
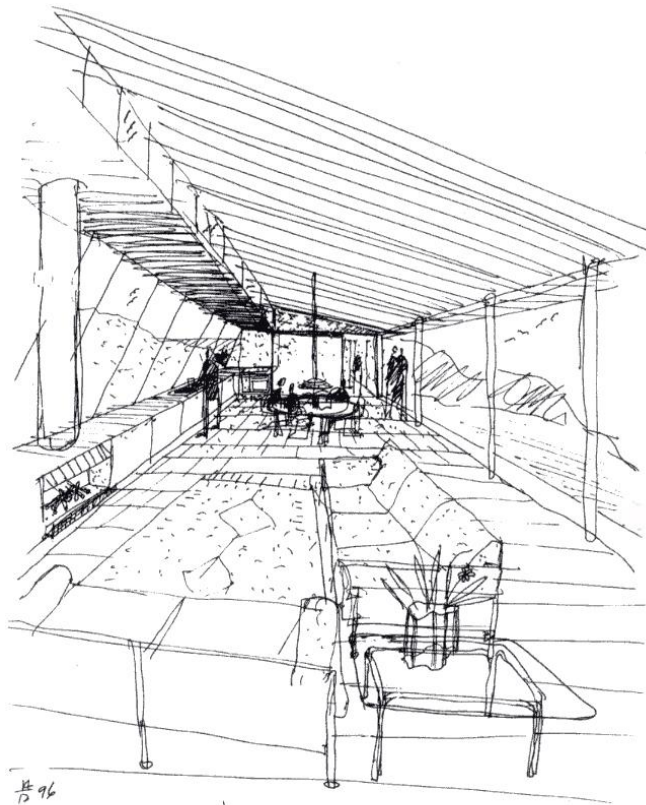
Figure 3f.   Murcutt's sketch of
Fletcher-Page House
Kangaroo Valley 1997-2000

Source: *Murcutt and Farrelly 2002*

they can see the spaces that result, they can see the elements which contribute to the space and often and most importantly they can see the space as a whole; its character, its feeling, what it would be like to be in that room. Once on paper, once seen, the room can be considered, reflected upon and challenged. Will it work for the client or make sense from the street as you approach? Does it bring about the desired experience? If what is sketched does not hold firm, the design needs to change. Another sketch is made, further consideration, and another and another sketch. Change after change the design unfolds in an iterative process, looping back on itself at the same time as moving forward.

Through the process of expressing an experience, passing it from eye to mind to hand, we find meaning in our experience of the phenomenon and in so doing, to use Norberg-Schulz's (1980) turn of phrase, we experience the environment in which we dwell as meaningful. How does another person access these meanings? John Bowden explains that phenomenographic research provides a method of discovering the meanings which underlie the way individual students see particular phenomenon (Bowden 2000). This suggests that a phenomenographic approach provides a method of discovering the meanings which underlie the students' sketching. More precisely we have a way of discovering the meanings which underlies the students' experience of a phenomenon as expressed in their sketching.

Bowden and Marton (1998) explain that in making visible different ways of experiencing things, we make explicit to other people that other ways of experiencing reality do exist. The phenomenographic outlook is founded on a non-dualistic world view in which the world is constituted through experience, experience being an internal relationship between a person and the world (Bowden and Marton 1998). That experience of the same reality can be different for different people is illustrated by the two sketches of the women's dance at Ambrym, a few pages before. (Figure 3e)

Bryan Lawson's (2004) '*experiential drawing*' type, spoken of in Chapter 2 takes on additional significance in this context as the drawings architects do to experience phenomena in the world around them. He describes them as a central part of the infrastructure of knowledge every designer must establish and in turn draw upon when designing, Hertzberger's *'library of experience'*. Figure 3g illustrates Lawson's and Hertzberger's point with Le Corbusier using his experience of Hadrian's Villa
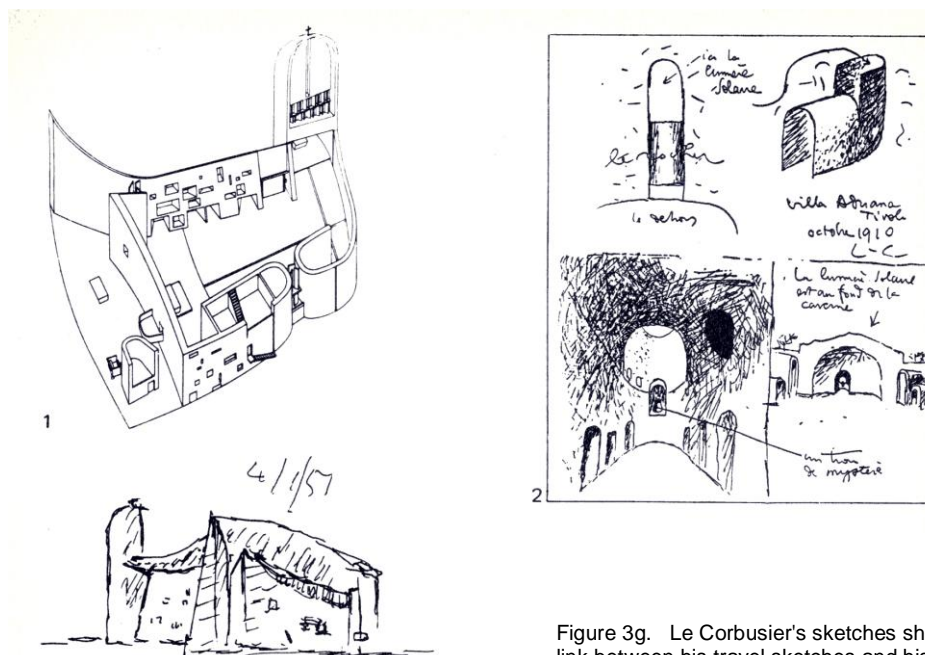
Figure 3g. Le Corbusier's sketches showing the link between his travel sketches and his designing of Ronchamp.

Source: Boesiger (1972)

recorded in his travel sketches to inform his design for the church, Notre Dame du Haut at Ronchamp, France.

Understanding gained through sketching is different to the understanding obtainable through photography and Lawson (2004) identifies a growing concern in design education about the extent to which experiential sketching may be declining. He cites the development of cheap digital photography as an easy means to record experiences of places but notes that sketching makes possible a level of understanding not achievable through the taking of a photo. Of even more concern is the extent to which the internet makes global image searching and retrieval easy and accessible, with students optimistically thinking they can partake of experiences without leaving their chair, let alone taking the time and effort to record them.

The understandings gained through sketching as a form of visual thinking are also different to those gained through writing. It follows that research based on sketching or visual expression will be offering different understandings to text based or word centred investigations. While this research intends to use students' sketching as its primary data this suggests that using text based interpretations as part of this investigation will add to the richness of the data. How can they both be used in the one investigation, what is their relationship? Would they need to be collected differently, analysed using different methods and interpreted by different means? We have spoken about the study by Tamm and Granqvist (1995) '*Death Studies*' which used sketching as data and also used a written component in their investigation. Children were asked to draw their impressions of the word death and to write a commentary on what they had drawn. The drawings were analysed based on the content of their drawings and the written commentary was used to confirm the observed content of the drawing. A similar use of written data to see the phenomena in two distinct ways could be used in this investigation to confirm interpretations of the sketched data.

Sketching depicts relationships

Architects recognize that the experience of a place is brought about by a particular internal relationship between a person and a place. When we experience a place, when we go to it, take it in and move through it, we enter into a certain relationship with the place. The place in itself is not central, neither is the person central in isolation from the place. Rather it is how we experience, how we relate to and engage with the place that constitutes our experience, our appreciation and the meaning we give to a place. The task of the architect is:

To bring order and relation into human surroundings. (Rasmussen 1959)

Phenomenographers similarly place importance on the relationship between a person and what it is they are experiencing. The individual and the world are not considered as separate entities; there is no objective world out there as distinct from a subjective world.

Developing this point, Hertzberger (1993) speaks of a unique relationship between architectural form, the designer and the users. He describes an inherent characteristic of architectural form is that it is *'interpretable'*, and he explains this in terms of form having an accommodating capacity which allows it to be filled with associations brought to it by the user, bringing about a mutual dependence between form and user:

> *So here we are not talking about a notion of form that presupposes and maintains a formal and unalterable relation between object and viewer. We are not concerned with a visual appearance as a shell around the object, but with form in the sense of accommodating capacity and potential bearer of meaning. Form can be vested with meaning, but can also be divested of it by the use to which the form is put and by the values that are attributed and added to it, or indeed removed from it - all depending on the way in which users and form interact.* (Hertzberger 1993)

Hertzberger, in his linking of architectural form to our experience of form, is expressing a similar relational view of the world to that which underpins the phenomenographic outlook:

> *It is constituted as an internal relationship between them. There is only one world, but it is a world we experience, a world in which we live, a world that is ours.* (Marton and Booth 1997 p13)

When experiencing a place or a phenomenon is seen as an internal relationship between a person and a place, it follows that the drawing of a place stands not only as an expression of an experience but also an expression of the relationship between a person and a place at the time the sketch is made. In the following example Richard LePlastrier (1999) draws in the top sketch the experience of sitting on a sloping bank in the lee of coastal tea trees, their wind sheared canopy providing shelter and enclosure. This is a drawing which expresses a particular relationship between a person, the bank and the tea trees, a sketch LePlastrier entitles *'looking for the lee*'. The lower sketch takes his experience of the lee and its key relationships and transforms them into architectural elements; the sloping bank becoming a stepped ground plane, the person on the bank inhabiting the ground plane and the wind sheared tea tree canopy becoming a sheltering, curved roof, securing the dwelling into the landscape. These

elements, synthesized into a coherent architectural entity offer an experience closely resembling the tea tree lee of the initial sketch. (Figure 3h)
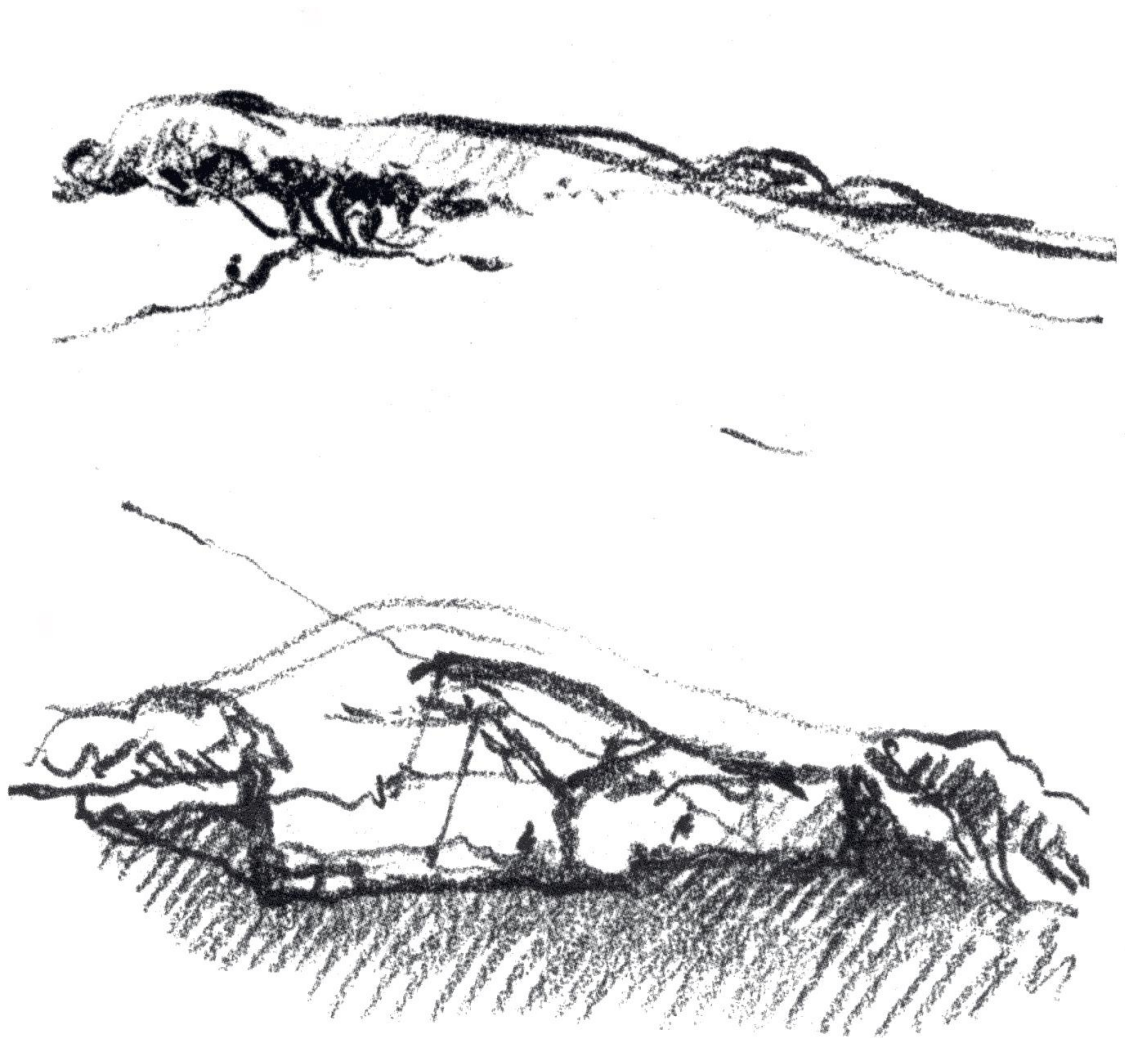
Figure 3h.   LePlastrier's early sketches for the Bruny Island House, Tasmania.
Source: LePlastrier 1999

Through the process of making a sketch, the person sketching sees the place or the phenomenon before them in terms the perceived relationships present. The relationships come to the fore through the process of putting marks on a page, marks which describe elements or parts. To draw the architect has to discern the whole and the placement of each element in relation to the next and to the whole. The account of sketching the entry to the Youth Hostel in the opening chapter describes the process in detail. Architects sketch to see relationships and the sense of discovery is delightful and frequently inspiring.

When sketching is understood as an expression of the relationship between the sketcher and what they are sketching and at the same time a means to help the sketcher to see and to appreciate internal relationships within what is being sketched, its relevance as an object of phenomenographic research comes to the fore. With few examples of research into sketching upon which to call, a challenge facing this investigation is to find ways to collect, to analyse, to interpret and to draw meaning from sketching that respects its evocative, searching and expressive nature.

An association between sketching, seeing and learning

If learning is about changing the way we see something, and sketching is a means by which we come to see, then sketching can be seen to be closely associated with learning. Indeed it could be suggested that when architects use their sketching as a way of coming to see something in a new way as they do frequently when designing, they are using their sketching as a means of learning.

Phenomenography has at its foundations an outlook on learning which links learning to experiencing. Learning in a phenomenographic sense is about coming to experience or to understand aspects of the world in which we live in particular ways (Marton and Booth 1997). It takes place when a person changes from one way of understanding to another, that is, their experience of something has changed. Marton and Booth (1997) associate learning with a shift in the relationship between the person and their experience of a certain thing, explaining:

> *Learning takes place , knowledge is born, by a change in something in the world as experienced by a person. The new way of experiencing something is constituted in the person-world relationships and involves both.* (Marton and Booth 1997 p139)

Bowden and Marton readily interchange the terms 'seeing' and 'experiencing', as evidenced in their description of learning as:

> *A change in our way of seeing or experiencing something in the world around us.*
> (Bowden and Marton 1998)

They go on to make the point that to see effectively:

> *We discern the aspects of the situation critical to our acts and take them into consideration, often all of them at the same time. .... We can prepare our students for effective action by enabling them to see certain situations in certain ways. By developing*

their seeing, by developing the eyes through which they see things: the photographer's eyes, the physician's eyes, the forester's eyes. New ways of seeing might occasionally replace old ways of seeing. (Bowden and Marton 1998)

As teachers of architecture we often say that we are helping our students to see. We are well aware that getting our students to sketch helps them to see situations and that better seeing discerns more and greater complexity of relationships. The discovery and elaboration of relationships drives and sustains designing. To expand on this statement, Marton and Booth (1997) explain that by learning we widen the range of possible ways of seeing the same thing and as a consequence our world grows richer and we have more options for our actions. Architecturally, sketching widens our range of possible ways of seeing a situation, our world grows richer and we have more options for our actions.

