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Introduction

Understanding the different ways students are going about their sketching requires understanding both what students are sketching and how students are going about their sketching. This chapter presents the analysis as two outcome spaces, describing the observed variation in what students are sketching (outcome space one) and how students are sketching (outcome space two). Each outcome space depicts a set of logically related categories of description which have emerged from the analysis of the sketched and spoken responses which formed the pool of data. Each category of description within an outcome space depicts a collective experience, or more particular to our focus on sketching, a collective expression, recalling an earlier line of reasoning that identified sketching as an expression of an experience.

![Diagram of A Way of Sketching](image)

**Figure 5a. Two outcome spaces**
Source: Authors diagram, adapted from Marton and Booth 1997
Each category has key or defining features that are shared by all the students' expressions that collectively give rise to a particular category. In this way the categories are constituted by and represent the collective variation observed across the group of students. The relationships between the categories of description in each outcome space are analysed in terms of the structural and referential aspects of the structure of awareness associated with each category, the structural aspects described in terms of what is figural and what is in the ground. These logical relationships are used to establish and explain the hierarchical nature of each outcome space.

**What students are sketching: the first outcome space**

**The outcome space**

The analysis process gave rise to seven qualitatively different categories of description. These are sketching:

A. isolated aspects of the site and/or client

B. related aspects of the site and/or client

C. abstracted and related aspects of the site and/or client

D. architectural pieces / parts

E. a coherent whole

F. architectural expression

G. different responses, alternatives

Table (Figure 5b.) depicts this set of categories (A, B, C, D, E, F, and G) and the relationships between as an outcome space. The relationships are defined in terms of the structural aspects, noted down the vertical axis, and the meaning or referential aspects associated with each category on the horizontal axis. The structural aspects are further defined in terms of what is figural and what is in the ground in the particular structure of awareness associated with each of the categories.
### WHAT STUDENTS ARE SKETCHING

#### FIRST OUTCOME SPACE

<table>
<thead>
<tr>
<th>MEANING (meaning attributed to the structure)</th>
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<tr>
<td>focus on the knowns</td>
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<td>focus on the unknown</td>
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#### STRUCTURE (figure + ground)

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<tr>
<td>C. abstracted + related aspects of site and/or client</td>
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<tr>
<td>beginnings (figure)</td>
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<tr>
<td>D. architectural pieces/parts</td>
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<td>a scheme takes form (figure)</td>
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<tr>
<td>E. a coherent whole</td>
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<tr>
<td>scheme elaborated (figure)</td>
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<tr>
<td>F. architectural expression</td>
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<tr>
<td>new directions seen and taken (figure)</td>
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<td>G. different responses, alternatives</td>
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Figure 5b. First Outcome Space
Each of the following descriptions includes the defining features, an explanation of the structure and meaning attributed to each category and examples from the students' sketched and spoken responses.

The categories of description

A. isolated aspects of the site and/or the client

Sketching that constitutes this category is concerned with aspects of the site and/or the client which were given to students as part of their briefing. What is sketched are tangible aspects, for example the trees or the slope, and the sketches take the same form as the images given, suggesting no insight or interpretation has taken place, it is simply a redraw of what has been given. The sketching is of isolated aspects not seen in relation to other aspects and as such each sketch is about one point or one issue. Key words or phrases at times accompany the sketches or can take the place of a sketch and when this happens, the words like the sketches, come directly from the briefing material. The following examples illustrate these features.

In Figure 5c1 LH has drawn a treed landscape, a wooded slope sketched in a manner similar to the fourth briefing panel (Figure 4b The briefing panels). In Figure 5c2 CG depicts upright spotted gums in
her left hand sketch, their trunks and canopy similar to the second briefing panel. She has added the words ‘one side’, to the vertical trunks, the ‘other side’ noted against the sloping trunks.

In KD’s reflection, she explains her sketching was about:

*The ideas that I picked out of the brief. Just things that hit me that seemed to be important about the place. So just visually showing the words that I got out of the brief.* (KD interview)

RK, whose first sketch was a series of words, explained:

*I was trying to just take out the words that I felt were important, that captured the place and the site and put them down so that I could use those words to make a drawing.* (RK interview)

LH (Figure 5c1), when asked what she was sketching commented:

*I actually just overlaid (traced) one of the pictures (briefing panels) to get a feel for the site.* (LH interview)

Collectively figural is that the sketching is a reproduction of a particular given aspect of the design situation, there is no interpretation. What is sketched is what is given. The aspect which is reproduced and in so doing brought to the fore is seen against a background of all the design givens represented in the briefing panels. The meaning underlying this structure is that the sketching stays within and is limited to only what the student has been told or what is known of the design situation.

### B. related aspects of the site and/or the client

The sketching constituting this category is concerned with relationships between aspects of the site and/or the client. The sketching is of tangible aspects, for example the foreshore, the slope, a path, the tree canopy etc. The aspects sketched are those given by the design situation, but in sketching one aspect in relationship to others, the emphasis is on new relationships being brought to light. The relationships are at times simple, with few aspects brought together, others are far more complex, bringing together many and varied aspects. Sketching such relationships often involves the use of arrows, the arrows visually connecting certain aspects in a particular way. Key words or phrases not
necessarily derived directly from the briefing material are often present, used in association with the sketches to express the new found relationships. The following examples illustrate these features.

What is noticed in the first sketch (Figure 5d1) is that KT brings into relationship particular aspects of the poet's journey. The sketch shows the boat, the jetty, the snaking path up from the water amongst the trees to the retreat depicted as a simple rectangle deep set amongst the trees. She identifies the components of the poet's arrival sequence in words and arrows: 'boat', 'old wharf', 'winding path amongst spotted gums', 'sandstone and grass', 'retreat' and orientates the foreshore in relation to the compass. In seeing these multiple factors each in relation to each other, the student begins to see
things in a different way to how they were presented in the briefing and in this sense there has been a level of interpretation in this sketching not apparent in the previous category.

In Figure 5d2 PH is exploring quite different aspects of the brief, yet they too are related. The city, set back in the distance, a curving path and something much looser, very different in its looping form at the closest end of the path. The letter ’NB’ is written over the path. Like the previous sketch it also depicts a journey, but quite a different one which seemingly takes a broader viewpoint, expressing a relationship between the city and the landscape the poet travels to. In a similar way to KT in Figure 5d1, PH is interpreting from and seeing aspects of the briefing material in his own terms.

MH described the way he linked together certain elements of the brief in his sketch, saying:

*I just got the water line and how I thought the slope worked and how far back I thought it would be situated from the water and just how steep the slope was.* (MH interview)

KD explained the extent of the aspects she was trying to bring together in her sketch, an extent which let her see the landscape in her own terms:

*This sketch is looking at a larger scale, looking at an idea of where you would sit in that landscape with the views of the points and looking out to the water. Up Pittwater, the bay, the activity in here and it being closed around, so it’s quite a sheltered bay. I just wanted to get an idea about where you would sit in a north-west kind of way and how it would relate to how you get there over the water.* (KD interview)

In sketching related aspects of the site and/or the client, what is in the foreground, what is most noticeable is that there is a level of interpretation taking place and in the process, certain newly related aspects of the design situation come into significance and are brought together in a way which gives the person sketching an understanding of the landscape and/or the client in their own terms, terms not initially present in the brief. These interpreted aspects are seen against a background of the design givens as they were represented in the briefing panels, the same background as the previous category. The meaning associated with this figure and ground structure remains an underlying concern with the known aspects of the design situation.

**C. abstracted and related aspects of the site and/or the client**
The sketching constituting this category is concerned with abstracted and related aspects of the site and/or the client. Here the distinguishing feature is that relationships are expressed and understood in an abstract way. The expression of these relationships has moved away from sketching concrete elements associated with the design situation and shifted towards abstracted forms consisting of diagrams of relationships or depictions of principles or ideas that arise out of the design givens yet are expressed in a form particular to the student sketching. Typically these diagrams are expressions of a whole made up of interrelated parts, with significant relationships highlighted by arrows and key words. Sometimes these abstracted relationships arise directly from aspects present in the briefing, others arise out of previous interpretations of aspects of the briefing. Their diagrammatic form and the relationships they depict are quite different to what was initially present in the briefing. The following examples illustrate these features.

Figure 5e1. KT sketch
Source: sketch held by author

Figure 5e2. NK sketch
Source: sketch held by author
In KT’s sketch Figure 5e1 you notice concentric circles, a hatched centre, something more solid forming around the centre as if protecting. In NK’s Figure 5e2 is a similarly circular form with its open centre linked by arrows to four important elements, lighter forms gathering around. These sketches are both abstract and diagrammatic expressions, the first an expression of the relationship between the poet and her surrounding landscape, the second an expression of how the poet’s retreat might be experienced. In being diagrammatic and abstracted expressions, both sketches are quite different from the sketching of tangible aspects in the previous two categories.

KT (Figure 5e1), reflecting on what she had sketched explained:

I just did a bit of a concept or diagram really of..., I drew a small circle, now I hate circles but it was in the concept. I drew a circle and wrote poet in the middle of it and a larger circle that I labeled landscape which engulfed that. Then I thought they were two separate things and I drew a bit of a middle zone. But then I realized the poet wants to be totally immersed in the landscape so I drew the whole thing. The poet is within the landscape mesh but also with a space of separation. (KT interview)

KT is describing her interpretation of the relationship between the poet and her surrounds in terms noticeably different to those used in the task briefing.

Figure 5e2, although like KT’s sketch in so far as it is an abstract diagrammatic expression of relationships, deals with a series of different issues. NK is describing how his poet’s retreat might be experienced as he explains in his reflection included below. He has drawn a whole made up of four darkly shaded parts held within a circle, which relate to ‘different zones of experience’. Around these are a series of uncertain forms, which when seen in the context of NK’s other sketches, are suggestive of the surrounding landscape. The four darkened ‘zones’ encircle a central element with arrows denoting a relationship back from the centre to the zones. North is noted, giving the diagram and the relationships expressed a physical orientation and in additional the words ‘sunset’ and ‘potential for sunrise’ are suggestive of particular living experiences the student is aware of. The sketch shares a concentric form with the previous one but has more parts, multiple layers and is complex. Associated with this complexity is a high level of insight and interpretation in doing such a sketch, the ideas and relationships expressed in ways which are substantially different to the initial terms of the briefing.

Turning to NK’s reflection on this sketch, he explains he was:

NK Looking more at the house and less at the site and looking at how there could be potentially different zones within the house that might contain different experiences. Umm,
I think that for a poet, possibly writing about experience, and you said she was interested in Sydney landscape and all that sort of stuff...

So let's look more closely, these hatched areas...?

NK   Yep, just sort of a conceptual diagram of..., I mean these would be completely different. For example at the back here, this southerly facing side of the building might only be used in summer as a retreat from... (NK interview)

Collectively figural in this sketching is that there has been a translation into the abstract of the tangible aspects of the briefing. Although arising directly out of the initial briefing it now has a markedly different form and expression to how the site and client were introduced. The ground these translations are seen against remains as in the previous two categories, the design givens as set out in the briefing panels. The meaning associated with this figure and ground has also remained unchanged, with the underlying concern of the sketching remaining with the design situation.

D. architectural pieces or parts

The sketching that constitutes this category is concerned with architectural pieces or parts and as such has a different focus to the previous three categories in which the sketching was associated with either the site and/or the client. The parts or the fragments sketched are not related to or seen to be part of an architectural whole yet they are expressed as having an architectural form and some have an architectural expression. For example the sketching might show a platform, a wall or a hinted at shape, light elements, heavy elements, a roof etc. In essence they are a part, an element or a fragment of an architectural scheme, or in other words part of a students' design response, as shown in the following examples.

Figure 5f1. JH sketch
Source: sketch held by author
What is noticeable in these sketches? In Figure 5f1 we see lines, small circles, darkened shapes set between lines, in Figure 5f2 a lid like form lifting up to reveal something different underneath and in Figure 5f3 a raised rectilinear plane coming out of and sitting above the ground, wrapping around trees, breaking and continuing on. Reading within the wider contexts of adjoining sketches, the page and the full sequence, the small circles in Figure 5f1 represent trees and a possible form for a building being considered in plan, a form that might fit between lines or intersecting geometries set in response to the surrounding trees. Figure 5e2 is a sectional view with something solid and seemingly heavy tilted or propped up above the ground, revealing something different underneath. These two parts share a raised ground and there is a sense of looking outwards from the form protected under the lid. Figure 5f3 appears concerned with a linear element or architectural form that wraps and twists its way out of the ground and through the trees. These three sketches use the conventions of architectural drawing, plans,
sections and views to depict undeveloped architectural parts or pieces, parts which, in the wider context of the sequence, seem to be pulled out of the air by the sketcher and do not necessarily lead on to further insights or become associated with a whole. The following quotes illustrate the fragmented nature of the focus.

*Just coming up with some overlapping forms that just sort of resembled the shape of a boat.* (JH interview, Figure 5f1)

*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.* (KT interview)

*From that I just instinctively drew something between them and hatched in the trees to make it a deeper drawing.* (KT interview)

PH refers to one of his sketches as a fragment because he doesn't follow through with the idea.

*That's a ..., that was something I put in because I started thinking about structure because I was thinking well, how is this house going to stand up? But I looked at it and hated it so I didn't follow it further. Mmm, a fragment, yes it was very much a fragment.* (PH interview)

Not surprisingly, few students in their reflections referred to drawing parts or fragments. With clarity of hindsight and distance on their sketching, most students explained plausible connections between one sketch and another, despite the connections not being apparent in the sketches themselves, in part attributable to students' skills at post-rationalizing, which one student, PC specifically mentions.

*First I drew the sloping ground, then I drew the vertical line, which, thinking about it now, is our position on the ground. It's like vertical and its upright and then the sloping post which sort of acknowledges the context, sort of a bit of post rationalization.* (PC interview)

These fragments are an architectural beginning and as such have taken a distinct shift in focus. The foreground has changed from aspects or relationships associated with the site and/or the client to aspects which are the beginning of a design response. The background has also changed from the givens of the design situation to the emerging architectural response. The meaning associated with this structure of awareness has also taken a significant change and where previously concerned with the known aspects of the design situation is now concerned with the unknown design response.
E. a coherent whole

The sketching in this category describes an architectural response as a whole, a new architectural entity. The sketches describe the response as a coherent whole consisting of parts and the parts in turn contributing to the whole. It is a whole which is being described for the first time and typically uses the architectural drawing conventions of plan, sections and elevations to describe its architectural expression. The sketches belonging to this category typically occur as part of a tight knit group describing the whole and its parts, because it is too much to cover in one sketch. For analytical purposes, all of the sketches involved in describing a whole are considered part of Category E. The following examples illustrate this sketching.

Figure 5g1. KD sketches, Page 3.
Source: sketch held by author

KD's Figure 5g1 shows two different pavilions, one darker and heavier, the other lighter. They are offset to each other and take their place at the edge of a terrace, around which the trees complete the enclosure. The terrace, the two pavilions and the trees work together to make the poet's place. The three sketches forming the group work together in plan and in section and each are loosely projected off each other. In reflecting on her sketching KD spoke of her need to consciously draw her ideas together, before going on to describe her retreat as a whole.
I've taken this idea of maybe trying to meld the idea of the platforms, the sandstone platforms with the shelter and the natural kind of clearing of the trees and how you would exist maybe in a more sheltered, needing more shelter in maybe one...having just a platform, just to observe but having some actual shelter in it. But having to cross this, because it's quite grassy and seemed quite soft so you could have the contrast between the really hard harsh sandstone, the platforms and the soft crushing of the leaves and the grass between and having to exist in that zone between the two. (KD interview)

RK's Figure 5g2, the top sketch included on the title page of this thesis, is a bold expression of a whole, bold in so far as its linework is far darker than any of the other sketching in the data pool.
The retreat is depicted as a place set into the ground, into the sandstone that forms the slope. The roof form is similar to the tree canopy and hard to tell where one starts and the other stops. The way light comes into the in-ground retreat is explored as well as an outlook beyond, largely by way of arrows which are a strong feature of the sketching, drawn almost as dark as the structure itself. The plan at the bottom of the group links the retreat to the wharf and the journey up through the trees. The sketches work as a group, similar to the previous sketch, with plans and sections aligned to and projected off each other. RK in her reflections describes how she sees the space working as a whole:

What I was trying to draw was the sunlight coming through the canopy and how that penetrated into the space and how that place was really quite dark and sitting in the bowels of the earth and the sandstone and the light from above was coming through into the space. (RK interview)

In JO’s Figure 5g3 Page 1 the three sketches on his first page describe an architectural whole when read as a group. The section describes a solid terrace and a light horizontal roof. Projected above, a plan reveals the way the functions might gather and include open spaces, and the small view in the top left describes how you might approach the retreat in the bush. On his second page is one large sketch, a view, which brings together the previous three sketches into a coherent whole, describing the retreat, its form, its structure and how it sits in the landscape.
JO explains of his sketch on Page 2, referred to as ‘drawing 5’:

Yeah, I guess or suppose that at each large scale perspective drawing, like drawing 5 and 12, the ideas, that are more or less a collage of ideas I put together in my head and draw them out to get an idea of what, what they sort of all come together like. (JO interview)

Students in their interviews spoke about using their sketching quite consciously to help bring their thoughts together into a whole. Three students made similar points:

Yeah I think this drawing had come about because its the combination of all the other drawing but into something that really was what I was trying to capture. (RK interview)

Well I did this drawing just to think of how it could, how the form could flow, because I wanted..., I didn't want it as bits and pieces, like I didn't want it as like a bit on the ground and a bit in the air. Like I wanted it as one whole work I guess. (AN interview)

I'd had a look at the building from the outside and what I thought of these shelves and floating and sitting in the trees....and I've looked at the heart, the difference between the heart and the outside part of the outer areas of the building, and the dormant and the active parts and then um, the linking between them all. (NK interview)
What is in the foreground of this sketching is that, in bringing together their designing into a coherent whole, the design takes on architectural form. By taking on form we mean in an architectural context that a scheme, a proposal or a design, comes into being and becomes an identifiable whole, an architectural entity in which its parts, the way the parts contribute to the whole and how the whole informs the parts are all understood. Using the Gestalt term, in taking form its ‘thing like quality’ becomes apparent. The ground against which this new architectural form is seen is a general one formed by a concern for an emerging design response as distinct from the ground of the design givens in the first three categories. The referential aspects or meaning ascribed to this structure of awareness is the same as for the previous category and is an underlying focus on the unknowns of the design response.

F. architectural expression

This category is concerned with sketching the architectural expression of a design response. It is sketching in which the character and or the language of the scheme is developed as distinct from being a description of an initial response. These sketches are architectural in their content, for example rooms, structure, character of spaces, materials, openings and so on are expressed, often in more detail or at a larger scale than the sketching of the previous category. People are depicted in most but not all of the sketches. The sketches are often plans, sections and or views, drawn in relation to each other and tend to work in groups, associated with developing a line of thinking. The following sketches are typical of this category.

Figure 5h1. MH sketches, Page 5
Source: sketch held by author
In MH's Figure 5h1 what is most noticeable is that he is starting to sketch how people engage with his retreat. People are interacting with the building, there is furniture set in the room, a platform to sit on the edge of, a roof to sit under and so on. We can see what the walls are like, the way the openings sit and the scale of the spaces. These sketches are about knowing the expression of the retreat. MH explains, what he was sketching:

*I'm just trying to work out what the character of this place needs to be and what sort of elements are important to create that.* (MH interview)

He goes on to describe in detail sketch 14 (the left hand sketch Figure 5h1):

*I was just trying to get a feeling for that internal area, how it would be sort of used and what sort of character it would have. Like you know, opening up to the north and letting light in from the front and then a sheltered area here where you could have your bed, you know sort of up in the air. Maybe you could fold it up or something and here a table and kitchen and maybe an area to sit here and just sort of...* (MH interview)

In FK's Figure 5g2 a retreat is drawn in section at different scales and set either amidst the trees or against the slope. You can see people in the building, offset platforms, roofs, columns, what the spaces might be like to be in, how the roof might be broken up so as to let light in and so on. As with MH's sketching, these also are concerned with knowing the architectural expression of the scheme.
FK in commenting on her sketches, confirms her concern with the building’s expression:

    Yeah, so you’ve got these columns and these infill members which kind of pick out and maybe they’d be irregular or something. Um, and then just looking up again at how you could make this an outdoor room. I don’t want to feel like you’re stepping outside so much, like I’ve got these barriers, like whether you have retractable walls or curtains or something that flows to … (FK interview)

Other students in their interviews spoke of their sketching to see the architectural character and expression of their buildings. One student succinctly explained:

    I suppose it’s starting to become more resolved, like it’s the first sign of building rather than a form. (JO interview)

Another student explained what she was drawing in terms of how the client would experience it:

    This would be that place where she would sit in, outside so it’s sheltered and you’ve got this low sort of sheltering thing and she’s looking out there and then something else up here to get more light in. I imagine it to be all made of wood and just the light on the wood and stuff like that. (KS interview)

The sketching in this category has in its foreground an elaborated whole. The figural whole of the previous category has been developed into an elaborated whole, one which the student knows more about the scheme’s architectural language and its expression. Individually each sketch has a different figure, is focused on a different aspect of the retreat, but collectively figural is that the sketching elaborates the initial form. The ground against which this collective figure is seen is that this sketching is associated with making a design response as distinct from being associated with the design givens. The meaning behind elaborating a scheme as part of making a design response, is that the student is dealing with the unknowns of designing.

### G. different responses, alternatives

The sketching comprising this category is concerned with initiating changes or alternative responses to what has been previously sketched. The sketches set one alternative against another so they can be seen in relation to each other or in relation to a previous group of sketches. Characteristically they are quickly drawn and often unfinished, lacking in development, cover a range of alternatives and are
concerned with many aspects of the design response. Sometimes the changes relate to the whole of a scheme, sometimes to its parts. The following page of JO's sketches (Figure 5i1) is a good example of these features.

In looking at this page you cannot help but notice the number of sketches close together, seemingly hard to tease apart. Things are drawn and redrawn differently, there are shifts in scale, new forms are looked at with different parts and alternative wholes described. Sometimes the sketching is three dimensional, other times a plan, a section or a diagram. In essence nothing stays the same in the sketching. It is as if the sketching is driven by a certain energy or keenness. Interestingly JO explains that in the drawings leading up to this page, he felt the scheme he had come up with was becoming too resolved:

So I tried to introduce some other ideas in it. And I guess this sheet is kind of similar to the first sheets. Um, like my ideas are just sort of spewing out... (JO interview)

In contrast PC's sketching in Figure 5i2 is ordered, calm and measured. Using the architectural conventions of plan, section, three dimensional views and diagrams, the sketching works its way through a series of logically related changes, one sketch leading on to the next and so on. Of note is that none of PC's sketches develop any detail in the scheme, being concerned more with shifting,
exploring different approaches and initiating different paths. A wide range of issues are raised and considered in his sketching.