Glenn Murcutt, a passionate advocate of the importance of drawing and what he refers to as *'eye / hand thinking'* takes this idea further with the opinion that architectural designing is not so much a process of creating with a focus on ego, but rather one of discovering possibilities (Murcutt 2008). Sketching is a way of seeing and a way of bringing to the fore different ways of seeing. Designing is also about coming to see things in a new way, in the sense that through the process of designing the architect brings into existence buildings and places previously not seen. In this way both sketching and designing are closely related to learning and as a consequence key aspects of the phenomenographic outlook on learning are directly applicable to both sketching and designing.

The analytical approach, tools and techniques associated with understanding learning developed by phenomenography can at a conceptual and practical level be used to understand sketching. This investigation will draw on a phenomenographic approach so as to offer new insight into students' sketching, essentially an architectural concern.

Characterizing a way of seeing

By identifying and describing a 'structure of awareness' (Marton and Booth 1997) relating to a person's experience we are able to define an individual's ways of experiencing a phenomenon. This structure corresponds to the organization of those aspects of the phenomenon discerned and simultaneously held as objects of focal awareness. The Gestalt notion of figure and ground provides a way of reading the objects of focal awareness in the sketches of students.

How then do we come to see something in a certain way? Bowden and Marton (1998) explain that a way of seeing can be characterized in terms of aspects discerned and taken into consideration. The difference between one way of seeing a situation and another relates to whether or not certain aspects of the situation are discerned. In our everyday world there are some ways of seeing things which are more effective or useful than others. The object of learning is acquiring more effective ways of seeing a given situation. Effective action comes about when all of the relevant aspects of the situation are discerned simultaneously and taken into consideration.

> *The learner has become capable of discerning aspects of the phenomenon other than those she had been capable of discerning before, and she had become capable of being simultaneously and focally aware of other aspects or more aspects of the phenomenon than was previously the case.* (Marton and Booth 1997 p142)

In other words learning is associated with experiencing a phenomenon in a more complex way. Returning to the question of how a person comes to experience something in a certain way, a particular way of experiencing a place, an event, an object, an exchange for instance, can be attributed to the aspects of that phenomenon that are discerned and taken into consideration and the meaning which they are given. These related aspects can be seen as forming a combination or pattern present in a person's focal awareness. This pattern of related aspects and their meaning Marton and Booth (1997) refer to as a certain structure of awareness.

Phenomenographers use different terms to describe the structure of awareness that relates to a particular experience. One way drawn from Gurwitsch (1964) uses the terms 'theme', 'thematic field' and 'margins' to describe a layered structure, not unlike a transparent and expanding onion. At the core is the object of focal awareness, the theme, the things that we notice or what Ference Marton refers to as the 'figure' and Marton and Booth (1997) as the 'internal horizon'. Surrounding the core are those aspects that are relevant and related to the theme, forming a thematic field or a 'ground' within which the theme is embedded or seen against, the context in which the theme sits, also referred to as the 'external horizon'. The same theme can be seen against different thematic fields. We are tacitly aware of aspects in the thematic field. Other co-existing aspects of experience present but not related to the core in content or meaning, recede still further to the extendable margins beyond.

The elements or aspects that constitute a certain structure of awareness and the way these aspects relate to each other can be described using either the terms, 'theme, thematic field and margins' or 'figure and ground' or 'internal and external horizons'. This inquiry uses the terms 'figure' and 'ground' because these are terms commonly in use in architecture and have their origins in Gestalt theory, first

being used to describe different ways of perceiving visual material. The notion of figure and ground is common to all three of our background domains and over the course of this investigation take on particular relevance and meaning.

Looking more closely at figure and ground from a phenomenographic viewpoint, when for example a person enters a room such as shown in Figure 3i, she is aware of many aspects associated with this experience at the same time. Some of the aspects will be to do with what is in the room, the window, the door, the table. Others aspects she is aware of might be to do with the place she has just left, while still others may have to do with her running late or whether her friend is in the room. Although she is aware of all these things simultaneously she is not aware of everything in the same way. Some aspects are to the fore of her awareness, they are focused, thematized or are the figure, while others recede to varying degrees to the ground, they are tacit or unthematized, less focused. The aspects she is aware of simultaneously can be described as having a structure or an organization, in phenomenographic terms, a structure of awareness. The meaning of that experience for her at a particular time and in that particular place corresponds to the organization or the structure of the aspects that are discerned and are simultaneously objects of her focal awareness (Marton and Booth 1997). If another person enters the same room, his experience will be different and can be attributed to a different structure of awareness, that is he has more or less aspects of the room simultaneously present in awareness and or related in different ways. He might have at the forefront of his awareness the need to pick up the book which he has forgotten from the table. In this case all of the other elements that make up the room are still present, but by not being figural, they recede to varying degrees into the ground. So by identifying and describing the structure of awareness relating to a person's experience we are able to define individuals' ways of experiencing a phenomenon, a core objective in phenomenographic research.

Using an architectural example to explain how Gestalt theorists use the notion of figure and ground to help read a drawing, we can consider again Figure 3i. When we look at this sketch we can see a number of simple figures we can name: the table, four chairs, the window, the door set, the lounge chair and the skylight. These figures all have a form or a physical shape, they have an edge or an outline defining where they begin or end, each figure appears prominent and is a memorable part of the composition. The ground against which they are seen seems to continue either behind, around or under them. The walls, the floor, the ceiling, the entry door and what is outside the room constitute the ground. They appear as the setting or the backdrop for the figural elements, tending to read as surfaces against which the figures are discerned. Through the effect of grouping, the chairs, the table and the weaker figure of the open book, a new figure emerges, that of a table setting with a distinct feeling that something has just taken place given the disturbed placement of the chairs.

Figure 3i.   Upon entering a room
Source: Author's sketch

The space forming the corner of the room becomes the ground for the newly emerging figure. Shifting our perception again, we can group the windows with the door set and make them one figure as well. They are similar in shape, in detail, in height and in their transparency. As these both come to the fore to form a new figure, what is beyond them reads as ground. Shifting our perception we can look at the whole room, where the fabric of the enclosure plus the elements that stand within the room emerge as the figure, while the space contained by the enclosure, the implied space, recedes to ground. It is foreseeable though not obviously apparent from the sketch that with a different eye, the negative space, the volume contained within the enclosing elements can come to the fore, while the walls, the floor, the openings and the table recede to ground, an interesting point because architects often speak of the negative space, the contained space or the interior space within a room. In the book '*Between Silence and Light*' (Lobell 1979), Lobell recounts that Louis Kahn thought he had discovered the idea of 'interior space' until given a copy of Kakuzo Okakura's timeless work, '*The Book of Tea*' (original version 1906). He found in it described that:

'The reality of a room was to be found in the space enclosed by the roof and walls, not in

the roof and walls themselves. (Okakura 1906)

This same interior space is associated with 'figure / ground' drawings commonly used in architecture and planning (see Figure 3j). In these drawings the buildings are typically coloured black, the public spaces white and in both having equal value, the eye is able to shift, readily focusing on the patterning of the buildings or alternatively on the patterning of the public open spaces. Mo Zell in her book entitled '*the Architectural Drawing Course*' (2008) explains the origins of such drawing was derived from the traditional Roman city survey map of 1748 of Giambattista Nolli, where Nolli rendered the buildings dark and non-buildings or space in white. Of particular note was his rendering of the enclosed public spaces of the churches and piazzas white, his intention being that their enclosed public space could be read as being continuous with the space of the public realm.

Figure 3j.   A figure-
ground plan
Source: Zell. 2008

The idea that new figures not necessarily intended by the sketcher, can emerge out of a sketch was introduced in Chapter 2 as 'emergence', and is of particular significance to designing. Outlining some of the original Gestalt theory enables us to more fully appreciate this significance.

Max Wertheimer (1924), credited as the founder of the Gestalt movement, saw Gestalt theory arising out of a dissatisfaction with the characteristic tone of European Science which he saw as being concerned with the breaking up of:

Complexes into their component elements. Isolate the elements, discover the laws, then

reassemble them, and the problem is solved. All wholes are reduced to pieces and

piecewise relations between pieces. (Wertheimer 1924)

He goes on to describe the fundamental outlook of Gestalt theory, explaining that:

There are wholes, the behavior of which is determined by that of their individual elements,

but where the part-processes are themselves determined by the intrinsic nature of the

whole. (Wertheimer 1924)

It was the hope of Gestalt theory to determine the nature of such wholes or 'Gestalten'. Sherrill (1986)

explains that the 'Gestalt', translated literally as the 'figure', is segregated from its surroundings or

ground by virtue of its internal organization and coherence. He explains that:

In addition to its internal organization as a Gestalt, a figure possesses a definite shape, a

prominent contour and the appearance of greater 'thing-character' than the ground.
(Sherrill 1986)

Gestalt theorists, particularly Wertheimer and Kohler, were careful to use the terms figure and ground

only to describe perceptions of visual entities where the Gestalten could be identified in terms of their

shapes, contour and thing-character.

Purcell (2001) explains that Gestalt theory sees the visual world we experience consisting of objects of

varying sizes from very small to very large, bounded by contours or edges of varying strengths. These

objects have a shape or form which is defined by an enclosing contour. Shapes can occur within other

shapes making up more complex forms. The objects we experience are always seen against a

background. The relationship between objects and their background is called the figure / ground

relationship and in general the visual world consists of a number of figures seen against a number of

different grounds.

A figure / ground relationship has certain distinguishing features. These includes: the enclosing contour

belongs to the figure rather than the ground, the figure lies on top of or is seen in front of the ground

which forms an apparently continuous surface behind the figure, the figure has form or object properties

such as size and shape and figures are more prominent and therefore better remembered parts of a

visual array. (Purcell 2001)

Figures can be of two different types, either single, coherent figures or emergent figures, which depend

on or emerge from the relationship between a number of distinct and separate parts, each of which can

consist of one or more single, coherent figures. The reason why emergent figures come into being, of

particular relevance to this research, is because an effect referred to as 'grouping' has occurred. In

grouping, particular relationships between the parts come to the fore and a new figure is seen in addition

to each of the individual simple figures. It is argued that this effect is what has given rise to the often

quoted and just as often misquoted, Gestalt principle, *'the whole is different to the sum of the parts'.* The

new figure seen is different to and does not depend solely on adding together the individual parts. This does not mean the new whole or new figure is independent of the parts or that the parts and their characteristics cannot be analysed and examined in relation to the whole. Rather it is the relationships between the parts and between the parts and the whole which are important and these relationships cannot exist without the particular parts being present. (Purcell 2001)

There are a number of principles of organization which govern the way figures are perceived. Simplicity, symmetry and completeness relate to the formation of simple figures. Distance between elements, similarity in shape, lightness, size or area, good continuation and differences in orientation are associated with forming a grouping from which new figures can emerge. All of the organizational principles can occur together their various relationships reinforcing or weakening the figures that emerge. Any complex visual image will have a number of figure / ground relationships available and these will vary in terms of how strong the figures are.

Recalling the sketch of the room (Figure 3i.), some of the possible figure / ground relationships giving rise to alternative sets of visual experiences of the sketch were described. Some sketches offer very few relationships and are therefore relatively simple or straight forward sketches to read. Others offer a larger number of relationships and hence visual readings while others may offer so many as to become chaotic or confusing. Although each reading of a sketch is an interpretation, in a sense one step removed from what the person sketching was experiencing this enumeration of the figure / ground relationships the researcher finds in sketches makes her interpretations explicit and transparent.

It is interesting to note that considering sketches in terms of a series of figure / ground relationships and appreciating how grouping can allow additional figure / ground relationships to emerge, allows us to understand how sketching can enable us to see something differently to how it was initially perceived. In designing it is the designer's response to new readings of their own drawings which gives rise to the cycling of moves and arguments, of 'seeing as' or 'seeing that' of Goldschmidt (1991) and the 'reflective conversations' between designer and drawing of Schön and Wiggins (1992).

The theme / field / margin model used to describe a structure of awareness within which the figure and ground are positioned, recognizes the occurrence of margins which extend outwards to include aspects of the world that are increasingly less and less related to what is in the theme. These ever expanding margins are not a feature of sketching although it can be argued that these margins lie not in the actual linework of the sketch, but in the mind of the person sketching.

This investigation will use the notion of figure and ground as a way of reading the structure of awareness expressed in the sketches of students.

Attributing meaning

The experience of meaning is dialectically intertwined with the structure of an individual's awareness of the phenomena. The experience of meaning is called the 'referential aspect' of the experience

An experience of a phenomenon is a particular structure of awareness which can be described in terms of the related aspects of the phenomenon making up the figure, the related and non-related aspects of the phenomenon making up the ground and the relationship between the figure and the ground. Marton and Booth (1997) explain that:

> *Structure presupposes meaning and at the same time meaning presupposes structure. The two aspects, meaning and structure are dialectically intertwined and occur simultaneously when we experience something.* (Marton and Booth 1997 p87)

The separation of structure and meaning is helpful in understanding and describing an experience but needs to be seen as an analytical device which describes different facets of an undivided whole. We have seen in the previous section that we can use the Gestalt understanding of figure and ground to identify and name the structural aspects of this experience. A certain structure of awareness is constituted by a number of aspects of the phenomenon simultaneously present and related in particular ways. A different way of experiencing a phenomenon involves more or fewer aspects of the phenomenon simultaneously present in a person's awareness and or related in different ways. So by identifying and describing the structure of awareness relating to a person's experience, in terms of the structural aspects and the dialectically intertwined meaning or referential aspects, we are able to describe individuals' ways of experiencing phenomenon. This is represented in the following diagram, Figure 3k.
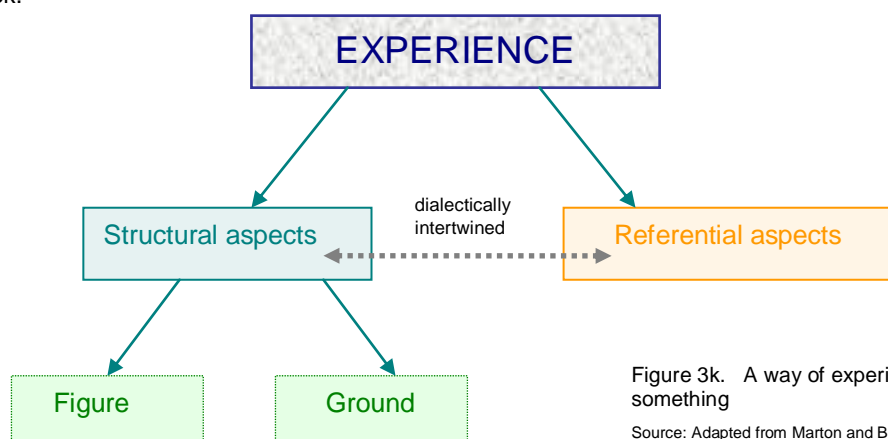
Figure 3k.   A way of experiencing something

Source: Adapted from Marton and Booth 1997 p88.

The meaning aspect of an experience can be accessed through what people tell us and interviews that are constructed to elicit meanings. Åkerlind, Bowden and Green explain:

> *A more useful follow-up question for eliciting participants' intentional attitude towards the phenomenon (and thus the underlying meaning of the phenomenon for them) is to ask why they go about it in the way they describe. The aim of the latter type of question is to explore the interviewee's underlying intentions or purposes with regard to the phenomenon.* (Åkerlind, Bowden and Green 2005 p80)

Meaning can also be interpreted by the researcher from the structural aspects of an awareness because a meaning corresponds to a particular structure (Marton and Booth 1997). This interpretation is obviously dependant on the researcher's own experience of the object of study. On the basis of descriptions of an individual's experience we can go on to build descriptions of the differences or variation between different ways students experience the phenomenon of sketching, a core objective in this research.

Learning involves change

When architects sketch they are learning as they change from a less to a more complex way of seeing a situation.