PC explains the shifting nature of his thinking when he explains in his own terms, what he was sketching in 9a and 9b, (centre top two sketches).

\begin{quote}
Then I drew the floor and then drew another line parallel to the ground and then another line parallel to the floor and then another line parallel to the ground and these last two lines become roofs. Still just playing around with all these angles and then looking at that, it made me think of a pylon or a truss. When I was looking at this, I thought yeah, that could be cool, the whole building could be some sort of truss where the angles of the members sort of have this relationship with the ground. And then I thought pylon, pylon is thinner, so I drew the vertical, again the ground, the vertical line, the angled line um….and then I picked up a couple of points where I thought they could become roofs or platforms or whatever. (PC interview)
\end{quote}
One student at the close of her interview when she was asked if there was something she wanted to add, explained how she would consciously sketch changes:

Maybe as it progresses more and something becomes problematic so I'll put that aside and test something really different, start again with something really different just to contrast and then draw from the two of them like their strengths and then come up with a third. (FK interview)

Although each sketch belonging to this category has in its foreground the particular aspects being changed, collectively figural is that new directions are seen and taken. The ground these are seen against, as with the previous three categories, is making a design response. The underlying meaning of this sketching remains dealing with the unknowns of designing.

**The hierarchical nature of the set of categories of description**

**An overview of the hierarchy**

How do these categories relate to each other?

Some students are sketching isolated aspects of the site and/or the client, their sketching reproduces known aspects which have been given to them in the design task briefing. Other students' sketching goes beyond this to include aspects of the site and/or the client which are related. In seeing relationships, the student is interpreting what they know of the aspects given to them in the briefing and are expressing a deeper understanding. Other students' sketching extends beyond this to express abstracted relationships of aspects of the site/client and express a yet deeper level of understanding. These three categories of different things being sketched, 'isolated', 'related' and 'abstracted' all relate to the site and/or the client and are thus all associated with what is known of the design situation. We can depict this increasing complexity as a hierarchy of three nesting categories where the hierarchy is one of expanding and inclusive complexity. Within this hierarchy, a higher or deeper level understanding incorporates all aspects of a lower level, however a lower level does not encompass any aspects of a higher level understanding. This nesting of Category A, B and C is depicted graphically in the overlay on the first outcome space. (see Figure 5j)
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<th>an architectural response (ground)</th>
<th>beginnings (figure)</th>
<th>D. architectural pieces/parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>a scheme takes form (figure)</td>
<td></td>
<td>E. a coherent whole</td>
</tr>
<tr>
<td>scheme elaborated (figure)</td>
<td></td>
<td>F. architectural expression</td>
</tr>
<tr>
<td>new directions seen and taken (figure)</td>
<td></td>
<td>G. different responses, alternatives</td>
</tr>
</tbody>
</table>

Figure 5j. Hierarchies associated with the first outcome space.
Common across the sketching that comprises the next four categories is that it is an expression of an architectural response and sketching a response involves engaging with an as yet unknown design. In having this concern in common the four categories can also be depicted as a nested hierarchy. The most simple of these categories is sketching architectural pieces or parts where the student is sketching unrelated parts or beginnings of an architectural response. Other students extend beyond this to sketching of a coherent whole and in describing this whole the students’ architectural response is deepened by being given architectural form. Others extend further to sketch the architectural expression of their design response. In elaborating on the scheme, these students are expressing a yet deeper level of understanding. The sketching which expresses the deepest level of understanding is sketching different or alternative responses, in which students are able to change their response by way of seeing and taking new directions from their sketching. As with the previous nested categories, these categories also form a hierarchy of expanding and inclusive complexity. (Figure 5j)

Having described the seven categories in terms of two nested hierarchies of expanding and inclusive complexity, we can see the outcome space as a whole as being comprised of four quadrants. The first quadrant relates to sketching of the site and the client, aspects which are known and given as part of the task briefing. The second quadrant, a void has no inclusions because it would need to have been concerned with sketching the unknowns of the design givens, an unlikely possibility because in being given, they were also known. The third quadrant is also void as it would have needed to include sketching of aspects of a design response which were already known, and given the participants were students relatively new to designing, sketching along these lines is unlikely. Were they experienced designers it may well have been different. The fourth quadrant relates to sketching an as yet unknown design response; its partial beginnings, its form as a whole, an elaborated scheme and finally one which changes.

The definition of the quadrants is distinct. There are no blurred edges. No sketching lies part way between one and another, the sharpness attributable to the fact that the sketching within each of the two nestings is simply about different things. One is not more complex than the other, they are just different. If we return to the sketches themselves we can see that they too echo this difference. The sketches associated with the site and the client are often descriptive and not necessarily architectural in nature. The single issue, simple line work of the earliest sketches reproducing information on the briefing panels, gives way to more personal and interpretive sketching, needing to communicate related issues. The abstracted translation of the third category tends to have its own language of diagrammatic drawings suited to describing relationships and ideas. In contrast the sketches relating to the design response, that is the sketches associated with the second nesting, repeatedly use the architectural
conventions of plans, sections and views, with single issue sketches associated with the simplest expressions of the parts, becoming more complex and interrelated in parallel with the students’ understanding of their scheme. A noticeable pattern emerges in the sketching where the more isolated the thinking, the more isolated or singular the sketching and, the more integrated and or multilayered the thinking, the more interconnected and larger the sketching group which needs to be read, lending support to sketching as being a direct expression of a student’s thinking.

To further understand the logical and hierarchical relationship between the seven categories of description, we can define the variation in the structural and referential aspects of each category.

**The structural aspects of the first outcome space**

The structural aspects of the sketching categories vary both in terms of the figure or what is in focus in the particular structure of awareness that characterizes each collective expression and the ground that figure is seen against. This variation can be seen and described as having an expanding and inclusive hierarchy which relates to each of the two quadrants.

In the first quadrant ‘isolated aspects of site and/or client’ is comprised of sketching in which a reproduction of material the student had been issued is figural. All the student has done is to choose what aspects they want to reproduce and this sketching is considered the simplest. Sketching in ‘related aspects of the site and/or client’ has figural an interpretation of what has been provided. In addition to choosing which aspects are of note, the students have brought these aspects in relation to each other, interpreting the material and expressing it in their own terms. This sketching is more complex than simply reproducing. Sketching ‘abstracted and related aspects of site and/or client’ has figural a translation of related aspects interpreted from the design task briefing. The student has not only interpreted but translated their interpretation into an abstracted and diagrammatic form and as such this is the most complex of the three categories of sketching.

To express this hierarchy simply and in increasing order of complexity

```
reproduction
↓
interpretation (inclusive of and expanding on reproduction)
↓
translation (inclusive of and expanding on interpretation + reproduction)
```
All three figures are seen against a common ground of the design givens, the givens constituting what a students knows of the design situation.

In the second quadrant, sketching ‘architectural pieces or parts’ has figural a concern with making an architectural beginning. In being a piece or part it is a partial beginning but never the less it is one and as such is associated with a design response. It is very simple sketching. Sketching ‘a coherent whole’ has figural a scheme taking form and through giving form the student is making an architectural response. In dealing with all that is involved in bringing together a whole, the sketching is more complex. Sketching the ‘architectural expression’ of a scheme has figural a concern with elaborating on a scheme, and through the process the scheme takes on more detail and resolve. In parallel the sketching also becomes more complex. Sketching ‘different responses or alternatives’ has in the fore a concern for seeing and describing new directions and once described these directions can be taken. This most complex sketching is related to the student being able to see new directions.

To express this hierarchy simply and in increasing order of complexity

```
beginnings
↓
a scheme takes form (inclusive of and expanding on beginnings)
↓
scheme elaborated (inclusive of and expanding on a scheme takes form + beginnings)
↓
new directions seen and taken (inclusive of and expanding on scheme elaborated + a scheme takes form + beginnings)
```

These four figures with their increasing complexity are seen against the one common ground of making an architectural response. The sketching is no longer associated with the design givens of the previous categories but rather is now associated with an architectural response the student is making. The difference in these backgrounds explains the horizontal splitting of the quadrants which characterizes the organization of the first outcome space.
The referential aspects of the first outcome space

The structural aspects of the seven categories of description have two distinctly different meanings or referential aspects associated with them. (see Figure 5)

In the first three categories concerned with sketching associated with reproducing, interpreting or translating the student is sketching what is known to them. They are working within what they know from the task briefing about the client and site. Certainly what they know may well be added to by their personal knowledge and life experiences but essentially they are dealing with the known aspects of the design situation. The other four categories are concerned with sketching the architectural issues of beginnings, giving form to a scheme, elaborating a scheme and identifying new directions. All these are sketching in which the student is coming to terms with the unknown aspects of their design response. These aspects are not part of the brief, they are the unknown made known through the process of designing. In this way designing is concerned with creating knowledge (Purcell and Gero 1998). The fundamental difference between these two meanings sets up a vertical divide in the outcome space not crossed by any of the categories.

The two part divisions of both the structural and the referential aspects makes the quadrants distinct and suggest that understanding what happens when a student moves across these lines, that is from the knowns to the unknowns, from the design givens to the design response might be of particular interest.
How students are sketching: the second outcome space

The outcome space

The second outcome space describes the observed variation in the students’ expressions of how they are sketching. Nine qualitatively different expressions have emerged from the analysis of the students’ sketched and spoken responses and are represented as a set of categories of description. Students were:

1. recalling
2. doodling
3. indiscriminate searching
4. initial exploring
5. proposing
6. knowing more along same lines
7. seeing it can be different
8. making a change
9. responding to changes

Figure 5k depicts this set of categories and the relationships between as an outcome space. As in the first outcome space the relationships are defined in terms of the structural aspects, noted down the vertical axis, and the meaning or referential aspects associated with each category on the horizontal axis. The structural aspects are further defined in terms of what is figural and what is in the ground in the particular structure of awareness associated with each of the categories.