Learning, seen as a change from a less to a more complex way of experiencing a phenomenon, can also be considered as a change from a less to a more complex structure of awareness of a phenomenon. In a less complex structure the figure that emerges may be poorly formed, poorly differentiated or partial, the range of aspects constituting the ground limited, and the relationship between the parts less clear. In contrast, a more complex structure has more aspects of the phenomenon present in the figure, the figure is better formed and there are likely to be better defined relationships between the figures and between the figures and the whole. The phenomenon is experienced in a more complex, differentiated way. With a change in the structure of awareness comes a simultaneous change in meaning, the phenomenon is experienced as different and learning has occurred. This change or variation is considered by Marton and Booth to be '*the chief mechanism of learning'*. They explain that this is the kind of learning which has been referred to as:

> *A change in the eyes through which we see the world.* (Marton, Dahlgren, Svenson, and Saljo 1977 p23)

Change, the ability to see change and to respond to change is the driving force behind progressing a design in an architectural setting and as designing parallels learning, change relates to architectural learning. Restating previous paragraphs, sketching is a way of coming to see and a means to see things in a new way. Central to changing the way we see things is the experience of emerging figures. Architects look for emergence and use it freely and to advantage to progress their designing. Examining emergence and change through an example we can return to Figure 3i.

We can see the table setting as the strongest figure in the sketch, easy to do because of its central position in the room and the darkness of its linework. The space around the table, that is, the space that occupies the corner of the room becomes the related ground. Considering the sketch, the architect might see and then question that if the table setting is the centre piece of the room, why is the skylight off to the side? Might it be more appropriate to move the skylight to a position over the top of the table to reinforce its importance? It is a relatively simple step to imagine that if it did move, then the skylight, the window and the doors would group to form a new figure, giving additional prominence to the corner of the room, a follow up sketch could quickly test this

Figure 3i.   Upon entering a room
Source: Author's sketch

out. The new sketch could then be compared alongside the original and a decision made as to which is more appropriate. The architect is engaging with the sketch, pulling different figures into and out of focus, changing the structure of his or her awareness and thus the experience and understanding of the room.

Progressing designing is driven by a process of change in experience in a similar way as learning. It is hoped the outcomes of this investigation help students and teachers alike to recognize the importance of change in sketching and more generally in their teaching and learning to sketch. To be able to change their sketching they need to see how they are sketching at present, see that there are other ways to sketch and assess if those ways are better and why. Providing students with a means to develop this understanding is central to this investigation.

The 'what' and the 'how' of learning

Learning and sketching have parallel structures.

The way a student is going about their sketching can be seen in terms of two components. There is 'what' a student is sketching, for example they might sketch a roof set amongst trees or a garden seen from a doorway. There is also 'how' a student is going about their sketching, for example they might be sketching to remind themselves of something important. To understand the way a student goes about sketching, or in other words the manner or the approach a student takes to sketching involves understanding both the 'what' and the 'how' aspects and the way they are related. Expressing the importance of understanding the relationship by way of example; a student quickly drawing a door to remind them of its size is sketching in a different way to a student elaborately drawing a door to look into the shaping of its panels. The phenomenographic outlook on learning sees learning as an experience consisting of related 'how' and 'what' aspects. The 'what' aspect of learning or the direct object of learning, concerns the nature of the outcome of learning or the experience of what is to be learned. The 'how' aspect relates to the act of learning or how the learner goes about learning.

We can see sketching in a similar way as phenomenographers see a learning experience, where the 'what' aspect of sketching or the direct object of sketching, concerns the nature of the sketching outcome and the 'how' aspect or the act of sketching concerns how the student goes about sketching what is to be sketched.

The phenomenographic outlook describes an individual's ways of experiencing phenomenon in terms of the structural aspects and the dialectically intertwined meaning or referential aspects which simultaneously occur within the structure of awareness relating to the experience (refer back to Figure 3k.). A particular way of sketching can now be described in terms of separate 'how' and 'what' aspects and is constituted in the relationship between the 'how' and the 'what' aspects of the sketching. The 'how' and 'what' aspects can be seen and characterized as particular structures of awareness. The structure of awareness is described in terms of related structural and referential aspects, the structural aspects being described in terms of aspects which are figural and those in the ground. As noted before these distinctions between what and how are analytical and as such have no actual existence as separate entities, rather they are different facets of an undivided whole (Marton and Booth 1997 p85), the undivided whole in our case being our object of study, the different ways students are sketching.

This investigation now has a way to analyse and describe different ways students go about sketching.

From undifferentiated to integrated wholes

Both learning and designing proceed from poorly differentiated wholes to more clearly differentiated and to integrated wholes.

> *In our view, learning proceeds as a rule, from an undifferentiated and poorly integrated understanding of the whole to an increased differentiation and integration of the whole and its parts. Thus learning does not proceed as much from parts to wholes as from wholes to parts, and from wholes to wholes.* (Marton and Booth 1997 p.viii)

Expanding on this, in order to learn a person has to have some idea, some pre-existing knowledge of what it is they are learning. Learning takes place by a change in our experience of what it is we are learning, so the thing being learned has changed through the process of learning. It can be argued that an appreciation of the whole, precedes an appreciation of the parts. This initial understanding might be poorly formed or undifferentiated, never the less it is an understanding of a whole. Through learning, this understanding shifts to include increased differentiation of parts and their integration as a whole. Seen in this way learning does not proceed from parts to wholes as an accumulation of more detailed knowledge, but rather from wholes to parts and from wholes to more complex wholes. The initial ideas, the un-integrated wholes which the learner holds when embarking on learning are partial understandings as distinct from wrong understandings and it is the desire to make more complete these partial understandings that fuels the desire to learn and in an architectural parallel, the desire to progress designing.

Partial understandings are the seeds from which valid knowledge can grow. Marton and Booth (1997) explain that whatever we learn or gain knowledge about, our learning takes place as part of our ongoing exploration of the world and our new learning is seen against previous learning, parts of wholes established earlier. They describe learning as mostly a matter of:

> *Reconstituting the already constituted world.* (Marton and Booth 1997 p139)

The notion that understanding of a whole precedes an understanding of the parts is closely echoed in architectural designing. Architects, like learners, typically begin their designing with sketches of unformed, loose and undifferentiated wholes. From these initial wholes, through the process of designing, creating, putting forward, questioning and changing, a coherent scheme or architectural whole emerges. Bill Lacy (1991) gives us insight into the similarly seed like nature of the earliest stages of a design when he refers to the first impulse sketch (Figure 3l) as:

An encapsulation of the final solution to the problem which will be followed by months and sometimes years of refinement and revision, but in that first tiny sketch, like the one James Stirling made for the Staatsgalerie Museum in Stuttgart, crude and brilliant, all the elements of an enormously complicated project are clearly present. (Lacy 1991)
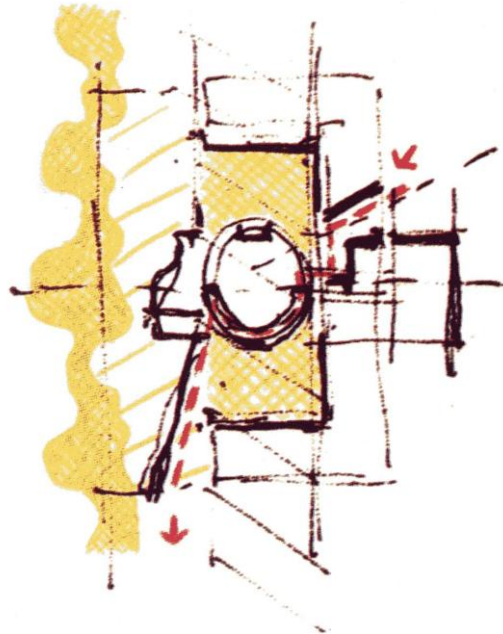
Figure 3l.   Sterling's sketch for the Staatsgalerie Museum, Stuttgart

Source: Lacy 1991

During what Lacy describes as the period of refinement and revision, the architect typically moves in an iterative looping process between working with the parts, the relationship between the parts and between the parts and the whole, and from simple wholes to new more complex wholes. Thinking about designing in terms of parts and wholes and the relationships between them and describing these in appropriately simple language is a familiar task for architects and particularly for architects who are teachers. The Gestalt principle that the whole is different to the sum of its parts is commonly used to explain the importance of working on a scheme as a whole, a complete thing. This is a notion at odds with the familiar belief that if one works on the parts the whole will look after itself and one which many students struggle with. The ability to focus attention on developing and differentiating the whole concurrently with elaborating the parts is considered an important part of developing an architectural disposition.

The close parallel between architectural designing and the phenomenographic conception of learning suggests that one may inform the other and that approaching this research with an architectural disposition will reveal something about students' sketching as a whole as well as features of its parts, aspects of the ways students go about their sketching.

Placing students at the centre of learning

Both teaching and research on learning should focus on understanding students' experiences.

Phenomenography has an underlying concern that the outcomes of research are useful to learners and places interpretation of students' and teachers' perceptions of their own learning and teaching experiences at the centre of efforts to improve learning and teaching (Prosser and Trigwell 1999). Marton and Booth speak of the need to make a shift:

> *Away from viewing the learner from the outside to one that tries to see learning from the learner's point of view,* (Marton and Booth 1997 p15)

and to do this, they explain we have to:

> *Ask learners what their experiences are like, watch what they do, observe what they learn and what makes them learn, analyse what learning is for them.* (Marton and Booth 1997)

The implication in the design studio is that students should be placed at the centre of learning. In Chapter 2 this need was identified on the basis of teaching experience. To teach design well, a teacher has to focus both on a student's scheme and the way a student is going about their designing. Not the teacher's scheme, nor what they think they would do if they were the student. The focus should lie with the student; what they are doing and how they are going about it, as expressed through their design drawings and models. Once a teacher understands the way a student is going about designing and as part of this sketching, the teaching can be directed towards the particular needs of that student. That teachers naturally focus on what is sketched, not on the way a student is going about their sketching is not surprising as there is no established understanding or language which makes explicit the differences in ways students are and could go about their sketching.

John Bowden (1986) describes similarities between good teaching and phenomenographic research. He explains:

> *In a sense, phenomenographic research mirrors what good teachers do. It tries to understand what the students are doing in their learning. It attempts to discover what different approaches students are taking and to understand these in terms of the outcomes of their learning activities. Good teachers do that as preliminary to further action to help their students come to understand the concept concerned and, of course, many do it instinctively. That is the appeal of Marton's work, of most phenomenographic research*

into learning; teachers can identify with both the methodology and the findings. (Bowden 1986)

Bowden's parallel between good teaching and phenomenographic research is supportive of a close relationship between learning and research. We need to place students at the centre of research for the same reason it is important to place students at the centre of teaching. Ramsden is of the view that:

Teachers should, in fact become scholars of their own students' learning and an important implication of this argument is that teaching and research in education are two sides of the same coin. (Ramsden 1988)

Marton and Booth explain that in order to place students at the centre of phenomenographic research we need to see their learning from the students' own viewpoint, saying:

The only route we have into the learner's own experience is that experience itself as expressed in words or acts. We have to ask learners what their experiences are like, watch what they do, observe what they learn and what makes them learn, analysing what learning is for them. (Marton and Booth 1997 p16)

Drawing is an expression of experience so to '*words or acts*' we can add 'drawing' and if we substitute 'sketching' for '*learning*' we find that Marton and Booth are telling us what this investigation has to do.

We have to ask sketchers what their experiences are like, watch what they do, observe what they sketch and what makes them sketch, analysing what sketching is for them.

An issue arising from placing students' sketching central is how to view their sketching from the students' viewpoint as distinct from the researcher's viewpoint. Reading a sketch involves a certain level of interpretation. What measures can be taken to ensure the researcher's reading is as close as possible to that of the student going about their sketching? Previous sections have suggested incorporating students' comments about their sketching as part of the data will provide a level of verification to these interpretations. Chapter 4 describes in detail the ways these two different forms of data have been engaged with and also outlines the measures this researcher has taken to remain as close as possible to what students intended in their sketching.

Ramsden (1988) is of the view that the dominant focus of learning should be on changing students' conceptions or understandings. He explains that in order to teach in a way which encourages changes in understanding, we must recognize how students already think about phenomenon, making ourselves aware of and use the understandings students already have. This raises questions as to how do you

focus research and teaching onto how students think? Can a phenomenographic approach help to understand how students think about their sketching? If we can do this we are in a position to suggest how a student might change, if they are to go about their sketching in a more useful way. He explains:

> *If learning is about changing one's conceptions, then teaching is about discovering students' conceptions and helping them to change their conceptions. The teacher's task entails learning about two related aspects of student's knowledge. The first aspect concerns developing an intimate acquaintance with students' current conceptions and models of the concepts and phenomena in a subject area.* (Ramsden 1988 p21)

A loop is emerging. Good teaching is concerned with understanding students' learning. Students' learning is an important focus of research and research into learning can and should inform good teaching.

In trying to help students change their conceptions there is little point telling them what concepts they should have, instead we should be setting up learning environments where the students have opportunities to question and to develop new understandings based on their recognition of where their old understandings fall short and how the newer understandings are helpful or of value. It is not about telling students but rather about them coming to understand for themselves. If the outcomes of this research are going to help students change their understanding of sketching, there is no point in findings which tell students ways to sketch. Rather the findings should enable students to recognize how their current ways of sketching fall short and how new ways of sketching could be helpful or of value. This intent, in architectural terms, establishes a performance brief for the findings.

Returning to Ramsden, in order to teach in a way which encourages changes in understanding, we must recognize how students already think about phenomenon. To access an individual student's thinking associated with their sketching we need to get below the surface of the sketch, beyond the linework to the thinking below. The phenomenographic approach provides a means to do this and has been used for this purpose in other studies. For example Lybeck, Marton, Stromdahl and Tullberg (1988) in their study *'The phenomenography of the mole concept in chemistry'* depict the qualitatively different ways in which secondary students think about and deal with the concept of moles. This study is of interest as it was explicitly concerned with identifying the underlying ways students think. Of particular note is that part of their analysis process involved the researchers' describing the path of each student's reasoning with the help of a diagram or map of patterns of reasoning. In an earlier chapter it was explained that the architectural sketching of students can be read not unlike the reasoning maps Lybeck et al used. However in Lybeck's case the major difference is that the researchers generated the

diagrams as distinct from the students themselves. If the students Lybeck et al had worked with could have made their own diagrams of their thinking, might the findings have been different?

Gregory Whelan in his 1988 study into '*Improving medical students' clinical problem-solving*' was of the view that studying how students go about solving diagnostic problems offers insight into how to improve teaching and ways to help students to learn to become better problem-solvers, an intention and an endpoint very close to this investigation. Certainly many of the difficulties his students faced in their learning about clinical problem solving have much in common with the difficulties students face in learning to use their sketching in designing. Whelan concluded that:

> *The experience gained during these various studies suggests that a knowledge of the characteristically different ways in which the students may approach the task of clinical problem solving offers a valuable viewpoint from which to help students who are having difficulties with the diagnostic process,* (Whelan 1988 p212)

suggesting that studying the characteristically different ways students approach sketching would offer a valuable viewpoint from which to help students having difficulties with sketching.

Being truthful to students

Teaching and research both require being faithful to students' experiences.

An inquiry is framed by the researcher's assumptions about the nature of reality and how one can come to apprehend it and it shapes the approach the researcher takes to the research. These assumptions convey a world view and the standards to be used in evaluating the quality of the research. Underlying phenomenography is a non-dualistic view of the world. Within this world there is one world, a world an individual comes to, relates to, understands and makes sense of through experience. The experience is the relationship between the person and what it is they are experiencing. Phenomenographic research is concerned with describing and finding the meanings which underlie the different ways people experience certain phenomenon. In focusing on other people's experiences, phenomenographic research adopts a second order perspective, where the researcher is exploring a reality conceived of and experienced by another, as distinct from a first order perspective which seeks to make statements about reality itself. First order statements, with their focus on describing phenomena, are judged in the light of other statements about the same; are they valid, consistent and useful statements? Second order statements, with their focus on describing how other people experience phenomena are required

to be truthful and to give a consistent account of an experience, trying to see the phenomenon through another person's eyes.

Sandberg (1997) describes this truthfulness and consistency in terms of being as faithful as possible to a person's experience. Quoting in more detail, Sandberg explains:

> *The basic idea of the phenomenographic approach, then, is to identify and describe individuals' conceptions of some aspect of reality as faithfully as possible. The rationale for phenomenography could be described in the following way: the more faithful we, as researchers, can be to individuals' conceptions of an aspect of reality, the better we are able to understand learning, teaching and other kinds of human action within society.*
> (Sandberg 1997)

Being as faithful as possible involves placing students' experiences as central and as such considering them to be the object of the study. The object is then the relationship between the students and the phenomenon, ways of sketching. (Figure 3m)
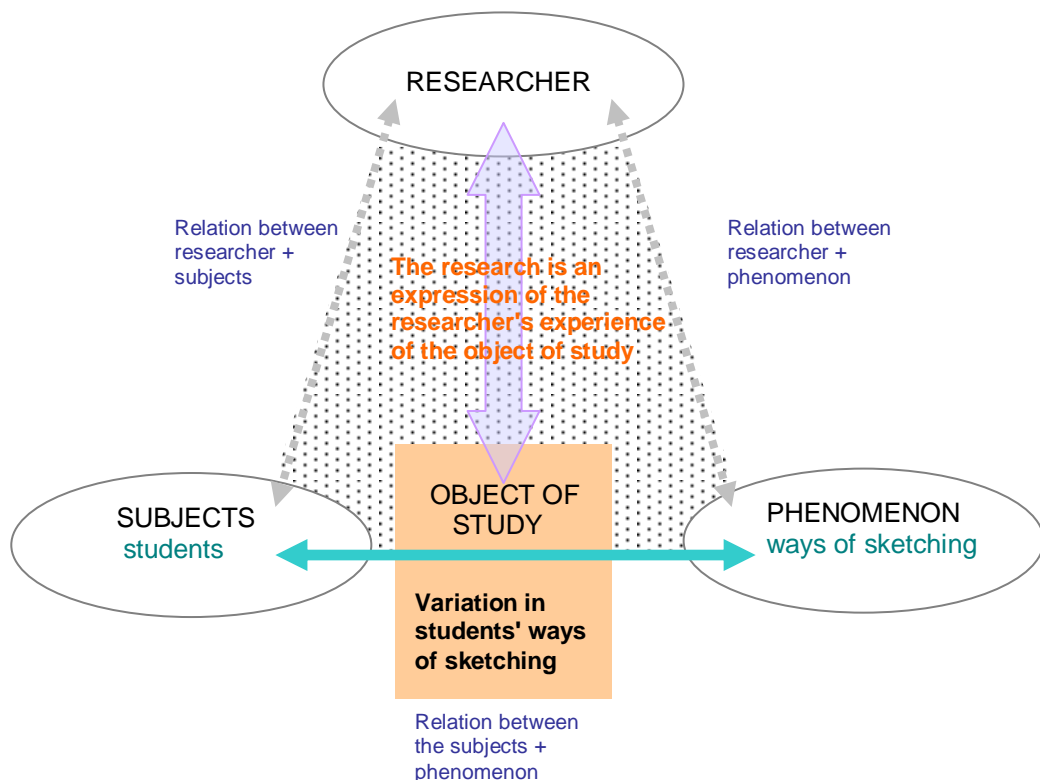

Figure 3m. Research as an expression of the researcher's experience of the object of study

Source: Adapted from Bowden 2005 p13.

The research itself is an expression of the researcher's own experience of the object of study and Bowden (2005) points out that the researcher needs to ensure that the focus of the research is maintained at all times on the object of study. To more fully understand what this means, it is helpful to state what the research is not. It is not an expression of the researcher's relationship to the student neither is the research an expression of the researcher's relationship to the phenomenon. As a researching teacher and architect, I have both a relationship to participating students and to sketching and it is important that I control these relationships by becoming aware of them and by making sure their influence is minimized across all stages of the research. I need to make sure I am not allowing my own understanding of either the students or the phenomenon to be imposed on and hence influence my interpretation of students' ways of sketching. Marton and Booth (1997) explain that the researcher:

> *Has to step back consciously from her own experience of the phenomenon and use it only to illuminate the ways in which others are talking of it, handling it, experiencing it and understanding it.* (Marton and Booth 1997 p121)

Sandberg (1997) proposes that instead of using replicability, a most common way of measuring the reliability of research in the social sciences, a more appropriate criterion would be maintaining an interpretative awareness, meaning that the researcher must acknowledge and explicitly deal with his or her subjectivity throughout the research process instead of overlooking it.

> *In order to be as faithful as possible to the individuals' conceptions of reality, the researcher must demonstrate how s/he has controlled and checked his/her interpretations throughout the research process: from formulating the research question, selecting individuals to be investigated, obtaining data from those individuals, analyzing the data obtained and reporting the results.* (Sandberg 1997)

He goes on to explain that one way of maintaining interpretative awareness is for the researcher to bracket their knowledge that is relevant to the issue at hand:

> *That is the researcher should strive to hold back his/her known theories and prejudices in order to be fully and freshly present to the individuals' conceptions under investigation.* (Sandberg 1997)

Sandberg (1997) and Bowden (2005) have established guidelines for how researchers can control and use themselves as interpreters in the research process. These and their application to students' sketching are discussed in the following chapter where they have a particular bearing on how the analysis was conducted. Sandberg's guidelines stipulate that the research

→ is oriented to the phenomenon as and how it appears throughout the research process

→ is orientated toward describing what constitutes the experience under investigation, rather than attempting to explain why it appears as it does

→ treats all aspects of the lived experience under investigation as equally important

→ searches for the basic meaning structure of the experience under investigation.

Being faithful to students' experiences, in this case, students' sketching is a principle which will need to underlie the actions and decision making associated with this investigation. It must become a manner, an attitude taken to all aspects of this research, a manner consistent with what is required of design teachers if they are to teach well. Teaching and researching well involves understanding how a student is progressing their designing as evidenced in their drawings and models and requires looking into a students' drawings to see below the surface, beyond what is being designed, to how the student is thinking. This requires being truthful to what the student herself has expressed. Once how the student is thinking is understood the teacher can make suggestions as to what the student should take into account and how she should do this to improve her designing. My years as a teacher seeking to understand how students are designing through reading their drawings will help when considering the sketching associated with this investigation. The next chapter outlines the design and conduct of the investigation and makes explicit the steps and measures taken to be as truthful as possible to students' experiences.

A brief for moving forward

When architects design they often restate the brief at the end of their initial investigation of the project. It is their appreciation of what they have to work with and embodies their understanding of the factors that will influence and contribute to the design. This 'return brief' stands as a description of what the architect wants to achieve. It does not describe the design of the building, rather it sets out what the building will do, what it is to be. It is not a list of aims or intentions, nor a checklist of things to include. It may include these but also includes potentials, new opportunities made possible by the particular qualities of the site, the needs of the client and the purpose of the building considered in relation to each other. The 'return brief' acts as a guide for the architect through the complexity of designing and is refined and developed as new factors influencing the design come to light. Good buildings benefit from a clear brief.

We are at the point in this research, where an architect would state their return brief. We know certain things, we can see inputs we need to take into account, shortfalls to avoid and opportunities with potential. With the synergies between sketching, visual thinking and learning, an understanding of the difficulties students face in learning to sketch and the extent to which architects highly value sketching as part of their thinking in an architectural way, we can draw these together to form a brief upon which to centre an investigation into students' sketching. This brief will be refined and developed through the course of the investigation as new factors and influences come to light.

The investigation will:-

- identify and describe the qualitatively different ways students go about their sketching when designing and in so doing, recognize and find value in the characteristic that different architects go about sketching in different ways.

- make explicit the variation in ways of sketching and to describe the features of this variation so as to be understandable and useful to students in their learning in the design studio. The unit of the investigation is a way of experiencing, understanding or going about sketching, the object of the investigation is the variation in ways of going about sketching.

- through describing and finding meanings underlying different ways of sketching, provide a means by which we can further our understanding of sketching and help to bring sketching into being an explicit focus of teaching and learning.

- approach, design and conduct the research in a manner which is truthful to students' experiences by placing the sketching arising out of students' normal ways of designing as central; seeing sketching through their eyes, asking them what their experiences of sketching are and analysing what sketching is for them.

- engage with the students' sketching, through its collection, analysis and interpretation in ways which respect, value and draw meaning from its expressive, evocative and at times uncertain nature.

- call upon a phenomenographic approach to shed light on what lies below the surface of students' sketching in order to make sense of what is going on when a student is sketching in a particular way.

The next chapter describes an investigation directed towards addressing this brief.

Chapter 4 *The study takes place*

Introduction

With the brief established, Chapter 4 describes an investigation into the different ways students are sketching, an investigation designed specifically to meet the terms of the brief. The investigation as a whole is described, the form it takes, the two part nature of the data and the manner of its collection. Details of the analysis process are explained and the researcher's concern with being faithful to students is introduced as underlying the orientation, the design and the conduct of the investigation.

The study as a whole

Phenomenography gives us a way of thinking about, a way of tackling or making sense of some of the complexity of factors raised up to this point. What it does not do is provide ready answers. It does not offer a recipe for how to go about the study, nether does it prescribe certain methods or techniques. Marton and Booth (1997) explain that:

> *Phenomenography is not a method in itself. Although there are methodological elements associated with it ... Phenomenography is rather a way of - an approach to - identifying, formulating and tackling certain sorts of research questions, a specialization that is particularly aimed at questions of relevance to learning and understanding in an educational setting. (*Marton and Booth 1997 p111)

This places the onus on the researcher to design and implement the investigation in response to their understanding of the phenomenon under investigation and the issues surrounding it. As with any designing the design becomes clearer and more exact as the process unfolds. The synergies showed us the close relationship between designing and learning and, as with learning, designing deals with wholes as well as parts. How then can we see this study as a whole?

This investigation is concerned with identifying and describing the qualitatively different ways students go about sketching when designing. So how do we identify these? Chapter 3 established that to understand the way a student is going about their sketching, or in other words the manner or the approach a student takes to their sketching involves understanding the 'what' and the 'how' aspects of their sketching and the way they are related. The 'what' or direct object of sketching concerns what is being sketched and the 'how' or act of sketching concerns how the student goes about sketching. The following Figure 4a depicts these two aspects as separate experiences which can be analyzed in terms of a structure of awareness. Each experience is described in terms of related structural and referential

aspects, the structural aspects in terms of a particular figure-ground relationship and the referential as an intertwined meaning. When a student sketches in a different way, what and/or how she is sketching is different and she is holding more or fewer aspects of the phenomenon simultaneously present in her awareness and/or related in different ways. That is, the structure of her awareness associated with her sketching is different.
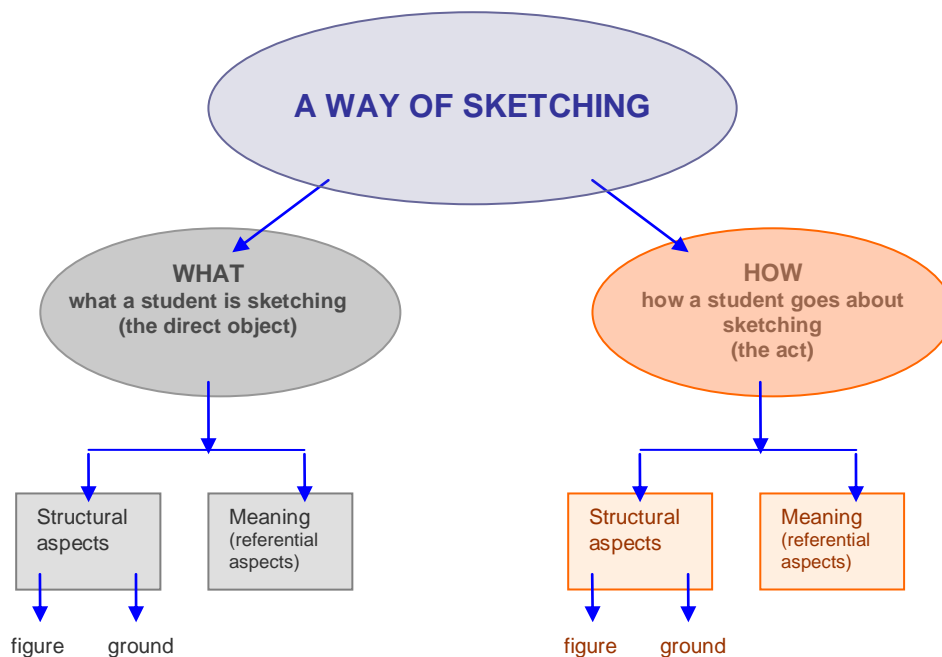
Figure 4a. Describing a way of sketching
Source: Adapted from Marton and Booth 1997.

With the object of study focused on identifying and describing the different ways students are sketching, how do we elicit students' experiences of sketching and what form should these experiences take?

If the outcomes of this study are to be useful to students the sketching under investigation needs to be generated, collected and considered within the setting of designing. It is critical that the sketching constitutes a student's actual design response closely resembling how students usually go about their designing. Only in being so, can the sketching be considered authentic and reliable. In the way we ask students to sketch their design response, they need to be free to sketch what they want and in the way they want to go about it. This needs to be consistent across all of the participants, so as to enable one students' sketching to be considered in relation to another. To fully see and to value the intricacies, the complexity, the hesitations and the subtleties of expressions associated with the different ways students go about their sketching, all their sketches will need to be taken into consideration when collected,

analysed and interpreted as each and every one of their sketches has made a contribution to the development of their design response. The messy and the unfinished are of as much value as the polished and precise. The sketches will need to be seen as part of a sequence, their relative position, line weight, prominence and character within the design sequence significant. Looking from the sketches to the students, it is not the experience of any one particular student that is of interest but rather the different ways students experience sketching. It is not an individual's voice but rather the collective voice in focus and the description reached is a description of the variation on a collective level. In this way, individuals seen as are bearers of fragments of different ways of experiencing a phenomenon (Marton and Booth 1997). In order to maximize the potential to observe such variation, a group of students within which one would expect to find a range of experiences is needed (Bowden and Green 2005). The researcher for this study needs to be able to view the sketching with an architectural eye, an eye experienced in reading the uncertain and often difficult to make out sketching of students. She needs to have an appreciation of the complexities of architectural designing and at the same time an appreciation of what designing students, as distinct from experienced practitioners, are capable of doing, an understanding likely to be found in someone who teaches. A teaching background would also assist the researcher in giving form to the findings in a way which is of use to both students in their learning and teachers in their teaching in the design studio.

Phenomenographic research using text based transcripts of interviews as their data provides principles which can be applied to visual data and offers a way of moving forward (for example Bowden and Green 2005). However early freehand design sketching brings to the fore a range of issues particular to its architectural character, its design setting and the personal nature of its expression which this study has to deal with. With an understanding that for some, phenomenographic research is a process of discovery, and knowing discovering is an integral part of designing, this study needs to move forward in a way which allows new things as they come up to loop back into and inform the movement forward. Shifting direction the course was irregular and needing of constant adjustment. This way of moving forward is responsive to opportunities newly seen and a way of working this researcher is used to and values in architectural practice.

Bowden is of the opinion that in developmental phenomenographic research undertaken with the purpose of using the outcomes to help students learn, as much focus is needed on the subjects of the study and on the nature of the data collection process as on the phenomenon under study (Bowden 2000). The following pages look in detail at how the student sample was chosen, the way the design response was elicited, how students were presented with the design task, the nature of their responses and offers an example. Care is taken to make explicit why decisions were taken and to describe the

manner in which the study was conducted, making apparent this researcher's commitment to being truthful to students and to their sketching. The students' loose, evocative and fresh sketching has been an ongoing source of inspiration through the lengthy and at times less than obvious passage of this exploration.