A description of each of the nine categories follows and includes the defining features, examples from the students’ sketched and spoken responses and an explanation of the structural aspects and meaning attributed to each category. As explained in Chapter 4, understanding ‘how’ a student was sketching, required reading the sketching across three contexts in order to see how one sketch led on to another and in turn another, and the spoken responses provided a particularly useful way into understanding the students’ underlying intentions.
<table>
<thead>
<tr>
<th>HOW STUDENTS ARE SKETCHING</th>
<th>MEANING</th>
<th>STRUCTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECOND OUTCOME SPACE</td>
<td>(meaning attributed to the structure)</td>
<td>(figure + ground)</td>
</tr>
<tr>
<td>sketching happens</td>
<td>Understanding sketching as being of no particular concern, it inadvertently happens, it is just something an architect does. It is not an explicit act to be shaped or guided intentionally by the architect. Sketching is not related to the design progress. If and when it occurs it is associated with trial and error and/or chance and is subject to whim, fancy, like, dislike, taste and choice.</td>
<td>sketching unrelated to designing</td>
</tr>
<tr>
<td>sketching as creating a path</td>
<td>Understanding sketching as being concerned with creating a path, a line of architectural thinking. The role of the architect is to create the path. Design progress is by sketching to understand, to explore and move along a path at the same time it is being created. With more knowledge of the path, the design takes on more detail and resolve through sketching.</td>
<td>sketching to note thoughts (figure)</td>
</tr>
<tr>
<td>sketching as initiating a rich field</td>
<td>Understanding sketching as being concerned with initiating a rich field of architectural possibilities. Design progress is by sketching across the field as it is being initiated, working on multiple and/or alternative paths, options and scenarios. New directions seen, opportunities discerned, possibilities engaged with, questioned, tested and responded to through sketching.</td>
<td>sketching to understand thinking (figure)</td>
</tr>
<tr>
<td><strong>S T R U C T U R E</strong></td>
<td><strong>(figure + ground)</strong></td>
<td></td>
</tr>
<tr>
<td>sketching unrelated to designing</td>
<td>1. recalling</td>
<td></td>
</tr>
<tr>
<td>sketching to note thoughts (figure)</td>
<td>2. doodling</td>
<td></td>
</tr>
<tr>
<td>sketching to understand thinking (figure)</td>
<td>3. indiscriminate searching</td>
<td></td>
</tr>
<tr>
<td>sketching integral with designing</td>
<td>4. initial exploring</td>
<td></td>
</tr>
<tr>
<td>sketching to discover new directions (figure)</td>
<td>5. proposing</td>
<td></td>
</tr>
<tr>
<td>sketching integral with designing</td>
<td>6. knowing more along same lines</td>
<td></td>
</tr>
<tr>
<td>sketching integral with designing</td>
<td>7. seeing it can be different</td>
<td></td>
</tr>
<tr>
<td>sketching integral with designing</td>
<td>8. making a change</td>
<td></td>
</tr>
<tr>
<td>sketching integral with designing</td>
<td>9. responding to changes</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 5k. Second Outcome Space**
The categories of description

1. recalling

In the sketching which constitutes this category students are recalling or bringing to attention aspects they feel to be significant in the design task briefing. The students’ recalling is usually of an isolated occurrence, something as an aside to their design response, at times serving as a reminder or a way of bringing something forward in their thinking. Sketching to recall generally takes the form of stand alone sketches, sometimes supported by or at other times consisting entirely of words. The following examples illustrate these features.

Figure 5.11. PC sketch
Source: sketch held by author

Figure 5.12. PH sketch
Source: sketch held by author

Figure 5.13. JO sketch
Source: sketch held by author

Figure 5.14. CG sketch
Source: sketch held by author
In Figure 5l1 the sketching recalls the placement and orientation of the retreat on the side of the headland and in Figure 5l2 the student recalls the harshness of the landscape that inspires the poet. The sketch in Figure 5l3, so entangled in its surrounding drawings, is recalling the bush/city relationship expressed in the briefing, as being one of importance and occurs well into the design response. In contrast Figure 5l4 consists of words sketched to catch attention, recalling ‘important aspects for client journey’.

Various students in their interviews also spoke of their need to recall what was important, referring to their sketching to ‘establish different elements that would be important..., to ‘identify important aspects of…’; or to ‘identify......as important.’

Figural in ‘sketching to recall’ is that the students’ sketching is directed towards noting a particular thing. They sketch to note its importance. Examination of the wider context of these sketches revealed that they do not relate in any obvious way to those around them. Nothing flows from these sketches, each is isolated, a stand-alone statement and this suggests that the ground against which ‘sketching to recall’ is seen is one of minimal engagement with the outcomes of sketching. Sketching for these students is something architecture students have to do, it just happens.

2. doodling

In sketching comprising this category, students were doodling. What is useful about doodling, when you look across the sketching sequences as a whole, appears to have more to do with the act of idly and repeatedly setting down lines, rather than what the doodle is about. It is as if the doodlers through their actions are giving themselves time to think and in this way their doodles are a visual representation of pondering or mulling something over. Surprisingly doodling did not occur often in the pool of sketching, perhaps because students had little time for idle thinking, feeling pressed to get a design response happening in thirty minutes. When it did occur it was at different points in the design process but was always associated with a pause, a chance to collect thoughts before moving on. The following sketches are examples. (Figures 5m1, 5m2)
Looking at these, even though they have been done by different people, there is an obvious similarity in the way the pencil lines have been drawn over and over again, sketching nothing of any distinct form but none the less sketching. Turning to what the students themselves had to say, CG who did the right hand doodle explained she was:

*Just drawing over and over and over while I was thinking about it...* (CG interview)

Another said:

*I don’t actually know what I was thinking, I was just drawing...I was just doodling.* (JH interview)

Both these students in the way they spoke related their doodling to their thinking. CG went on to speak of her doodling as an attempt to get something out of her head. She explained:

*It's moving my hand around and it's like I'm...I dunno, relieving something from in there.*

(CG interview).

AN spoke of doodling as a way of coming up with something new:

*Sometimes I'll just be doing mindless doodling in class and I'll be like woah..., that looks pretty cool. I've never really done anything like that before.* (AN interview)

Figural in a students’ doodling is that their sketching notes their thoughts. They may not be formed thoughts or have any tangible consequence but they are taking place and students, as in their reflections above, do relate their doodling to their thinking. As in the previous category there is minimal engagement with the outcomes of their sketching and as such the sketching is unrelated to their designing. The meaning behind doodling is that for these students sketching is something which just seems to happen. They are not conscious of it, they do not direct it, sketching is simply something an architecture student has to do.

### 3. indiscriminate searching

In sketching which constitutes this category, students are indiscriminately searching. It is not the outcomes of the searching but rather that searching is taking place which matters. Each sketch looks into a particular issue, but when seen in the context of the sketching sequence as a whole, what is noticeable is that the searching doesn't go anywhere, it is neither guided or informed and as such is left
to chance or trial and error. The sketching is often uncertain, and might read as being feint and or unfinished. The following examples illustrate this searching.

In Figure 5n1 JH is looking to see if a certain geometry can give shape to a design response and in Figure 5n2 KT is searching through different possibilities of intersecting a space. Students in their interviews used such phrases as ‘wondering if...’ or ‘I was just playing with...’ to describe their searching. JH (Figure 5n1) explained the disconnectedness between her sketches when searching in such a way:
Yep, new idea... Drawing No.7 basically ignored everything else, just looked at roof, light structure, trees are gone. Drawing No.8 again, I didn’t like what I was seeing, so I moved on... (JH interview)

CG spoke of her random thoughts associated with her searching:

And then, that just led on, I was just thinking randomly and went ohhh... what about the journey she’ll be taking? (CG interview)

Sketching to indiscriminately search shares the figure of sketching to note their thoughts with the previous two categories. The student has a thought then notes it, has another thought then notes it, the thoughts remaining isolated, not developing into a line of thinking. As a background we see minimal engagement with the outcomes from their sketching and their sketching remains unrelated to their designing. The meaning attributed to this figure and ground is again that of the previous two categories. These students understand sketching as something which just happens. They do it but do not consciously direct it or engage with its outcomes.

4. initial exploring

In sketching that constitutes this category, students are exploring. They are searching, looking and examining, in this case with a sense of direction or purpose, as distinct from the indiscriminate searching of the previous category. More particularly the exploration is initial exploration, initial in so far as it takes place prior to a scheme taking form or being proposed. Noticeable is that the student is searching in a way which is informed or directed, they have an intent behind what they are doing and this gives them a focus, and the sketches themselves read as being purposeful. A large number of sketches belong to this category.

To illustrate this initial exploration, we look at a group of KD’s sketches and see what she has to say about her exploration. The sketches (Figure 5o.) are KD’s second, third and fourth sketches in her design sequence.

KD Now this (sketch no.2) is about an approach, so what you see when you get to the wharf or see this path just disappearing up into this amazingly tall, very straight spotted gum trees and how you feel disappearing into that, uncertain kind of..., so you see where it goes.
and then that led you to...?

KD  Number 3 up here, which is exploring the idea of the sandstone shelves. Like as platforms to exist on and how they deal with the slope. So kind of just going up in scale.

s  Yes and then the next?

KD  It talked in the brief of the shelter of the trees and how it's carved out a natural kind of clearing in the grass and the trees and I just wanted to see how that would feel....This whole page was just exploring the ideas...  

(KD interview)

Figural when a student is sketching to initially explore, is that the student is trying to understand their thinking. They are no longer focusing their sketching on noting isolated thoughts, it is focused on developing and understanding a line of thinking, thinking associated with initial exploration. The ground against which this figure is seen has also changed because now the student is engaging with the
outcomes of their sketching and as a consequence their sketching is informing their designing. The meaning underlying this structure is also different. Students now see their sketching as being concerned with creating a path, their sketching helping to form a line of thinking and in so doing it is able to guide the progress of their designing.

5. proposing

In this category students are proposing, in the sense of putting something forward or getting it out on paper so it can be seen. This proposing is usually associated with an initial scheme, a student's first standing up of a coherent whole. Sketching concerned with proposing has a characteristic confidence, perhaps attributable to the student feeling they have something they need to put forward for others to see. Gone is the uncertainty associated with searching. There is also a quality of completeness and usually more than one sketch is involved in order to describe the full extent of what is being proposed.

The following is an example of proposing, with NK’s two pages (Figure 5p.) followed by his reflections.

Figure 5p. NK sketches, Page 4
Source: sketch held by author
NK explains how he consciously pulls the parts together:

This is the stage where I'd had a look at the building from the outside (Page 4) and what I'd thought of these shelves and floating and sitting in the trees. So I just had a look ... with the zones. And I've looked at the heart, the difference between the heart and the outside part of the outer area of the building, and the dormant and the active parts and then um, the linking between them all. (NK interview)

The four sketches represent NK's proposing of a coherent whole, and illustrate the confidence and sense of completeness which distinguishes this sketching. It is through the process of proposing, being represented as a scheme for others to see that a scheme takes on an architectural presence in the sense that it has an existence on paper, as distinct from one in the student's mind. Architects often refer to a scheme at this point as a 'proposal'.
Figural in proposing is that a student is sketching to understand their thinking. They are getting their thoughts out on paper so they can see their thinking. The ground against which this figure is seen is one in which the student is engaging with the outcomes of their sketching and as a consequence their designing is being informed by their sketching. The meaning attributable to this figure/ground structure is that there is an underlying understanding that sketching is concerned with creating a path, a path which guides and informs the way designing progresses.

6. **knowing more along the same lines**

In this category students are sketching to know more along the same lines. In other words they want to find out more or to know in more detail aspects of something they have already initiated. While new understanding is being developed, the students are moving along a known path which is becoming richer through the development of their understanding. The sketching is typically more detailed, often expressing what it is like to experience the retreat either by coming upon it or living within it. The following examples (Figures 5q1, 5q2) illustrate this sketching.
KS’s Figure 5q1 shows a relaxed poet, book on lap sitting on her hill-side platform retreat looking out and over the bay beyond, the sketch evoking a sense of repose and comfort in the way the poet is accommodated in her place. The second (Figure 5q2.) reveals how the building, through its use of solid and light materials is held by and at the same time projected out from the landscape it sits within. In both examples, the retreat is sketched as a building, it has substance, is made of tangible things and can be experienced. One student described her sketching as being directed towards:

Seeing how you could live in the ideas... or trying to get a bit of the experience.

Another explained he was:

Thinking about the character and the experience of the inside..., another was:

Trying to put some walls and some sort of built elements in...

Figural in sketching to know more is that, as in the previous two categories, students are sketching to see or to understand their thinking. In the background is that the sketching is informing their designing, by way of the student engaging with the outcomes of their sketching. The meaning associated with this figure/ground relationship is that sketching is understood as being concerned with creating a path. They see their sketching as a means to explore and understand the path's rich possibilities, the desire to know more and to see in finer detail serving to move the student along their path.

7. seeing it can be different
In the sketching associated with this category students see that aspects of their design response could be different. This is a marked change in comparison to the previous category where a single line of development was followed. The sketching in this category does not represent what the change is but rather it is an expression that the student sees change as a possibility. The following is an example of FK coming to see potential differences. The three sketches are not striking in themselves but, when understood in relation to the student's full design sequence and her reflection, illustrate this sketching. (Figures 5r1, 5r2, 5r3)
The first sketch, a section, shows a sleeping mezzanine on top of a large platform for the poet's work. In the lower sketch she has turned this upside down so as the work platform is on top and the sleeping below and the final smaller sketch describes this new direction.

FK in her interview explains

s Just unpacking that a little bit more, in Drawing 7 (Figure 5r2) you said you put the working on top, and then you realized having done that, that the sleeping could be...

FK Well it went the other way. From Drawing 4 (Figure 5r1) I saw the potential to have the sleeping downstairs, so I drew the site.

s Hang on, I'm a little bit confused. Drawing 4 is that the working or the sleeping?

FK That's the sleeping.

s Ahh, so 4. had the sleeping up top.

FK And the working down and I didn't like the way you were kind of working under this ceiling.

s Ok

FK So looking at that I was like, well can't I tuck something in there?...So yeah, using the section pretty much lead everything...looking for opportunities. And then...8. (Figure 5r3) was kind of refining Drawing 7. Um... it's quite different, it's got quite a different look but I was just thinking about the roof...

(FK interview)

In the light of FK's comments, and this is a good example of how the students' reflections helped to clarify what was going on in the drawings, drawing 4 was included in this category because it was at this point in her sketching she realized things could be different. Her next sketch, drawing 7 was associated with the next category 'initiating change'.

Figural in going about sketching to see things can be different is that the student, through their sketching, sees the possibility of change. They use their sketching to initiate new and different thinking. This is seen over a distinctly different background to that of the three previous categories because in seeing the possibility of difference in their sketches, the outcomes of sketching are sustaining designing. In this way sketching has become integral with the designing process. The meaning associated with this figure and ground is significantly different. Sketching with this purpose is underlain by students
understanding that their sketching is very much associated with initiating a rich field of possibilities. They see their role as being one of directing and initiating change across this field.

8. making a change

This category concerns sketching associated with making a change. Students look for change through their sketching, they explicitly seek it out and are comfortable with it. Making a change becomes part of developing their design response. Associated with looking and making change is that the student is widely looking across their designing at multiple aspects and concerns and consistent with this is that the sketching constituting this category is often quick, in the sense that a student gets them out and moves on, and simple in the sense they are not elaborate or detailed. The following example illustrates this sketching. (Figure 5s)

On his page, JO has drawn a maze of drawings difficult to tease apart. Consistent with this, when reflecting on his sketching, he found it hard to remember which sketch came where in the sequence and
where one sketch started and another finished. He tried to clarify this by drawing circles around individual sketches to delineate them. As he moved from sketch to sketch little remained constant.

Some students are conscious of sketching to make a change. FK explains her sketching:

> So I’ll put that aside and test something really different, start again with something really different just to contrast and then draw from the two of them like their strengths and then come up with the third. (FK interview)

Others have spoken of their sketching being directed towards 'trying to find a new direction', 'trying to see a relationship in a new way' or 'finding a new approach, another way of looking at it.'

Figural in sketching to make a change, is that sketching is associated with discovering new directions, with different thinking and this new thinking leads to change in the design scheme. In the background is that the outcomes of sketching are sustaining designing and as such sketching and designing are integral. The meaning relating to this figure and ground is the same as the previous category. There is an underlying understanding that sketching is associated with initiating a rich field of possibilities and the student sees their role as being one of directing and initiating change across this field. Seeing and making change is seen as being central to this process of discovering new directions and to progressing a design.

### 9. responding to changes

The sketching in this category is distinguished by its concern with responding to changes. Changes are worked on, seen one in relation to another, questioned, evaluated and tested in order to see a better way to go or what might be a new opportunity or appropriate direction to respond to. A distinguishing feature is that changes are not just seen and made but they are responded to. The outcome being that the design response arrived at through an iterative process of seeing, questioning and responding, has been tested and challenged.

Sketching concerned with responding to changes has similar characteristics to the previous category, in so far as the sketching is quick and simple, and each sketch is closely related to the one before and the one after. It covers a lot of ground, in the sense that many different ideas are tried, tested, evaluated and used if appropriate. The following sketches of PC illustrate this sketching. (Figure 5t)
Quoting from PC’s reflections, we can gain insight into the way he works with his sketching to see new and different directions to take. In this particular excerpt he is referring to the drawing second from the top,

PC  So in 8a. I drew this sort of sinuous line, sort of getting that and thinking well, you know the building could probably be in one of these flatter parts.

s  And what was this line above?

PC  Well I drew this one and then I drew a parallel line.

s  Ah, that one very faintly in there, right?

PC  Yep, in drawing the parallel line it occurred to me that it might be more interesting to draw an inversion above it. So you get these areas that are quite tight and then it opens up and there’s this expansive space.

s  Are you seeing this from your drawing or...?
PC: Yeah, yeah, that comes from the drawing. From drawing the parallel line I've..., this occurred to me ahhh...that would be more interesting flipped.

S: Okay so when you, you've quite often said something occurred to you or something became clear, if I'm understanding you correctly its the drawings that are triggering that?

PC: Well it's both, um, obviously I think unless you enter your mind and you make a mark and then you look at that mark and you go from that. What you start with is a thought, do a drawing, and then the drawing feeds into the thinking process, so it's like feedback.

(PC interview)

In sketching which is directed towards responding, what is in the foreground is that the sketching is associated with discovering new directions, a figure this category shares with the previous three. However it is the degree to which this is done which is heightened in this category. In the background, the outcomes of the sketching process are sustaining designing and the sketching is integral with designing. The meaning underlying this figure / ground relationship is an understanding that sketching is a means to initiate a rich field. It is a means to discern, to question, to test and respond to new directions, strategies and opportunities and it is through engaging with the changing outcomes the process of designing progresses.

The hierarchical nature of the set of categories

An overview of the hierarchy

The nine categories can be arranged into three groups on the basis of increasing complexity.

Some students are 'recalling', some are 'doodling' and some are 'indiscriminately searching'. Each of these actions are different but share certain features and can be considered as forming a grouping. Within the grouping, all three are simple sketching and no fine grain distinction is made as to whether one is more complex than another. All are associated with sketching which notes students' thoughts and there is minimal engagement with the outcomes of sketching. This sketching is seen as unrelated to designing. It is something which just happens.

'Initial exploring', 'proposing' and 'knowing more along the same lines' again share certain features and can be considered a second grouping. Across this grouping the sketching is more complex because they are using their sketching to understand their thinking. A developing line of thinking, an emerging
path is being understood and explored rather than simply noted. These students are showing some engagement with the outcomes of their sketching, and to varying degrees the sketching is informing their designing.

A third grouping consists of sketching associated with ‘seeing it can be different’, ‘making a change’ and ‘responding to changes’. This sketching is the most complex in so far as it is being directed towards discovering new directions and different ways of thinking initiated through the process of sketching. The outcomes of this sketching are sustaining designing. Sketching and designing are integral.

These three groupings with their increasing complexity can again be depicted as a nested hierarchy of expanding and inclusive complexity, where more complex acts of sketching incorporate aspects of simpler acts and simpler acts do not encompass aspects of more complex acts of sketching. The three nested groupings are depicted graphically in the second outcome space (Figure 5u) and take a different form to the hierarchy present in the first outcome space with its distinct quadrants and marked divisions.

The structural aspects of the second outcome space

To further understand the origin of this grouping and the logical and hierarchical relationship between the nine categories of description we can define the variation in the structural and referential aspects of each category. This variation can also be seen and described as having an expanding and inclusive hierarchy which relates directly to each of the groupings.

Each grouping has relating to it a particular figure and an associated ground and as the groupings increase in complexity, so too do the figures and the grounds. The figure associated with the ‘recalling’, ‘doodling’ and ‘indiscriminate searching’ group, is that the students' sketching is noting their thoughts. Students have isolated thoughts either about the site, the client or their design response and once they have a thought they sketch it. They have another thought about a different concern and then sketch this. The resulting series of isolated sketches stands as a noting of isolated thoughts and for these students isolated thoughts constitute the students' way of going about designing. In the background is that the student is not engaging with what they are sketching or in other words they are not seeing or taking anything forward from what they are sketching. Their sketching is unrelated to their designing.
HOW STUDENTS ARE SKETCHING

SECOND OUTCOME SPACE

<table>
<thead>
<tr>
<th>MEANING</th>
<th>(meaning attributed to the structure)</th>
</tr>
</thead>
<tbody>
<tr>
<td>sketching happens</td>
<td>Understanding sketching as being of no particular concern, it inadvertently happens, it is just something an architect does. It is not an explicit act to be shaped or guided intentionally by the architect. Sketching is not related to the design progress. If and when it occurs it is associated with trial and error and/or chance and is subject to whim, fancy, like, dislike, taste and choice.</td>
</tr>
<tr>
<td>sketching as creating a path</td>
<td>Understanding sketching as being concerned with creating a path, a line of architectural thinking. The role of the architect is to create the path. Design progress is by sketching to understand, to explore and move along a path at the same time it is being created. With more knowledge of the path, the design takes on more detail and resolve through sketching.</td>
</tr>
<tr>
<td>sketching as initiating a rich field</td>
<td>Understanding sketching as being concerned with initiating a rich field of architectural possibilities. Design progress is by sketching across the field as it is being initiated, working on multiple and/or alternative paths, options and scenarios. New directions seen, opportunities discerned, possibilities engaged with, questioned, tested and responded to through sketching.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>(figure + ground)</th>
</tr>
</thead>
<tbody>
<tr>
<td>sketching unrelated to designing</td>
<td>1. recalling</td>
</tr>
<tr>
<td>sketching to note thoughts (figure)</td>
<td>2. doodling</td>
</tr>
<tr>
<td>sketching to understand thinking (figure)</td>
<td>3. indiscriminate searching</td>
</tr>
<tr>
<td>sketching in parts of designing</td>
<td>4. initial exploring</td>
</tr>
<tr>
<td>sketching to sustain design (ground)</td>
<td>5. proposing</td>
</tr>
<tr>
<td>sketching to discover new directions</td>
<td>6. knowing more along same lines</td>
</tr>
<tr>
<td>sketching integral with designing and outcomes of designing (ground)</td>
<td>7. seeing it can be different</td>
</tr>
<tr>
<td>sketching to discover new directions</td>
<td>8. making a change</td>
</tr>
<tr>
<td>sketching to sustain design (ground)</td>
<td>9. responding to changes</td>
</tr>
</tbody>
</table>

Figure 5u. Hierarchy present in second outcome space.
In the foreground of the second group ‘initial exploring’, ‘proposing’ and ‘knowing more along the same lines’ is that students’ sketching is directed towards seeing, or understanding their thinking, as distinct from simply noting their thoughts. A student might start by thinking about an issue, they then draw it and instead of going on to think about another unrelated concern, the student engages with what they have just sketched by considering what is there. Depending on what they see, they draw again, consider what is newly drawn and sketch again. What results is a developing line of thinking and associated with this thinking, a series of related sketches unfold. As their thoughts have become related into a line or path of thinking, so too do their sketches. The degree to which this happens varies with an individual. What lies in the background of such sketching has also increased in complexity, because students, where previously not taking anything forward, are now engaging with their sketching to the extent that what their sketching suggests informs their designing.