The form of the study

Working with students

The participants chosen for this study are a group of students in their third and final year of the Bachelor of Design Architecture at Sydney University; the first of two degrees (minimum five years of study) necessary before a student becomes a graduate architect. These students are mid way in their architectural studies, and as such have begun to develop a characteristic way of sketching in their designing. They have also begun to acquire the skills necessary to independently progress their way through a design project and have enough of a vocabulary of architectural experiences and architectural knowledge to begin to go about their designing in an architectural way. These students' abilities have been acquired within a university setting and have not been supplemented through experience of architectural practice. In short it is reasonable to expect the students to have enough variety in their architectural understanding to provide a range of responses to the design task. Being in the midst of their studies it is likely that the range of their responses will give rise to findings complex enough to be relevant to students in their later years and simple enough for novice students to learn from. All of the students selected have had contact with me and I have with them in my role as year coordinator, design teacher and drawing lecturer, as would be the case with most architecture students in the undergraduate degree. Recognizing these relationships, measures have been taken to minimize their possible effects on the participants and their sketching and on the way I engage with them through the process of analysis and interpretation. My experience as a practicing architect outside of the university also influences the way I read students' sketching and needs to be recognized. The measures taken in response are expanded on throughout the chapter.

Fifteen students, ranging in age from twenty to thirty two years, were asked to be involved and fourteen agreed, this number being a balance between providing sufficient variation in responses and keeping the volume of their sketching manageable as a body of data. The participants, eight females and six males, were selected so as to be representative of a range of design abilities as evidenced by their mid-semester third year design grades, ranging from 'requiring supplementary work to pass' through to a

'high distinction'. Each participant had experienced similar design studio learning over five semesters, however some had backgrounds in different degrees or workplaces (not related to architectural practice), whilst others had come to their studies straight from school. I was familiar to all of the participants and they to me, although my role as a researcher was new to them and aroused their curiosity with some commenting on the obvious link between the focus of my recent teaching and the topic of this research. Importantly for this study the students were used to me being around when they were designing in the studio. None of the students selected were doing my courses, nor was I co-ordinating their year. They were not pressured to participate and a connection between their participation and course performance or assessment could not be made.

The design task: asking for two responses

In response to the brief and in line with what came to light through the synergies, the study centres on students' sketching, sketching done as part of students' designing. The form the data took and the way it was collected were directed towards enabling this researcher to see students' sketching through the students' eyes, to watch what students do, observe what they sketch and what makes them sketch, to ask students what their experiences of sketching are like and analyse what sketching is for them. It also took into account that what students say about their sketching is potentially quite different to what they actually do and, verbal thinking has the potential to interfere with visual thinking.

With this in mind and knowing the data had to reveal both structure and entwined meaning, the data was in two forms; students' sketched design responses and spoken reflections on their sketched responses. The sketches were considered the primary data, an expression of sketching in practice, the spoken responses considered secondary as a reflection on that practice. The spoken responses, although a different expression were potentially valuable in revealing the meaning of both individual sketches and sketching in general for each student, as well as helping to confirm or dispel this researcher's readings of the sketching.

To outline briefly, students were asked to complete a short and intense design task. The response to the task was in two forms; the sketched response in which students were asked to '*use sketching to develop an initial response for a poet's retreat',* and a follow-up spoken response, during which students were asked to describe in a brief semi-structured phenomenographic interview, what they had just sketched and why. The sketched responses, in all fourteen cases, although not specifically asked for, were sequences of multiple sketches, the spoken responses were transcribed interviews.

The sketched response - sketching in practice

To outline the collection of the data in more detail, students arrived in their regular design studio at individual appointed times, having previously read a participant outline sheet sent prior to their agreeing to take part. I thanked them for coming, asked if they had any questions about the study, requested they sign a consent form permitting me to use the sketches they produced and pointed out they retained authorship, a measure consistent with the conditions of the ethics committee approval. All agreed to do so.

Each was briefed about the design task, *'a poet's retreat on the western foreshores of Pittwater, Sydney'*. The briefing material was the same for each student and limited to their client's book of poems *'Fallen Angel'* (Manefield 1999) and five A4 briefing panels. The panels were intentionally concise yet presented as an evocative description of the design task. They were primarily visual, specific enough to contain an adequate level of background information about the client and the landscape and open-ended enough to not channel their responses. Multiple large colour photos conveyed the character of the landscape and helped to reduce the uncertainty associated with not being able to physically visit the site, something I was aware of after participating in other studies. The students were asked to *'use sketching to develop an initial response for the poet's retreat'*, these were the only words used to describe what it was the student was asked to do and were deliberately chosen to make explicit that the task was not writing based. The verbal briefing lasted only a couple of minutes, was the same for each student and was designed so as no additional inputs were needed in order to complete the task, in this way keeping to a minimum influence from the researcher. Figure 4b depicts the five briefing panels.

1. The study identified

UNDERSTANDING THE ROLE OF SKETCHING IN ARCHITECTURAL DESIGN EDUCATION

A phenomenographic study of students' approaches to using sketching as a tool to progress their design thinking

Susan Rice
Faculty Of Architecture, University Of Sydney

You are asked to use sketching to develop an initial design response for a poet's retreat.

2. '*You are asked to use sketching to develop an initial design response for a poet's retreat*'

Your task is to develop an initial design response for a small retreat for the Sydney based poet, Jorie Manefield on the western shore of Pittwater.

The retreat is to be sited on the sloping north-western flank of Woody Point on one of the grassy patches between a series of gently shelving, sandstone outcrops.

For Jorie, a teacher and a writer, she feels that connecting with the qualities of the Sydney landscape is central to maintaining the creativity in her later writing. It has been suggested that her poems speak of a *'world of beautiful but harsh landscapes, of small but meaningful objects, inspiring an intensity of feeling and a sharpness of reflection that study and celebrate life with all its pleasures, risks and glories'*

Whenever she finds the opportunity she makes the journey from the city, significantly leaving more behind than she takes with her. She boards the ferry and travels across the open stretch of water to the old wharf down by the end of the point. She carries her few supplies up the winding path, through the stands of spotted gums to her place.... It is the qualities of being there that are her ongoing inspiration.

3. The poet's needs, her poetry and her journeying to the site are described.
The landscape within which the retreat is sited is described in qualitative terms.
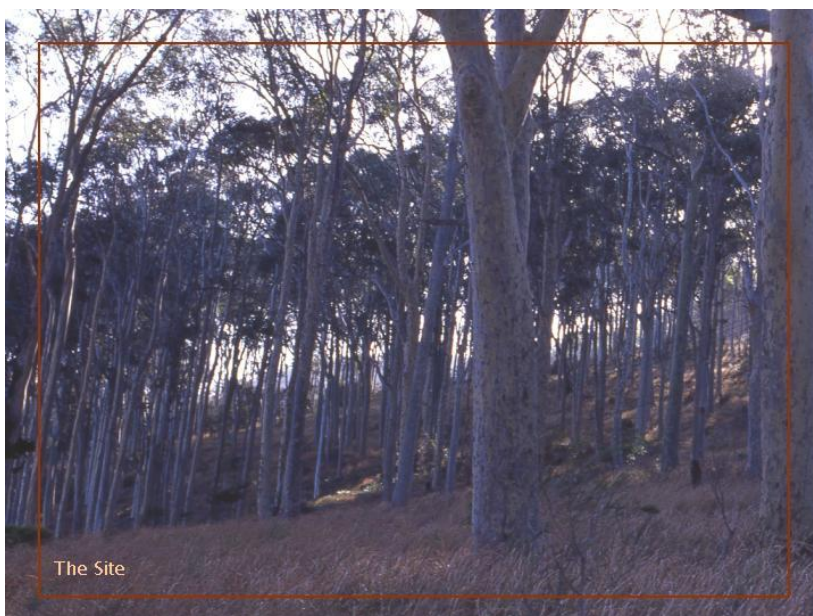
The Site

4. '*The site*'

5. *'Typical outlook from high up on the ridge'*

Figure 4b.   The briefing panels

Source: Author

With the briefing finished, the student was asked to take the panels, the book of poems, any number of clean A2 butter paper sheets and my best soft graphite sketching pencil (Figure 4c), to a drawing board that suited nearby and advised that in thirty minutes I would ask them to put their pencil down and collect their pages.

Figure 4c.   What the students were presented with to complete the design task

Source: Author

To capture students' sketching and designing in a normal way the sessions took place in the design studio, an environment they were used to and associated with designing. Each person chose where they sat so as they could be at a familiar drawing board, comfortable to progress their work in their own
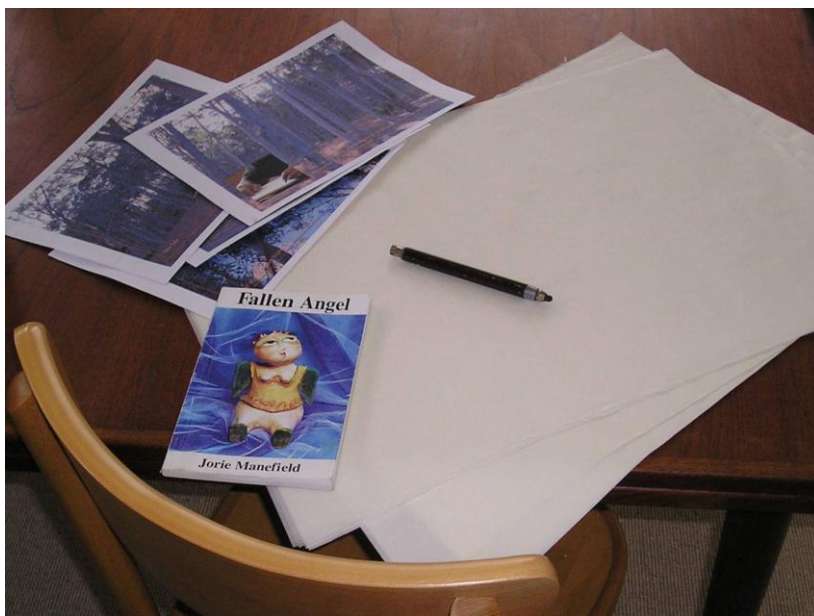
way, undisturbed. The sessions were conducted in the semester break, and the studio being clear of other students meant they could maintain focus on the design task. The sketched response was followed directly by the spoken response minimising inconvenience and reducing opportunities to talk to other students who had taken part in the task. Each session both sketching and speaking, focussed solely on the participant making it apparent I valued their input and was interested in their response. A few commented they enjoyed the process and to their surprise had learnt from it.

The way the design task was described was in terms consistent with students' regular design studio project briefings in which they are typically given a site, a client and a purpose to address in their designing. Guidance as to how they should go about the task was intentionally kept to a minimum, the only instruction being that they were asked to *'use sketching to develop an initial design response for a poet's retreat'.* All students were provided with the same quality materials, eliminating any unnecessary variation attributable to poor papers and/or limited pencils. Good quality butter paper of an intermediate size was provided so as to neither limit nor encourage either drawing large or small. Transparency of the paper allowed for overlays to be made if they chose. The pencil was my best; a large, beautiful to use pencil well suited to early or initial sketching. Thirty minutes proved to be a workable length of time for the sketched response, as confirmed by the pilot study, enabling students to have sufficient time to get closely involved in the task and to have felt they got somewhere, yet short enough so as to not be overly demanding or difficult to sustain, given the intensity of and the level of concentration needed to complete the task. Most students in the time covered three or four A2 (420x 594mm) sheets with somewhere between five to sixteen sketches, one hundred and fifty sketches in all.

The spoken response - reflection on practice

The spoken responses were developed with a view to paralleling other semi-structured phenomenographic interviews upon which there is a significant and clear body of writing (for example Bowden and Walsh 2000 and Bowden and Green 2005). Bowden (2005) suggests that immersing participants in the data often reveals a much greater variation in ways of seeing rather than asking more narrow questions such as 'what is x...?' or alternatively expecting them to philosophise about an issue they might not have thought much about. The interviews took place directly after each student had finished their sketching, so their sketching was still fresh in their mind, with no new inputs or distractions between the two. Having gone over and collected the drawings, to facilitate a shift in focus we laid them out between us on a different board, along with an open laptop, a relatively discrete way of recording. I asked if they were comfortable with the interview being recorded and explained the patterning behind

the questions. The sessions began by bringing into the foreground the purpose of the study, asking each student to say a little about how they thought they went about their sketching when designing. This served to refocus the student away from their designing so as they could take a step back to reflect on what they had just done.

I then asked the student to consider their sketches before them and to identify which they had done first, to number it and to explain what they were sketching and then why they did that sketch. The student was then asked to identify which had been done next, to number it and follow through the same pattern of questioning, describing firstly what they had sketched and secondly why they had done that sketch. The process continued until all of the sketches completed had been numbered and reflected upon. The session concluded with me asking the students if this was their normal way of working and if they wanted to add anything they thought we had missed.

In general the aim of the interview was to get students to describe not defend their use of sketching (Bowden 2005). The form of the interview exchange was structured and planned so as to make sure all of the participants went through a similar interview experience, in line with Bowden's view that consistent planning and even handed questioning are ways to minimize the influence of the researcher. The plan of the interview was such that an initial question orientated and relaxed the student and a repeated pattern of two specific questions followed. The first asked the student to tell 'what' they had sketched, relating specifically to the direct object of an experience of sketching. The second question asked the student to explain why they had sketched what they did, the purpose being to get to the underlying intent behind a student's sketching, relating to the 'how' aspects of an experience of sketching. Having gone through this pattern for each sketch, a final question took a broader view giving the student opportunity to comment on all that had been discussed or to add anything they felt had been missed.

With a view to minimizing the influence of the researcher, care was taken to avoid any new inputs, with the interviewer making sure questions and comments beyond those planned were limited to requests for further explanation about issues raised by the students. In this way the students were encouraged to be as complete and explicit as they could. Taking into account a recommendation by Entwistle (1997), specific terms and expressions students used to refer to their sketching were picked up on and used through the course of the conversation so as to allow students to describe their actions in their own terms or frame of reference rather than one imposed by the researcher.

Most interviews lasted between twenty to thirty minutes. A number of students made the point they found it difficult to think about why they had done a particular drawing, offering the reason that it was not something they usually took the time to articulate. Some commented on their learning from their

reflecting and one described the experience as 'therapeutic'. The interviews were transcribed by a person completely independent from the study and having no architectural background. The resulting transcripts are between two to five thousand words long.

As the interview process very closely parallelled the typical 'design crits' of the teaching / learning design studio, I had to keep reminding myself not to respond to students as a teacher and part of this was not to make any judgemental comments. In this regard the opportunity to practise in the pilot study was particularly useful. I had to keep foremost in mind the purpose of the interview, as an opportunity for students to reveal their understandings, their own ways of seeing their sketching. In contrast this was not an issue at all with students completing their sketch responses, as I had no opportunity for input into a student's response other than the initial briefing. This is an interesting distinction, the ramification being that the sketching represents a form of data relatively free from contamination by the researcher, a feature not necessarily, even with this researcher's best efforts, able to be said of the interviews. This distinction suggests that more than just being different to each other, the sketched and the spoken data have varying degrees of contamination. The logical consequence being that the sketching is the primary source of data and the spoken response a secondary source, the two sources having the potential to complement, to confirm, to augment or to dispel the readings of each other.

A pilot study

A pilot study involving four participants (two female and two male), with a range of design abilities was used to test the appropriateness of the design task, the manner of the briefing, the two different forms of response and of particular help, the techniques associated with phenomenographic interviewing. It revealed that the design task, the briefing and the materials used were appropriate and able to be comfortably handled by the students in the time frame. It was particularly helpful in revealing the difference between the teaching oriented exchanges usual between design teacher and student and an exchange focused on eliciting reflections on their own sketching. The need to keep the questions simple and consistent across all students was reinforced and fine adjustments were made to the wording of the questions. Considering no adjustment of the sketch response was required and given the sketching had, since carrying out the pilot, come to be considered the primary source of data, the four pilot responses, both their sketched and their spoken responses were included into the main body of data.