The third and most complex grouping of ‘seeing it can be different’, ‘making a change’ and ‘responding to changes’ also has the most complex figure and related ground. What is figural is that in addition to sketching to understand a line of thinking associated with the previous grouping, students are sketching to discover new directions, different thinking. In raising new directions and new possibilities, the student by way of questioning, testing, and evaluating one possibility against another is able to make changes to not only progress their designing but also to improve their design response. What lies in the background is that in addition to engaging with the outcomes of sketching, the sketching by way of raising new possibilities, sustains the design process and the sketching not only informs but is integral with students’ designing.

These increasingly complex figures and related grounds have the same hierarchy of expanding and inclusive complexity present in the set of categories and again a more complex figure and or related ground incorporates aspects of the simpler, however a simpler figure and or related ground does not encompass aspects of a more complex one.

To summarize this hierarchy of increasing complexity, from the simple to the more complex, in regards the figural aspects

```
  sketching to note thoughts
   ↓
  sketching to understand thinking (inclusive of and expanding on noting)
    ↓
```

Chapter 5      The findings
sketching to discover new directions  
(inclusive of and expanding on understanding + noting)

The hierarchy in regards the aspects in the background, in order of increasing complexity,

sketching unrelated to designing
↓
sketching informs designing  
(inclusive of and expanding on unrelated)
↓
sketching integral with designing  
(inclusive of and expanding on informs + unrelated)

The referential aspects of the second outcome space

The structural aspects of the nine categories of description, have related to them three distinctly different meanings or referential aspects. These meanings entwined with the figure/ground relationships described, are the underlying understandings of sketching held by students when going about their sketching in a particular way. How a student understands sketching, that is the meaning sketching has for a student relates to how the student goes about sketching and, how a student goes about sketching relates to the understanding they hold. With underlying understandings not necessarily having a physical presence in the sketches, the reflective interviews proved particularly useful in getting to the meaning behind students’ sketching.

In sketching to ‘recall’, to ‘doodle’ and to ‘indiscriminately search’, where in being simply a noting of thoughts, sketching is unrelated to designing, the meaning attributed to sketching is that it is something that happens. Sketching for students holding this understanding is of no particular concern, it is just something an architect does, it is not an explicit act to be shaped or guided by them, rather it happens as a consequence of doing something else. Sketching is not seen as relating to progressing a design and progress if it occurs is associated with trial and error and is subject to students’ whim, fancy, like, dislike, taste and choice. Illustrating this understanding is best done by quoting from the students’ reflections. CG describes her designing in terms of:

I'm just like going to come up with something. (CG interview)

JH speaks of the way she goes about her designing:
Yeah, my first initial response when I see the design brief is almost automatically something subconscious in my head. That's what I am going to do, I'm going to create something that looks like this or something. And then I try and draw it out until I get to that. I think it's because I am not good at getting what's in my head down onto paper, it takes a while so I try lots of things and I pick and choose out of those things to make the final design. (JH interview)

She gives us further insight into the way she progresses her designing by describing step by step what she is doing in a number of sketches.

So like I picked things from No.5 and I picked things from No.6 and I went and made No.9. So like its pick and choose. So No.11, I looked at No.10 and I thought the whole point was overlapping elements so I went into little doodles and I thought I like that form so let's see if I can overlap it with itself a couple of times which you can see (in No.11). (JH interview)

In sketching to 'explore', to 'propose' and to 'know more along the same lines', the meaning is quite different and more complex. There is an understanding that sketching is concerned with creating a path, a line of architectural thinking which gives direction and guidance and students see their role as one of creating it. Design progresses by creating a path and moving along it, the design response taking on more detail and resolve as progress is made.

This understanding is illustrated in MH's following words, who in referring to one of the sketches in his design response sequence, reveals the extent to which he interconnects and works his insights into a line of thinking through which his retreat starts to take form. Asking him a simple question became not unlike opening a flood gate. When asked, was he referring to sketch No.7, he replied at length:

Yeah, or this one as well (pointing to the adjoining sketch), like you know the idea of a platform like those two kinds of planes to offset with the, like the gradient of the land and there's the trees which from this picture here, they sort of, I imagine they'd be like that a bit..., so they sort of..., they're a mark of a truly vertical sort of thing so there's those two things recurring and then I thought do you want to project out into that? So, maybe a flat platform and it faces sort of north so you get a bit of sun in there to the back sort of area and just the simplest kind of shelter I could think of, and that sort of came in there. So then that was a sort of sectional drawing, then I went to the plan, which um.... So then I first establish there's a winding path up there, and sort of when you are walking up a slope
there's a ..., you're sort of focused on what's right ahead of you, you're not really thinking about what's behind you and you get up here and you're kind of focus is down on the ground and up into the trees in the distance. So you're looking up this was..., and as you come, and what I'd imagine would be my structure. You come around from the back, enter from the back and then you're projected back out onto this sort of area which then um.... It's a reflection of the journey, but sort of the end of the journey, the place where this poet or teacher would sort of, where she would spend her time, however long she's going to spend there. (MH interview)

In the grouping of 'seeing differences', 'making a change' and 'responding to changes', the associated meaning has changed again and increased in complexity. The sketching in this group is understood as being concerned with initiating, initiating which a student gives rise to and responds to through their sketching, and in so doing they open up a rich field across which further sketching and designing takes place. Sketching is seen as not just moving along one or even multiple created paths but rather movement across a wide front. The path evident in the previous understanding has been replaced by a discovered network of new paths, new directions, opportunities and insights that are actively engaged with, discerned, delineated, questioned, developed, tested and responded to both in their own right and in relation to each other through the act of sketching.

This understanding is illustrated in PC's description of his thinking behind part of his sketched response. It is a lengthy description but one worth including in full, so as to demonstrate the spread and nature of the thinking associated with holding such an understanding of sketching. When PC was asked what he was doing in one particular sketch (see Figure 5t p176) he replied:

I'll tell you what I was doing. After I did the inverted line I started drawing these vertical lines which are perpendicular. See, I was thinking, I was thinking where the two wavy lines come close to each other they are parallel so you can draw a perpendicular line through both of them, and then I was thinking but you can't. Here you can draw a line perpendicular to the bottom one but its not perpendicular to the top one so then I was sort of just drawing these vertical lines linking these other ones. I don't know why, it just seemed like something interesting to do and then that made me think about trees so then I started drawing the foliage, the canopy. And I thought yeah that looks like I was in the bush, you know, scrub. And that didn't really lead to it, that was like an aside. That didn't really lead to any architectural thing that I was aware of. Um..., I guess, well I guess it did actually. Yeah it did because these lines, these perpendicular lines become the poles and
ok there's...like in the roofs we had back in No.5 we had the roof that was parallel to the sloping ground and the roof that's parallel to the floor, these two angles, you can do that with these perpendicular lines. You can have a post that's perpendicular to a floor and a post that's perpendicular to a sloping ground...so then you can set up like a system or rules. Rules like having a grid. I like that. Its like music. In No.8 I'm thinking it's starting to look like a chair. Um, and also in 8B I've still got the roof condition where there's two roofs similar to 5B, but there's one platform. Yeah that leads you to 9. Yeah I mean I don't want to over emphasize the importance of the chair, I just, that struck me. I thought ahhh, this looks like a chair and I can imagine the poet sitting there in the site looking out. So the chair can be a, you know, an analogy for the structure, like a platform to observe from.

(PC interview)

These three meanings have again a hierarchy of expanding and inclusive complexity. To summarize:-

sketching happens

↓

sketching as creating a path (inclusive of and expanding on happens)

↓

sketching as initiating a rich field (inclusive of and expanding on creating a path + happens)

The next chapter considers the relationship between the two outcome spaces and synthesizes 'what' and 'how' students are sketching into a coherent whole identifying and describing qualitatively different 'ways of sketching'.
Chapter 6  Drawing understanding from the findings

Introduction  186.

Looking for relationships between what students are sketching and how students are sketching  186.

Identifying interactions  188.

Three different ways of sketching  195.

Three palettes  200.
Introduction

The analysis findings tell us students are sketching qualitatively different things and there are differences in how students are sketching. These have been identified, along with the characteristic features and differences, and the meanings underlying each category of ‘what’ is sketched and ‘how’ students are sketching. Understanding the different ways students are sketching, involves looking into the relationships between ‘what’ students are sketching and ‘how’ students are sketching and this chapter is concerned with this exploration.

Looking for relationships between what students are sketching and how students are sketching

The distinctions between ‘what’ and ‘how’ of sketching 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 this case being our object of study, the different ways students are sketching. In this sense, different things students are sketching and differences in how students are sketching are seen to be facets of different ways students are sketching. To understand the undivided whole, we can begin by looking for possible relationships between what students sketch and how they sketch by revisiting the data and working with it in different forms and configurations to see what is revealed. A useful starting point is to see whether there are preferred or repeated combinations of ‘what’ and ‘how’ aspects evident in students’ individual sketches. For example, do students repeatedly draw aspects of the site when they initially explore or are they likely to doodle alternative directions?

In order to begin to look for these combinations, the previously identified ‘what’ and ‘how’ components were assembled for each sketch and plotted to form a table (Figure 6a); the ‘what’ components on the vertical axis and the ‘how’ components, increasing in complexity across the horizontal. Each small circle represented one sketch which comprised a certain ‘what’ and a certain ‘how’ aspect. The what/how combinations for all one hundred and fifty sketches are shown in Figure 6a.

Examining the table, we see particular what/how combinations which occur frequently, others to lesser degrees and many combinations which do not happen at all. The general configuration of the combinations lies in a diagonal band extending down and across the table, its diagonal form likely to be due to the least complex levels of how students sketch being associated with sketching the least
complex aspects of the design givens, the more complex levels of how students sketch associated with sketching the unknowns of the architectural response. The two voids above and below the diagonal would seem to be present because the simple ‘hows’ of sketching are not associated with sketching the unknowns of a design response and the more complex ‘hows’ of sketching are not associated with sketching the knowns of a design response. The diagonal band is not neat or trim, accounted for in part by the fact that students can go about their sketching in the same way yet draw different things, or alternatively, the same things can be drawn by students going about their sketching in quite different ways.

Of the most frequently occurring combinations, one in particular stands out, where the sketching is associated with 'proposing' a 'coherent whole' (30 out of a possible 150 combinations). This seems logical for two reasons. Firstly students, when proposing need to have something to propose, and given the shortness of the design task students would have felt it appropriate to try to present a scheme or a coherent whole within the allotted time. Secondly multiple sketches were usually needed to describe a whole and each were counted in the combination. Only three out of one hundred and fifty sketches were concerned with proposing pieces or parts. Other combinations which repeatedly occurred included 'recalling' 'aspects of the site/client' (10 sketches), 'indiscriminate searching' of 'architectural pieces or parts' (15 sketches), 'initial exploring' of 'related aspects of the site/client' (13 sketches), 'initial exploring' of 'architectural pieces or parts' (10 sketches), 'proposing' ‘abstracted and related aspects of the

Figure 6a. ‘How’ and ‘what’ combinations present in individual sketches
Source: Author
site/client' (7 sketches), 'knowing more' about the 'architectural expression' (12 sketches) and 'making a change' to 'alternatives' (8 sketches). However, even though these combinations repeatedly occurred, the general width and the irregularity of the band suggests there to be no hard and fast associations between what students are sketching and how students sketch except to say that in general the more complex acts of sketching are associated with the more complex things sketched, whether it be in relation to the design givens or the design response, the more simple acts associated with sketching simpler things.

The data considered in this way, that is focused on individual sketches, did not reveal an organization to the combinations which suggested there be a direct association between particular what/how combinations and different ways students might be sketching. This is not surprising for to look at the individual sketches of students will only tell us about either the individual sketches themselves or about an individual's sketching, in effect, facets or fragments of different ways students are sketching. To understand the different ways students are sketching as an undivided whole, we need to turn to the collective expressions, the variation observed within the group of students which are represented in the two outcome spaces.

**Identifying interactions**

Turning to the variation observed in the group, as depicted in the two sets of categories of description, we can again look for relationships between what is sketched and how students are sketching by looking more deeply into the hierarchical organization within the two outcome spaces. Recalling this organization (Figure 6b), the first outcome space depicted different things the group of students were sketching and comprised four quadrants, two active and two being void. The two active quadrants were constituted by categories which nested to form a hierarchy of expanding and inclusive complexity. Both quadrants were discrete and different; the first being associated with sketching the knowns of the design givens, the forth concerned with sketching the unknowns of the design response. The second outcome space depicting the differences in how the group of students were sketching, comprised three increasingly complex, nested groupings, where each grouping expanded on and included the previous.

Looking more closely at the first outcome space, although the first and the forth quadrant were discrete and different, they are also related in so far as the unknowns and the knowns, the design givens and the design response are parts of an indivisible whole, the whole being the extent of possible things the group of students might sketch when designing.
Stepping back from the outcome space and considering the nature of designing, when a student designs, to progress they have to move from the design situation towards a design solution and this process, as previously suggested is an iterative process which loops back on itself as it moves forward. Therefore, it is likely a student in progressing their designing, moves back and forth between the knowns.
of the design situation or the design givens and the unknowns of their design response or what they see to be their emerging design solution. Shifting our focus from the group to an individual, we can see how this movement plays out in an individual student's designing.

Doing this involves reconstituting the sketches of a student back into the sequence within which they were created, the sequence effectively depicting a student's designing or the progression an individual has made from the design situation to their design response. With the data in this form focusing on the sketching of individual students, we can see how certain features, relationships and combinations present in the group variation depicted in the outcome spaces, play out in the case of individual students.

Students' sketching sequences can also be looked at through particular lens and they can be depicted so as to make this possible. For example if we are wanting to understand the different things individual students are sketching when they are designing, their sequence can be depicted in terms of 'what' they are sketching or in terms of 'how' they are sketching or in terms of what/how combinations. Over the course of the following pages the data is depicted in such ways to consider how particular features, relationships and combinations observed in the group (the categories of description) are realized in the sketching of individuals.

To consider how students move between the knowns of the design situation and the unknowns of the design response, we can look at any one of the fourteen reconstituted sequences depicted in terms of 'what' students were sketching. Looking along a sequence we can see the number of times a student moves back and forward between the knowns and the unknowns through their designing. Figure 6c depicts each student's designing sequence along one line. Each sketch within a sequence is coded by letter to show what is sketched and coded by colour to depict whether what is sketched is known or unknown. The grey boxes represent sketching associated with the knowns of the design givens, that is sketching associated with the first quadrant, and the blue boxes represent sketching the unknowns of the design response, sketching associated with the fourth quadrant.

The sequences show that five out of fourteen students (KD, JH, KS, RK and LH) began by sketching within the first quadrant then moved on to the fourth. No students sketched only in the first quadrant and only one student (FK) sketched exclusively in the fourth. Other students moved back and forth between the two to varying degrees; two students shifted three times (NK, JO), five students shifted four times (MH, KT, AN, PC, PH) and one student (CG) moved back and forth five times.
The sequences also revealed that ten out of fourteen students began by sketching the design givens. What the sequences show is that students in their designing do move between sketching the given knowns and sketching the unknowns of their design response and they move between them to varying degrees and seemingly in ways which vary from student to student, although most start by sketching what is known of the site and/or the client. On the whole this suggests that being able to move between the two is an important aspect of progressing designing. If moving between is important what is it that lets a student do this? If we ask this question a little differently, for instance, how does a student move from the knowns to the unknowns or from the design givens to a design response, the answer becomes one which our investigation is able to shed light on. The way a student moves back and forth between the knowns and the unknowns relates to how a student goes about their sketching. So in effect we have identified nine different ways of moving or ‘hows’ of sketching. Bringing these together, how a student progresses from the knowns to the unknowns and in turn back to the knowns and so on between, is by way of either ‘recalling’, ‘doodling’, ‘indiscriminate searching’, ‘initial exploring’, ‘proposing’, ‘knowing more along the same lines’, ‘seeing it can be different’, ‘making a change or responding to changes’. In short moving from design situation to design solution, from knowns to unknowns and from the design givens to a design response involves

<table>
<thead>
<tr>
<th>STUDENTS SKETCHING SEQUENCES - DEPICTED IN TERMS OF 'WHAT' IS SKETCHED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual sketches comprising the sequences</td>
</tr>
<tr>
<td>Student</td>
</tr>
<tr>
<td>MH</td>
</tr>
<tr>
<td>KD</td>
</tr>
<tr>
<td>NK</td>
</tr>
<tr>
<td>JH</td>
</tr>
<tr>
<td>KT</td>
</tr>
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<tr>
<td>PC</td>
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<tr>
<td>RK</td>
</tr>
<tr>
<td>CG</td>
</tr>
<tr>
<td>PH</td>
</tr>
<tr>
<td>LH</td>
</tr>
</tbody>
</table>

Figure 6c. Students’ sketching sequences depicted in terms of what is sketched
Source: Author

The sequences also revealed that ten out of fourteen students began by sketching the design givens. What the sequences show is that students in their designing do move between sketching the given knowns and sketching the unknowns of their design response and they move between them to varying degrees and seemingly in ways which vary from student to student, although most start by sketching what is known of the site and/or the client. On the whole this suggests that being able to move between the two is an important aspect of progressing designing.

If moving between is important what is it that lets a student do this? If we ask this question a little differently, for instance, how does a student move from the knowns to the unknowns or from the design givens to a design response, the answer becomes one which our investigation is able to shed light on. The way a student moves back and forth between the knowns and the unknowns relates to how a student goes about their sketching. So in effect we have identified nine different ways of moving or ‘hows’ of sketching. Bringing these together, how a student progresses from the knowns to the unknowns and in turn back to the knowns and so on between, is by way of either ‘recalling’, ‘doodling’, ‘indiscriminate searching’, ‘initial exploring’, ‘proposing’, ‘knowing more along the same lines’, ‘seeing it can be different’, ‘making a change or responding to changes’. In short moving from design situation to design solution, from knowns to unknowns and from the design givens to a design response involves
any number or combinations of the nine different ‘hows’ of sketching, depicted in the second set of categories of description.

Earlier it was revealed that more complex ‘hows’ of sketching are associated with sketching more complex things and more simple ‘hows’ of sketching are related to sketching more simple things. What this suggests is that moving between the simplest known and the simplest unknown, involves the simplest ‘how’ of sketching. Similarly moving between a mid level known and a mid level unknown involves a mid level ‘how’ and moving between the most complex known and the most complex unknown involves the most complex ‘how’. But the data tells us these interactions between what students are sketching and how students are sketching are not quite so neat and trim, recalling the wide band of the diagonal configuration when earlier the ‘what’ and ‘how’ were plotted for each sketch (Figure 6a). However, taking into account the hierarchy of expanding and inclusive complexity that is present in both ‘what’ is sketched and ‘how’ students are sketching, the diagonal configuration of the data makes sense as the hierarchy allows for broader interactions between ‘what’ and ‘how’ of varying complexities. For example a student might be noting an isolated aspect of the site but they also might go on to note, later in their designing a particular architectural expression they want to achieve. What this means is that the interactions just identified are enriched by this expanding and inclusive complexity to the extent that simple ‘hows’ interact directly with simple ‘whats’ but with an increase in complexity, mid level ‘hows’ which extend and include simple ‘hows’ interact with mid level ‘whats’ which extend and include simple ‘whats’. This builds to the extent that the most complex ‘hows’ which extend and include the mid and simple ‘hows’ interact with the most complex ‘whats’ which in turn extend and include the mid and simple ‘whats’. This network of interactions between ‘what’ students sketch, in terms of the knowns and the unknowns and ‘how’ students sketch, together with the respective hierarchies of expanding and inclusive complexity have been depicted as a whole in Figure 6d.
WHAT STUDENTS ARE SKETCHING - KNOWN GIVENS

A. isolated aspects of site/client reproduced
   plus
B. related aspects of site/client interpreted
   plus
C. abstracted + related aspects of site/client translated

HOW STUDENTS ARE SKETCHING

1. recalling
2. doodling
3. indiscriminate searching
4. initial exploring
5. proposing
6. knowing more along same lines
7. seeing it can be different
8. making a change
9. responding to changes

INTERACTIONS BETWEEN WHAT STUDENTS ARE SKETCHING AND HOW STUDENTS ARE SKETCHING

WHAT STUDENTS ARE SKETCHING - UNKNOWN RESPONSE

1., 2., 3.
4.
5.
6.
7.
8.
9.
plus

plus

plus

plus

plus

plus

plus

plus

plus

plus

D. architectural pieces/parts - beginnings
   plus

E. a coherent whole - a scheme takes form
   plus

F. architectural expression - scheme elaborated
   plus

G. different responses, alternatives - new directions seen and taken
   plus

Figure 6d. Source: Author
Looking at the overall organization of Figure 6d, there can be seen three levels of interactions. The first and most simple level sees students sketching so as to move between isolated aspects of the site/client they have reproduced and architectural pieces/parts associated with the beginnings of a scheme, by way of indiscriminate searching, doodling and or recalling.

The second, more complex mid level of interactions, see students sketching so as to move between their interpretations of both related and isolated aspects of the site/client, and their elaborations on the expression of their scheme, their scheme taking form as a coherent whole and the pieces or parts associated with the schemes, by way of knowing more along same lines, proposing and initial exploring, as well as indiscriminate searching, doodling and or recalling.

The third and most complex level of interactions, involves students sketching so as to move between their translations, interpretations and reproductions of abstracted, related and isolated aspects of the site/client and the different responses they see and new directions they take, their elaborations on the expression of their scheme, their scheme taking form as a coherent whole and the pieces or parts associated with the schemes. They move between these by way of responding to and making a change, seeing things can be different, knowing more along the same lines, proposing, initial exploring, as well as indiscriminate searching, doodling and or recalling.

With each increase in complexity the students' sketching becomes richer in the sense that they have increasingly more and different things to sketch and increasingly more and different ways of going about it.

Having identified these three levels of increasingly complex interactions between what students are sketching and how they are sketching, we can return again to the students' sequences to see how these interactions are present. Figure 6e depicts students' sketching sequences in terms of the particular 'what' and 'how' interactions associated with each sketch, with each is coloured to show what level of interaction has taken place. The key below explains the coding.

What we notice is the familiar feature that each of the students' sequences are different and involve different levels of interactions and to varying degrees. Four students' sketching (MH, JH, RK, and LH) involves simple and mid level interactions, two students' sketching (KD and KS) involves exclusively mid level interactions, five students' sketching (NK, KT, FK, JO and PH) involves mid to complex interactions, one student's sketching (CG) involves simple and complex interactions and two students' sketching (AN and PC) involves all three levels of interactions.
Figure 6e. Students’ sketching sequences depicted in terms of what / how interactions.

Source: Author

Again there seems to be little patterning but what is noticeable at a general level is that most of the sketching involves mid level interactions (33 simple, 81 mid and 37 complex) and most of the students move up and down between the different levels of interactions (4 move from a lower to a higher complexity, 2 remain constant and 8 move up and down to varying degrees) a point we will return to look into more closely in the final chapter.