An example

To illustrate the nature of the data a full sketch response (3 x A2 pages) from one participant, KT is set out below (Figure 4d), with each rectangular box a reduction of an original A2 (420 x 594mm) page.
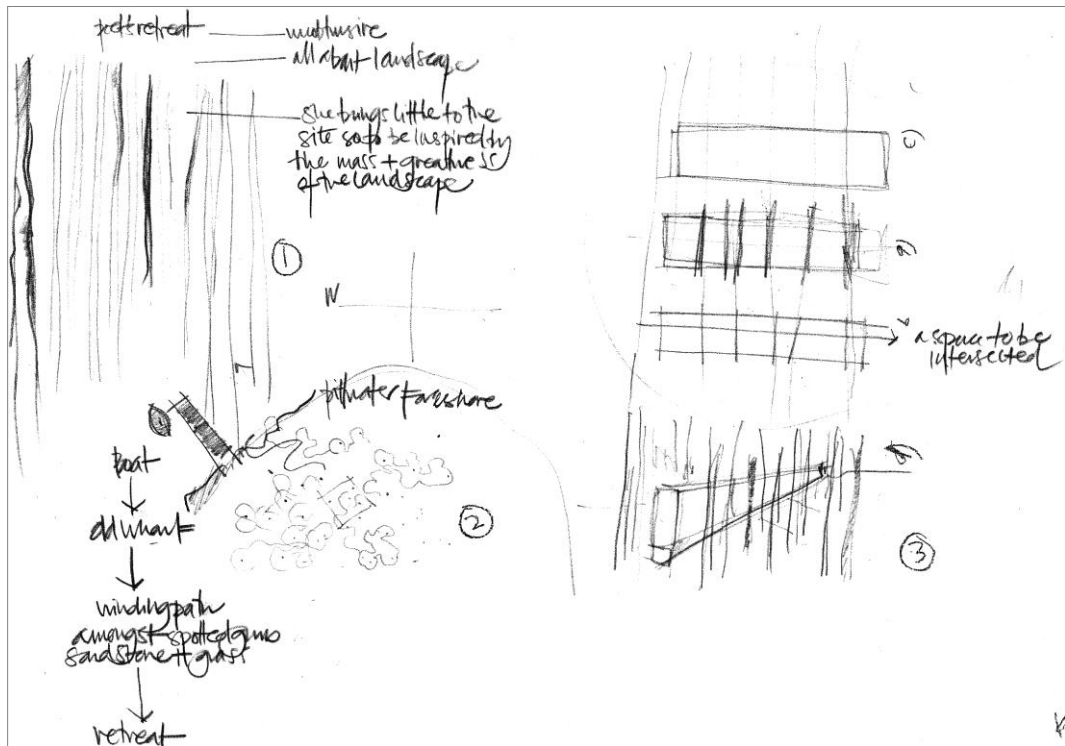
Page 1 - Sketch 1, 2 and 3
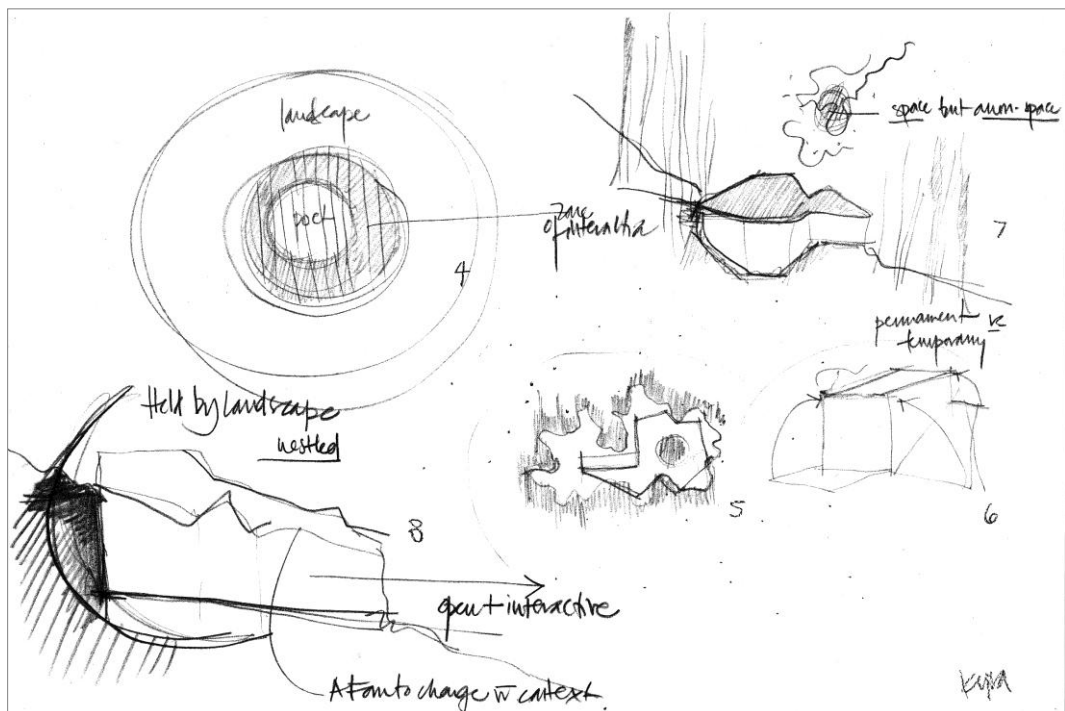
Page 2 - Sketches 4, 5, 6, 7, and 8

Page 3 - Sketches 9 and 10

Figure 4d. KT's sketching sequence
Source: sketch held by the author

The following part of the spoken response relates to the first page of this sequence, and shows how KT spoke about her sketching. Note the numbers associated with each sketch put on by the student through the interview to link what was being spoken about with what was drawn.

KT interview transcript - excerpt from full transcript relating to Page 1 of Figure 4d
(KT = student,   s = researcher)

s   What we'll do first K.... just to set the scene... tell me a little about how you think you use sketching to progress your scheme.

KT   Um..., for spatial…I generally start any scheme with a plan, I don't know why it's just the way I've always seemed to have done it, so it's more about spatial progression with sketches and linking spaces and what's important and the context in a plan form first.

s   Ok well let's have a look at each drawing in particular. We'll look at the sketch that you did first. (KT...this one) Let's label that 1. Why don't you do the labeling, we can label them as we go. Okay so what were you doing in 1?

KT   Um...my first response was to the photograph of the screen of trees, and that was the thing that hit me first. The mass of trees and the…if you were to build anything in there you wouldn't want to lose that aesthetic. You wouldn't want to affect that at all, so then I did this….

s   Well hang on... just before we move on to that, let's just tease out a bit more why you did that one. You've said what it was, that it was the trees, and then you said you didn't want to lose that aesthetic, what do you mean by that?

KT   Well I suppose if I..., the design, if any would be a response to that vertical line system. And that, that's the most important part of the context.

s   What might be quite helpful is if I explain the structure behind my questioning. What we'll do is look typically at what you're trying to draw and then try and look at why you have actually done that. (K...ok) So let's have a go at that with No. 2, why don't you describe what you're doing?

KT   Um..., I started to plan out the sequence of her getting off the boat, off the ferry and up the path through the trees to a space that… I drew the trees within that space.

s. So this little faint square is what?

KT   Ahhh, the possibility of a space.

s   The possibility.... okay and then why would you say you were doing that?

KT   Um..., so it became clearer in my head what I was trying to do at all. Like I just wanted to figure out it's…it's a really beautiful description that you've written there (referring to the briefing panels) *but I just needed to sequentially plan it out…*

s   Yeah sure. Okay, now let's look at No. 3.

KT   I continued the vertical line drawing of these trees here and then started drawing something that would be behind it or through it. I drew kind of a series of boxes and then a little bit of a perspective. I didn't really like the perspective and didn't know whether a square would be the best thing, but then I think curves can also look really man made in a natural situation too. So sometimes really, really simple symmetrical geometry might be the best option for something like this.

s   So if you were to try to describe then why you're doing it, let's try and think about that.

KT   Well I suppose I just wanted to see what it would look like. Like you've got all the trees there and what would a rectangular space behind that look like, what would it look like with a little bit of 3D, a 3D element behind it, and maybe a possible plan also using the same lines to intersect a main space.

s   So when you drew this did you draw..., did you draw from the top down?

KT   No I drew the lines then I drew that one.

s   So you drew the verticals first?

KT   I drew the verticals then I drew this box and did something…I think I did that one first.

s   Well let's label that one 3a, because the sequence I think is quite important. 3b...?

KT   I think I did that one last.

s   Okay, and you say this is 3a, 3b and 3c? Are they looking side on or more in plan?

KT   This one was in elevation because I drew up the trees with a bit of depth, and this was just the continuation of that pattern of trees into maybe what could possibly become a divided space in plan.

s   So 3b then is starting to look in plan?

KT   Yes. And the elevation in 3c, I never really got….I thought maybe that was the roof…I didn't really....

s   That's ok, now let's look at why you're doing 3d?

KT   Um... just...I dunno..., one of my weaknesses in design is that I'll work more in plan that anything else, so I'll have a really logical spatial sequence but then I might not have developed the 3D aspect of it, so I suppose I'm just trying….(tapers off).   (KT interview)

Doing the analysis

Working with sketches

Phenomenographic analysis is often referred to as a process of discovery in that the outcomes of the analysis, the set of categories, conceptions or meanings emerge from the data itself. They are not known in advance neither are they pushed and pulled into a pre-determined form, representative of or to confirm a certain line of thinking. In the same way as the outcomes of the analysis are discovered, the way the analysis is conducted also arises out of the nature of the data and the object of the study. This study has needed to find ways to logically interpret sketching so as to make its distinctive nature an asset rather than a difficulty, respecting, valuing and drawing meaning from its expressive, evocative and at times uncertain nature. Methods of interpretation, the relationship between sketched and spoken data and the techniques appropriate to communicating the outcomes all became clearer as the analysis unfolded.

Bowden and Walsh (2000) and Bowden and Green (2005) gave helpful advice in terms of how other people have gone about phenomenographic analysis and Tamm and Granqvist (1995) in their paper 'Death Studies' provided a precedent although, as sketching itself is not the focus of their study, they do not look beyond what is sketched.

Understanding through a process of discovery is not unlike new understandings arising out of the process of sketching. Through the analysis process, seen as exchanges between the researcher and the data, new understandings feed back into and inform the way ahead giving rise to an iterative cyclic process valued both in phenomenographic research and by architects in their designing. Architectural experience suggests that to work effectively using an iterative process, you need to have both a certain structure which keeps the process moving along, yet at the same time hold the way you are progressing and what you are finding on your open palm so as to clearly see the outcomes of each iteration and once seen you can go on to question them, to consider and to make informed changes as the need becomes apparent. This requires the researcher to be comfortable to allow the process to run its course and to be open to making changes without knowing the nature or extent of the outcomes. While demanding of the researcher and needing intense focus this is, through its continual refinement of direction, a way of working which is self correcting as it moves on, revealing more and more closely what is present in the data. John Bowden (2005) explains that it is through the way the iterative cycles are conducted, the cycles between the data, the researcher's interpretations of the data and the checking of the interpretations back against the data, that phenomenographic researchers most clearly establish their interpretive rigor.

Before this analysis could begin there were questions which needed to be answered, questions quite particular to sketching. For instance, how do we engage with the sketching or in other words, how do we read the sketches before us? In what form should the sketching be presented for analysis to allow us to read them in ways as close as possible to what students were doing?

Engaging with the data

The two forms of responses meant there was a large body of data to work with. The sketched responses consisted of fourteen sequences of drawings, each sequence between five to sixteen sketches, totaling one hundred and fifty sketches in all. The spoken response consisted of fourteen transcribed interviews of between two to five thousand words.

Laying out all of the sketching data, over fifty large sheets of butter paper, it became clear that it was almost impossible to work with in this form. The images were too large, I was seeing each sheet as being closely connected with a person, I couldn't tell where to look or what to look at.

Dealing with each of these issues in turn, in terms of the images being too large A4 reductions were prepared for each of the A2 pencil on butter paper originals. The A4 was small enough to be manageable and easy to reproduce and all fifty sheets could be laid out as one body of sketching (see Figure 4e). The small size allowed each page to be re-assembled into its overall sequence, each sketch could be read in relation to other sketches on the same page and it was still large enough that each sketch could be read on its own. Being A4 also meant that the whole page could if needed to be taken in at one glance.
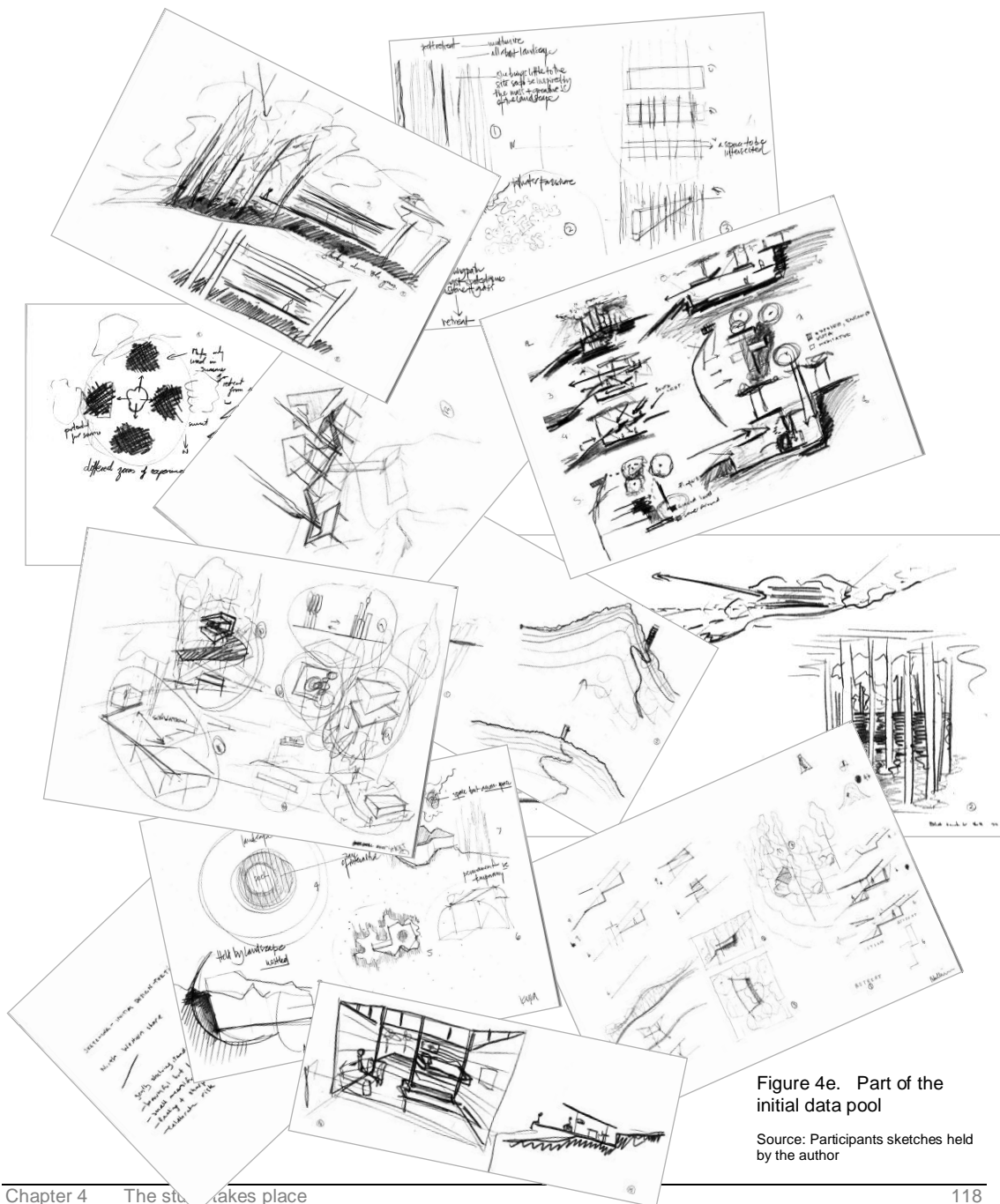

Figure 4e. Part of the initial data pool

Source: Participants sketches held by the author

Lawson (2004) makes the point that many architects intentionally work on small drawings, A4 in particular, explaining that:

> *The fovea is such that we can see clearly the whole of an A4 sheet of paper when held at a distance from the eye normally used for drawing ... The designer can see the whole thing at this size and concentrate on all the contents of the drawing without losing sight of any elements. Any larger and this particular quality of experience disappears.* (Lawson 2004)

In preparing the reductions care was taken in the photocopying to use a constant exposure across all sketches to preserve the full range of relative distinctions discernable through line quality and line weight. It was also important to preserve all of the information present in the originals, giving the researcher every opportunity to pick up on subtle or uncertain line work students might have done. Originals were kept to the side, always there to check against if any details had been lost in the reduction process, which proved not to be the case. In contrast finding an appropriate form for the transcripts was straight forward, simply being A4 double spaced, word processed documents, set out so the researcher's questions could be readily distinguished from the students' reflections. All sketches and transcript pages were coded to identify their author.

As regards seeing the sketches as being closely associated with a particular student, reducing the drawings to A4 had an instant and useful effect. Whilst the drawings were large I had kept them in their sequence. But in being smaller they could all be spread across a table, mixed up and turned around. Broken free from their sequences they were no longer so closely connected with an individual student. The data in this form could be seen as a collective pool with which to work.

With them all laid out, approximately four times the spread in Figure 4e, the questions of where to look and what to look at emerged. The issue was really one of asking what was to be the unit of analysis? From a phenomenographic point of view, experience is the unit of analysis, and a sketch is an expression of an experience. What then does this suggest for our sketching data? If we look at the pool of sketching, each page has in common that it is comprised of a number of individual sketches, sometimes large, sometimes small, sometimes only one or two, sometimes many. It would seem that students consider a sketch as being a certain entity, perhaps an individual thought. They sketch their way through their design response in discrete sketches, suggesting that the students are using an individual sketch as the unit of their designing or of their thinking. So it makes good sense to use the individual sketch as the unit of this analysis.

With the sketching at A4 and an individual sketch the unit of analysis, what are the contexts able to be drawn upon to make sense of an individual sketch? Consistent with the brief, we know students' sketching has to be considered in the general setting of their designing. There are a number of layers to this and these layers provide multiple contexts for our readings. We can use these multiple contexts to confirm our readings by checking them for consistency across each other.

An individual sketch needs to be read in the context of the whole sketch sequence, effectively the student's whole design response, not dissimilar to considering a sentence in the context of a body of writing. The next context is considering the sketch in the context of the page. When you look at the data, and certain participants have confirmed this in their interviews, pages seem to have a logic or be associated with the development of a line of thinking or a certain issue. There is something which lets the group of sketches on the page work as a whole, not unlike a paragraph expressing a certain line of thinking or relating to a particular issue. Finally there is the sketch itself, our unit of analysis. It might be a representation of a particular thought, an attempt or an insight and it too has a sense of being an entity. In phenomenographic terms it may be an undifferentiated or partial entity, but never the less there is something about it which stands as a whole, continuing with our literary metaphor, not unlike a sentence. Phenomenographic researchers speak of moving between whole transcripts, paragraphs and sentences, (Akerlind, Bowden and Green 2005) and for sketching, it is no different.

An individual sketch needs to be seen not only in the context of the sequence and the page but also in the context of the sketches immediately around it. It is hard to make sense of an isolated thought but
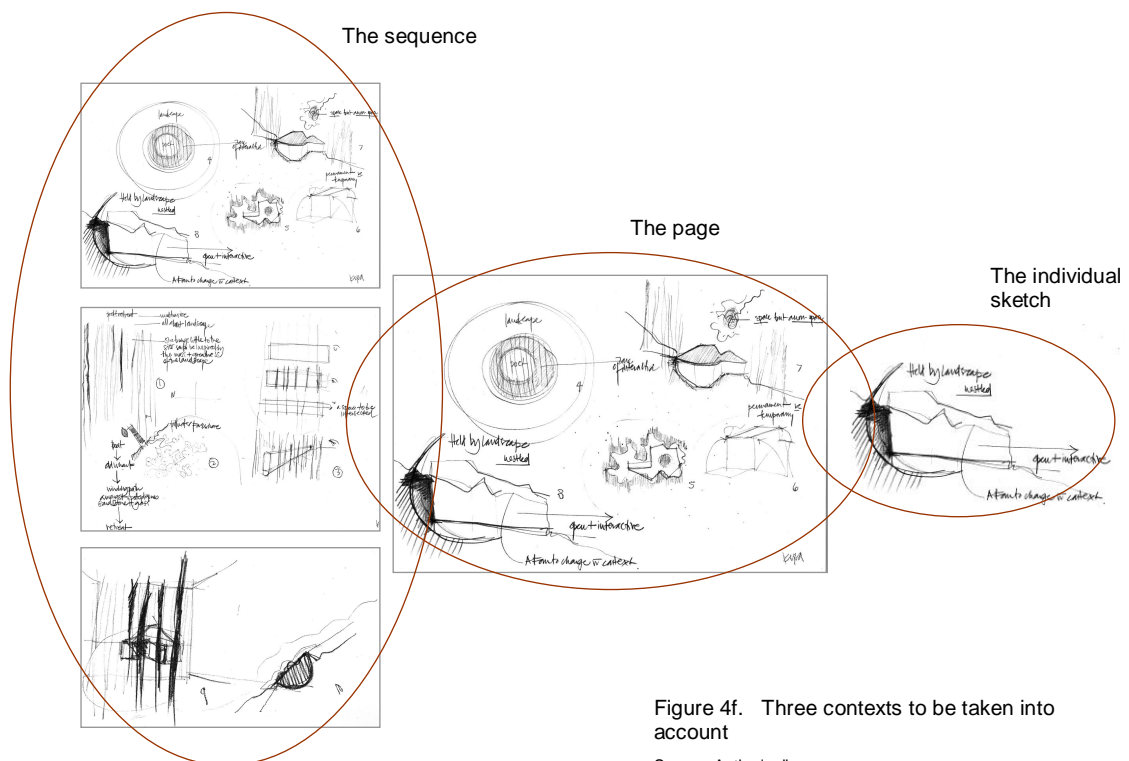

The sequence

The page

The individual sketch

Figure 4f. Three contexts to be taken into account

Source: Author's diagram

when seen in relation to the thought before and the thought after we can start to see associated thinking. Figure 4f depicts these three contexts graphically.

The final form of the sketching data was one hundred and fifty A4 pages each with a sketch highlighted by a pad of light grey tone, which made it easy to see which sketch was in focus, but at the same time enabling it to be read in the immediate context of the other sketches on the page. Each page could also be read in relation to the overall sequence by reassembling the relevant pages. A final A4 page is shown in Figure 4g.
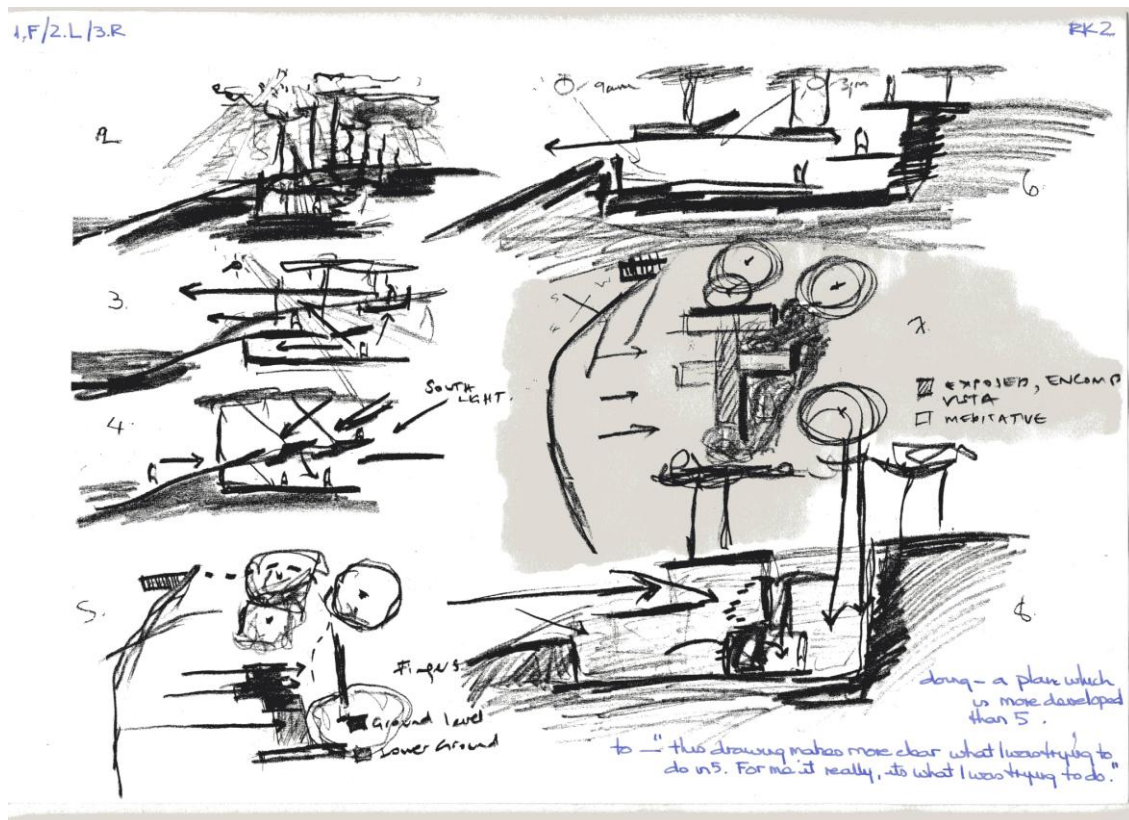

Figure 4g.   The final form of the sketching data.
RK's sketch page, tone and noting added by author.
Source: sketch held by author

The sketching data stands as an immediate and direct expression of a student's way of sketching. Each sequence represents an uninterrupted initial design response relatively free from the influence of the researcher. The transcripts are different. They are a reflection on the sketched expression, a record after the event of what and why they had sketched and the final form of the data reflected their secondary nature. For each sketch the relevant section of their transcript was noted in the lower right hand corner as a reminder of the students' reflections, readable in relation to each sketch. The potential for a significant difference between what is said and what is actually sketched has been discussed and in the few cases where these differed the researcher's reading has been given priority. Completing each

page is a coding at top left which identifies the author, the page position in the sequence and its allocation in different analysis passes.

Using this system of one sketch per page, also served as a check to ensure that each and every sketch a student did in their sequence was included in the analysis. The feint lines, the half finished drawings, the unformed shapes or tapering off lines, the subtle shades or less obvious features of sketching are all taken into consideration and have a bearing on the outcomes of the analysis. This addresses the concern Barnacle (2005) aims at phenomenographic analysis, where she is of the opinion that the elements of shadow or aspects of phenomenal experience that are ambiguous and undefined are not attended to. Taking into account these subtleties and uncertainties is also associated with remaining truthful to students. If they made unclear and doubtful lines then at the time these were related in some way to their design thinking, a point confirmed by the transcripts, and as evident in the findings of this study, they also have a significant contribution to the outcomes of this research. On two particular occasions it was clear in the sketch that students had abandoned a sketch partway through its making and this was confirmed in the transcript. Apparent also in some sequences was the interruption to the last sketch at the thirty minute close to the task.

From bundles to draft categories of description

Recalling the theory behind the analysis outlined in the opening of the chapter (Figure 4a), a student's experience of a way of sketching can be seen to consist of two related components: 'what' a student is sketching and 'how' a student goes about their sketching. The purpose of the analysis is to identify the variation in students' experiences of the related 'what' and 'how' aspects of sketching when they are designing. This variation is described in terms of a set of categories of description, the first set associated with 'what' students are sketching, the second set with 'how' students are sketching. Each category depicts a qualitatively different experience and are constituted from the collective variation observed in the group of students and as such they do not represent the experiences of individuals, rather the categories of description identify the collective variations in experiences between various individual responses. The two sets of categories of description are presented as two outcome spaces, in which the logical relationship between each category is delineated and defined in terms of the structural and the intertwined referential aspects that constitute the particular structure of awareness characterizing each category. The structural aspects are further described in terms of what is figural and what is in the ground. Both the categories of description and the outcome spaces are presented in detail in Chapter 5.

The analysis is structured as two parallel processes and results in two outcome spaces. The first looks at the 'what' components of students' experiences of ways of sketching, that is what students are sketching. The second looks at the 'how' components of students' experiences or how students are going about their sketching.

Outlining the analysis process in detail, considering firstly 'what' students are sketching, all one hundred and fifty of the prepared A4 sketch pages were laid out on a large table and from this spread, disassociated from their authors, consideration could be given to them as a pool of data. This pool was looked at as if through a lens, a lens focused on what was being sketched. Keeping this in the fore of my thinking, I asked such questions as 'what do these sketches tell me about different things being sketched?' or 'are there certain things being sketched in common? 'Are there aspects about what is being sketched that are shared or aspects that are different?' These gave me a way in to considering the pool of sketching. With inklings in mind, possible groupings suggested themselves from the spread of sketches and their features were noted. Shifting focus from the spread to the individual sketches that comprised the pool, a pass was taken over all, literally picking up each one, looking very closely at the sketch highlighted and asking of it 'what is being sketched here?' and with the next 'what is being sketched here and how is it different or similar to the one before?' 'In what ways are they similar and how are they different?' Answering these questions involved reading across the three contexts, at times referring back to the page as a whole or to the full design response. What was noticed in answering these questions, re-informed the tentative features which defined each possible grouping. Through this process of questioning and refining the grouping definitions, an understanding emerged of how each grouping was different to the next. With subsequent passes moving between the pool of sketches and the emerging definitions, redefining the features and clarifying their differences, it came to the point where there was sufficient understanding of the characteristics of each to begin to apportion individual sketches to literally form a bundle, so as they could be seen to take their place alongside other sketches that shared defining features.

Shifting consideration onto the sketches that comprised each bundle and considering them collectively, the defining features were reconsidered and again adjusted. This cycle was repeated a number of times, the features and differences between bundles being re-informed with each pass over the sketches. Some sketches fell easily into bundles, others really could not find places to come to rest, suggesting the need for further adjustment to the defining features and or to the bundles themselves. With more iterations, the bundles started to settle. As part of this settling, the individual sketches seemed comfortable in their bundles, the bundle descriptions were shared by all of the sketches that constituted the bundle and the differences between the bundles came into view. With this settling there was a

concurrent shift away from the individual sketches over to the collective aspects now present in the bundles and it was at this point the bundles could be considered to be categories depicting differing experiences of what was being sketched.

Various passes were made looking at these draft categories of description and their defining features with a view to testing as to whether the category descriptions were representative of the collective voice of the sketches that constituted the category, remembering that the categories are not intended to correspond to the experience of any particular individual, rather they are:

Compositions formed out of an aggregate of similar perceptions. (Barnacle 2005)

As the category descriptions were tested and clarified, the way each category was distinguished from another also became clear.

A similar process was used in relation to the 'how' components of students' experiences of ways of sketching, each category finally arrived at depicting a qualitatively different experience of how students go about sketching. The process took a very similar path to the analysis of what was being sketched, although it was certainly harder to get to the less obvious, underlying intent associated with the students' acts of sketching, echoing student comments during the interviews that the reason why they did a sketch was hard to articulate. Through asking across the sketching pool 'what does this sketch tell me about how a student is going about their sketching?', it became apparent that an individual sketch was not able to tell very much. How a student was going about their sketching was not able to be read from the surface of the sketch, as it had been when considering what was being sketched. To get below the surface required more particular reference to the sketches immediately adjacent and around the one in focus, extending often to the context of the page and at times beyond to the sequence as a whole. Reading how a student was going about their sketching, involved seeing how the student had moved or progressed from one sketch to another, and from that sketch, on to the next and so on. If you could appreciate this progression it seemed you could appreciate how they were going about their sketching. It was here that the transcripts also became particularly useful. Despite the students' saying it was hard to articulate why they were doing a certain sketch, they used phrases which shed light on what they were doing. For example, they spoke of sketching to:

Bring out my ideas from my head
See how the building might sit
See how you could live in the ideas
Get a feel for…

See where that would take me

Play with the forms

See if anything comes to mind

Establish different elements that would be important.

<div align="right">(various student participants, interview transcripts)</div>

Again the analysis proceeded through a lengthy and involved process of sorting across the pool, sifting through sketches, considering transcript excerpts, looking for similarities in individual sketches and in the transcript excerpts, looking for differences, forming groupings then bundles, defining bundles, reforming, redefining, apportioning and so on until gradually the bundles, their distinguishing features and their differences began to stabilize and a draft set of categories of description emerged, depicting experiences of how students are going about their sketching.

From draft categories of description to an outcome space

At this point in the analysis two draft sets of categories of description were arrived at, one set associated with 'what' was sketched, the other set with 'how' students go about their sketching. At this stage the draft categories in reality consisted of bundles of sketches dog clipped together, coded in the corner and with a much written over, edited and adjusted description in various coloured pens, setting out the defining features relating to each category. Laid out on a table between each on a separate sheet of paper were noted the emerging differences between the bundles.

With the draft categories of description established, the analysis shifted focus to explore the logical relationship between the bundles, in other words how the categories are internally related. Bowden is of the opinion that it is important the categories of description be established before turning to analyse the relationships between each category. The reason being that looking for the structural relationships involves the perspective of the researcher and in taking every opportunity to minimize the influence of the researcher, this perspective should not distort the categories. (Bowden and Green 2005)

This internal relationship between categories, this logic or organization, sometimes referred to by Marton and Booth (1997) as the '*architecture'* of the variation in experiences, phenomenographic researchers depict as an outcome space. Marton (2000) explains that:

An object can be seen as a complex of the different ways in which it can be experienced.
These different ways are logically related to each other, it is in this sense they are

experiences of the same object. The logically structured complex of the different ways of

experiencing an object is what has been called the outcome space of the object. Outcome

space thus turns out to be a synonym for 'phenomenon', the thing as it appears to us.

(Marton 2000)

In terms of coming to understand the relationships between the categories with a view to forming an outcome space, Mike Prosser (2000) suggests the early set of categories are unlikely to have much of a logical relationship. Keith Trigwell (2000) speaks of at times, having difficulties seeing the categories and their differences clearly. Both suggest a useful inroad to understanding the relationship between the categories is to see each category, each a description of a collective experience, as having two internally related aspects; structural aspects and meaning or referential aspects. Trigwell explains that not all individual descriptions will contain both but within a group it is usually possible to see both aspects. The structural and the referential aspects can help define and relate the categories. The structural aspects are seen in terms of what is figural and what is in the ground, both features able to be read in sketching as described in the previous chapter. The outcome space or the *'logically structured complex of the different ways of experiencing an object'* (Marton 2000), can then be depicted as a table setting out the categories, their related structural aspects, in terms of what aspects are figural, what are in the ground and their related meaning or referential aspects (Figure 4h).
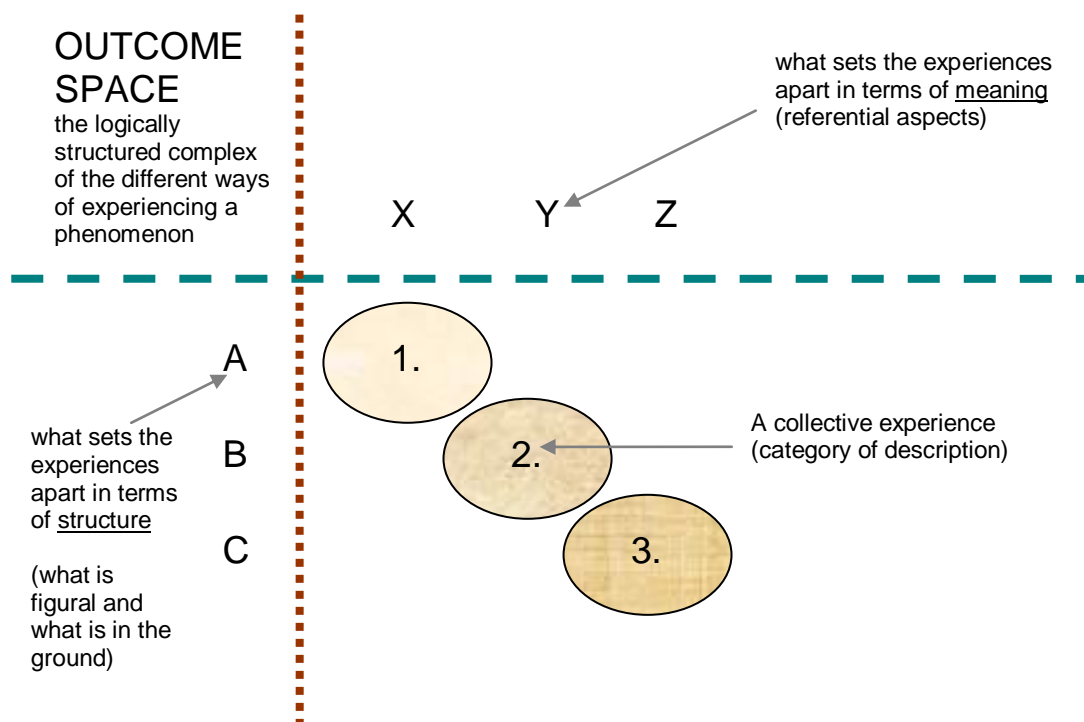

Figure 4h.   The form of an outcome space

Source: author's diagram

The nature of the relationship between categories can be seen as being an hierarchical one, one which Trigwell (2000) describes as a certain nesting of the categories, suggesting a sense of each category fitting within another. Within this nested hierarchy, a hierarchy of expanding and inclusive complexity (Figure 4i), a higher level or more complex experience incorporates aspects of a lower level. However a lower level experience does not encompass higher level experiences.
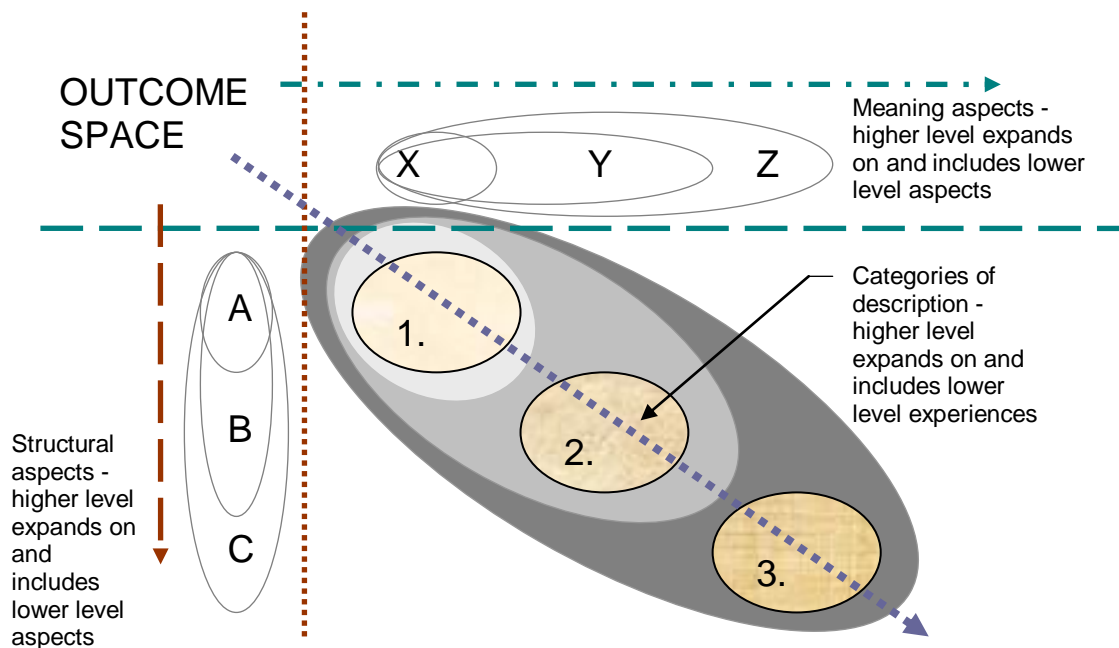

Figure 4i. Hierarchy of expanding and inclusive complexity associated with an outcome space

Source: author's diagram

Another way of describing this, is that a second category includes the features present in the first category as well as having certain additional features, the third category includes the features of the second and the first, plus its own additional characteristic features. Similarly, the structural and the meaning aspects attributed to each category include and extend the preceding lower level aspects.

Akerlind, Bowden and Green (2005) comment that the nature of the hierarchical relationships between categories is often misunderstood. They explain that the hierarchy is not one based on value judgments of better and worse ways of understanding, but on evidence of some categories being inclusive of others. Thus the relationships searched for in a phenomenographic outcome space are ones of hierarchical inclusiveness. This does not mean that a linear hierarchical structure need emerge; forks

and branches in the hierarchical structure are also common. The observed hierarchy can however be used to discern more advanced from less advanced ways of experiencing sketching as:

> *A particular way of experiencing something reflects a simultaneous awareness of particular aspects of the phenomenon. Another way of experiencing it reflects a simultaneous awareness of other aspects or more aspects or fewer aspects of the same phenomenon. More advanced ways of experiencing something are, according to this line of reasoning, more complex and more inclusive (or more specific) than less advanced ways of experiencing the same thin, 'more inclusive' and 'more specific' both implying more simultaneously experienced aspects constituting constraints on how the phenomenon is seen. (*Marton and Booth 1997 p107)

Returning then to our draft sets of categories of description, how can these be analysed so as to form outcome spaces?

In order to identify an outcome space from a set of draft categories of description, echoing Prosser's and Trigwell's suggestions, each category needed to be analysed in terms of its structural and referential components, the structural aspects of the experience described in terms of what aspects were figural and what aspects were in the ground.

The two sets of draft categories of description were analysed separately. Initially each of the draft categories were laid out so that each sketch that belonged to a category could be seen alongside its draft defining features, with the draft differences placed between. In the case of the first outcome space, to get to the structural aspects of what was being sketched I asked across the sketches belonging to each category and of the category's defining features, 'what was I noticing, what was coming to the fore or what was figural in what was being sketched?' In the case of the second outcome space, the question was similar, 'what was I noticing, what was figural in going about sketching in this way?' When asking this question of each sketch, a figure could be readily identified and it was something which could be pointed to in each sketch. Finding a common figure across all of the sketches was more difficult for it meant that no longer could a specific figure be pointed to, rather it had to be a figure which took into account and collectively described all of the component figures, a collective figure being a general characterization of all of the individual figures.

To see what was in the ground, we needed to ask what was the figure being seen against, or what was in the background? The question was systematically asked of each of the individual sketches in each of the categories and in turn of the group of sketches that comprised each category. Bearing in mind that

what was in the ground also needed to be associated with the collective expression in the same way as for the figural aspects, the collective ground tended to be more general than the ground in any one sketch. A second pass of these same questions were asked of the defining features of each category, and it was expected similar answers would arise out of these as out of the collective voice of the sketching.

This process was carried out on each category of description and across both sets of categories until all had been described in terms of the figural aspects and the aspects that constituted the ground. Categories do not necessarily have both a unique figure and a unique ground. A figure could be seen against a different ground or different figures could be seen against the same ground. Concurrently with defining the features of each category, the differences between the categories received attention, again in terms of the differences in the figure / ground aspects. The most appropriate and simple way of doing this was to say if 'x' is figural in this category, 'y' is figural in that category, how is 'y' different to 'x'? This line of questioning progressed across all of the categories in the set and both sets until the structural aspects settled and were seen to be a fair description of what was happening in the sketching.

Our analysis approach requires both the meaning and the structure to be given equal priority. Returning to the draft categories and putting the structural aspects aside, passes were made over the sketches that belonged to each draft category. In terms of the first outcome space the question was asked, 'in sketching these things, what is the underlying intention?' or 'what are they getting at when they sketch this?' In terms of the second outcome space the question was 'in going about sketching in this way, what is the underlying intent?' This questioning was done across all of the categories in both sets, with close attention also given to considering the differences between each, asking how is the meaning of this category similar to and or different from the one before and the one after?'

Throughout this process changes tended to occur concurrently on several levels with one change necessitating another. With time, adjustments became progressively finer until they effectively settled. It was upon reaching this point that that it was felt the outcome space and its associated categories of description were as fair a description as could be arrived at and one which was as true to the students' sketching as this researcher could achieve.

Lengthy, exhaustive and intense, each time a pass was made in the iterative analysis process, it served as a means of recharging the research, as fresh insights emerged through spending time questioning and exploring the students' sketching. I conducted the analysis as a sole researcher, but over the three months of its duration, a series of fortnightly meetings with my supervisor meant I had to account for each twist and turn in my thinking in relation to the emerging categories and had to respond to his

regular inputs. His phenomenographic expertise and sharply focused set of non-architectural eyes meant his collaboration in reviewing, reallocating and restructuring the analysis was an important contributor to the rigor of the analysis process. In addition at a number of key points through the analysis I was able to discuss the ways the analysis was panning out, the bundles, the emerging categories and the structural and referential features with other experienced phenomenographic researchers, their comments re-informing subsequent iterations. I found researchers were keen and interested to speak about how sketching was being analysed and interpreted, perhaps because of the visually expressive nature of the sketching itself or that sketching it seems, has not often been put to the rigors of phenomenographic analysis. Their interest put pressure on me to clearly articulate and account for the twists and turns associated with conducting the analysis and the underlying measures and lines of thinking associated with the interpretive processes involved in arriving upon the outcome spaces. At a more formal level, presentations and related discussions at numerous different forums, some phenomenographic in focus, others architectural, have served as a means to review and to check from different angels the ways the analysis was approached, progressed and conducted, how the categories arose out of the analysis process and the emerging structure of the outcome spaces. These included a presentation at the Phenomenographic Symposium, 2005 University of Sydney, conducting a workshop session at the Higher Education Research and Development Society of Australasia Conference, Sydney 2005, a poster presentation at Research Conversazione 2007, Faculty of Architecture, Design and Planning, University of Sydney and presentations as a participant each semester in the University of Sydney's Institute for Teaching and Learning research seminar series.

Being faithful to students' experiences

Being faithful to students' experiences is a principle underlying this analysis. Teaching experience has made it abundantly clear that to teach well involves placing students at the centre of both their own learning and of a teacher's concern, and I have learnt this is also the case in research. Being faithful to students is a manner or an attitude which lies at the very heart of how a person is with students; whether it be with a group of students, an individual, their work or an expression of their opinion and in line with what I am coming to understand of the increasingly close parallels between teaching and research, being faithful to students in research is no different. It is not a matter which can be seen in terms of the specific conduct of a part of this investigation although it certainly does have a bearing on it, rather it is one which permeates the research, both in terms of what the research is about and how the research has been conducted. This researcher hopes this attitude of being faithful to students comes through in the overall tone and expression of this thesis, through the focus on students' sketching, through how

closely the students' sketching has been worked with and its nature respected, through how the students are the subjects and the differences in their ways of sketching the object of study and in the ways the outcomes of this research are shaped so as to be useful and meaningful to students in their learning in the design studio. Although an underlying attitude, I have attempted to articulate my faithfulness to students by way of describing particular steps and measures which have been taken over the course of this research and where appropriate these have been included through the body of this thesis so they can be made sense of in the particular context in which they occurred.

Part of being faithful to students is to respect what they do and learning is usually central to their doing. Undertaking this candidature has placed me in a position of being a student in parallel with my teaching and serves to amplify the respect I have for students and the significance of learning. My learning has been an important and highly valued outcome of the process. Part of this learning has been to keep a reflective journal, which has been not only a way of recording my thinking and my progress but also a way of bringing together the multiplicity of inputs which have helped to shape the research. The journal serves as a log tracing the complexity of the iterative processes, the emerging of synergies between phenomenography and architecture, it records conversations and exchanges, opinions from meetings, responses called for and ones made. It includes drawings of decisions, diagrams to think by and maps to organize, all interwoven with a narrative thread of personal reflections. The log now runs to eleven volumes and what had started out as being a means of being accountable to a range of people associated with this research, has grown into a full and rich description of the unfolding journey associated with this research. The journal sits in the background of this research. It is not something I feel comfortable directly quoting from because it seems too closely related to my own learning, but its value for me in particular is more one of setting in place a discipline or a practice which by getting into the habit of making regular entries, a person can see and describe a large undertaking in terms of simple, everyday occurrences, not dissimilar to how a skipper of a vessel logs a long passage across an ocean in terms of weather, speed, direction, sails and sightings, the log years later serving as a depiction of a significant crossing, a number of which I have kept on my own seafaring.

Having described the investigation and detailed the way the analysis was conducted Chapter 5 describes the findings of the analysis.