### Three different ways of sketching

What do these different and increasingly complex levels of interactions between ‘what’ students are sketching and ‘how’ students are sketching tell us about our object of study, that is, the different ways students are sketching?

They tell us there are three qualitatively different and increasingly complex ways students are sketching when they are designing. These are

1. sketching to note
2. sketching to understand

3. sketching to discover

which take their name from the three figure/ground relationships associated with the second outcome space depicting how students are going about their sketching. We can describe these ways of sketching in terms of the interactions between what students are sketching and how they are sketching. (Figure 6f)

![Diagram of sketching relationships](source: Author)

1. Sketching to note

This simplest way of sketching is done to note students' isolated thoughts. This is sketching which reproduces unrelated aspects of the site and/or the client or unrelated architectural pieces or parts, fragmented beginnings of a scheme (Figure 6g.). How a student progresses or moves between the given knowns and the unknowns of their response is by way of either recalling, doodling and/or indiscriminate searching. Students sketching in this way, in doing no more than noting isolated thoughts, are only minimally engaging with the outcomes of their sketching and as such their sketching is unrelated to their designing. There is an underlying understanding that sketching just happens, sketching is something an architecture student has to do and is of no direct concern or focus. It is not an explicit act to be shaped or guided intentionally by the student. Sketching is not seen to be related to design progress, and progress when it occurs is associated with trial and error and/or chance, subject to the student's whim, fancy, likes and dislikes,
taste and choice. This way of sketching is the most limited because students have few aspects and interactions between what they sketch and how they sketch to call upon.

2. Sketching to understand

This mid level way of sketching is done to see or to understand one’s thinking. This sketching interprets and reproduces related and/or isolated aspects of the site or the client, gives architectural form to coherent wholes, elaborates on architectural expression and makes fragmented beginnings of architectural parts or pieces. How a student progresses or moves between the given knowns and the unknowns of their design response is by way of knowing more along the same lines, proposing and initially exploring as well as recalling, doodling and indiscriminate searching. Students sketching in this way, sketching to understand their thinking in addition to simply noting their thoughts, engage with the outcomes of their sketching to the extent that their sketching informs their designing. There is an underlying understanding that sketching is concerned with creating a path, a line of architectural thinking and they see their role as one of creating it. (Figure 6h) Design progress is by sketching to see, to explore and to move along the path at the same time it is being created. With more knowledge of the path the design takes on more detail and resolve through sketching. This way of sketching is more complex, because students have more aspects and more interactions between what they sketch and how they sketch to call upon.

3. Sketching to discover

This most complex way of sketching is done to discover new directions and different thinking. This is sketching which translates, interprets and reproduces abstracted, related and/or isolated aspects of the site and/or the client, sees different responses and takes new directions, elaborates on architectural expression, gives architectural form to coherent wholes and makes fragmented beginnings of architectural
parts or pieces. How a student progresses or moves between the given knowns and the unknowns of their design response is by way of responding to changes, making a change and seeing things can be different, by knowing more along the same lines, proposing and initially exploring as well as by recalling, doodling and indiscriminate searching. Students sketching in this way, sketching to discover new directions in addition to understand their thinking and simply to note their thoughts, fully engage with the outcomes of their sketching to the extent that these outcomes sustain designing. Their sketching is integral to their designing. There is an underlying understanding that sketching is concerned with self directed initiation of a rich field of architectural possibilities. (Figure 6i) A design is progressed by sketching across this field as it is being initiated, working on multiple and or alternative paths, options and scenarios. Directions are identified, opportunities discerned, engaged with, questioned, tested and responded to through sketching. Sketching in this way is an explicit act and is consciously directed towards progressing a design. This way of sketching is the most complex because students have far more aspects and interactions between what they sketch and how they sketch to call upon.

Looking again at the students’ sequences we can see how these three ways of sketching are present. Figure 6j sets out each sketch sequence and notes for each sketch whether a student is sketching to note (N), to understand (U) or to discover (D).

<table>
<thead>
<tr>
<th>STUDENTS’ SKETCHING SEQUENCES</th>
<th>DEPICTED IN TERMS OF WAYS OF SKETCHING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual sketches comprising the sequences</td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>SK 1</td>
</tr>
<tr>
<td>MH</td>
<td>N</td>
</tr>
<tr>
<td>KD</td>
<td>U</td>
</tr>
<tr>
<td>NK</td>
<td>U</td>
</tr>
<tr>
<td>JH</td>
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<td>KT</td>
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<tr>
<td>RK</td>
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<td>KS</td>
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<tr>
<td>JO</td>
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<tr>
<td>AN</td>
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<td>PC</td>
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<tr>
<td>RK</td>
<td>N</td>
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<td>CG</td>
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<td>PH</td>
<td>U</td>
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<tr>
<td>LH</td>
<td>N</td>
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</table>

WAYS OF SKETCHING

<table>
<thead>
<tr>
<th>WHAT / HOW INTERACTIONS</th>
<th>A WAY OF SKETCHING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple interactions 1, 2, 3, A and D</td>
<td>SKETCHING TO NOTE N</td>
</tr>
<tr>
<td>Mid level interactions 1, 2, 3 and 4, 5, 6, A, B and D, E, F</td>
<td>SKETCHING TO UNDERSTAND U</td>
</tr>
<tr>
<td>Complex interactions 1, 2, 3, 4, 5, 6 and 7, 8, 9, A, B, C, D, E, F and G</td>
<td>SKETCHING TO DISCOVER D</td>
</tr>
</tbody>
</table>

Figure 6j. Students’ sketching sequences depicted in terms of ways of sketching

Source: Author
If we look at the sketches themselves, 54% are associated with sketching to understand, 22% with sketching to note and 24% with sketching to discover, and on the whole students are sketching to understand their thinking. However if we focus on each student more closely by looking along their sequences, we can get a more detailed picture of how they move between different ways of sketching. Describing these movements,

- MH begins by noting but moves quickly and continuously into sketching to understand.
- KD sketches to understand throughout her sequence.
- NK begins by understanding, moves to discovering in the middle of his sequence and returns to understanding.
- JH predominantly sketches to note, however near the end of her sequence she sketches to understand, goes back to noting then on to understanding again.
- KT in a very similar pattern to NK begins by understanding, moves to discovering in the middle of her sequence then returns to understanding.
- FK begins with understanding and then by the middle of her sequence moves on to discovering.
- KS similarly to KD sketches to understand throughout her sequence.
- JO begins with understanding, moves to discover, briefly returns to understand, then continues to discover through to the end of his sequence.
- AN begins briefly by understanding, moves on to discover, returns to note and then continues to discover.
- PC starts with noting and quickly moves on to understanding for the first half of his sequence and on to discovering for the final half.
- RK starts briefly with noting and then goes on to understand for the rest of her sequence.
- CG notes for the first third of her sequence, moves to discovering through the middle and returns to note with occasional discovering to the end.
- PH predominantly sketches to understand with brief discovering towards the centre of his sequence.
- LH predominantly sketches to note, with a brief go at understanding in the first third of her sequence before returning to note her way through to the end.

Looking for patterns, of the eight students who move back and forth between the three different ways of sketching, four of these move twice, three move three times, and one moves four times. Four students increase the complexity with each of their moves and two students sketch in one way only. Two
students use all three ways of sketching. All except two students move in singular increments between different levels of complexity, the two exceptions swinging widely between the simplest and the most complex way of sketching. Students are also using their different ways across varying numbers of sketches, for example one student sketches fourteen sketches using the same way, others sketch only once in a particular way.

What this indicates is students are not simply sketching in one way. They are using different ways, in different combinations, they are using them at different points in their designing sequence, they use them to varying degrees and they move between them differently, indeed there is very little in common with the ways students sketch. However it is these differences we need to understand. Marton and Booth (1997) in recognizing that people can move between different ways of experiencing make the comment that:

*It is common for children to alternate between different ways of experiencing number, in the first place within levels, but to some extent between levels as well.* (Marton and Booth 1997 p65)

These differences raise a number of questions, questions which need addressing if we are to get to the core of students’ sketching. What lets a student move from one way of sketching to another? Are more movements between different ways, better? Should a student progressively increase the complexity of their sketching? Why might a student persist in sketching in one way? Do students sketching in the same way, use the same aspects the way of sketching has to offer? We return to these questions in the final chapter.

**Three palettes**

Returning to our descriptions, the different ways of sketching need a rich verbal and visual description in keeping with the expressive and visual nature of students’ sketching if it is to be useful to our students.

The previous verbal description describes the three ways of sketching in terms of the different aspects of sketching associated with each. It provides an understanding of the relationships between aspects of sketching and the way these build in complexity across the three ways. In being focused on parts and being expressed in words, it is difficult to grasp the ways of sketching as a whole, one in which the parts are seen both in relation to each other and in the way they contribute to an integrated whole. A visual representation would be better suited to the task. Seeing the whole is particularly important because
students do not sketch in only one way, they move back and forth between different ways guided by their own experiences. If we want students to improve their sketching they need to be able to see how they are sketching at present and be able to discern what might be a better way, why it is better and what they need to do to be able to sketch in this better way. They need to see the different ways of sketching, one in relation to another, grasping and understanding the whole without losing the complexity and detail contained in the text-based and diagrammatic descriptions used up until now in the analysis process.

To give visual expression to this whole an analogy has been drawn between a certain way of sketching and a painter’s palette upon which sit an array of colours. A different way of sketching is likened to another palette with its own array. The colours are representative of the different aspects of what students sketch and how students sketch, the students’ interactions with the palette similar to the painter's mixing of their colours. The analogy is simple yet it is also rich, simple in the sense that a way of sketching can be seen as a particular palette, spread with certain colours (Figure 6k.). But it is also rich in so far as it is suggestive of wider concerns, such as a painter mixing and applying their paint in different ways, the less experienced painter making limited use of the palette, the more masterful painter finding more opportunities in the same palette, so too for the students working with their sketching. The palette is not an end in itself but rather a means to express, in the same way as sketching, and at the end of the day it is the painter’s engagement with their palette or the student’s engagement with their sketching, that has influence over the quality and character of the final work.

![Figure 6k. A way of sketching is like a palette from which a student sketches](source: Author)
It is easy to imagine the painter spreading and mixing her colours, giving rise to new hues and tones, extending and enriching her palette from which to paint, raising the opportunity for students to see themselves doing the same with their sketching. This evoking of the painter and what they bring to their use of their palette has the potential to closely echo what students might bring to their sketching and helps make this analogy not only appropriate but also suggestive of new and different ways of seeing and going about sketching.

Sketching to 'note', to 'understand' and to 'discover', can be represented as three palettes, each differing in size and having its own array of colours (see Figure 6l). Sketching to 'note', is likened to the smallest palette with few colours. It is the most restricted and requires only limited ability to use. Sketching to 'understand', is likened to a mid size palette, with additional colours available to the painter and a greater range of abilities is required to make use of this larger palette. Sketching to 'discover', is likened to the largest palette and offers the widest array of colours from which to paint, colours which include and extend beyond those available on the first two palettes. A full and diverse range of abilities is needed to realize the full potential of the extended palette.

We can bring this analogy and the detailed descriptions together into a framework which is descriptive of the three different ways of sketching. The framework draws on the qualities of the analogy so as to understand them as a functioning whole and on the depth of the analysis so as to identify the particular aspects of sketching arrayed on each palette, in terms of their features, their differences, their meanings and their interactions. Providing a graspable whole and identifiable parts, the framework is designed to be useful to students and teachers in the design studio. Figure 6m depicts the descriptive framework.
SKETCHING TO DISCOVER
Students are sketching different responses and alternatives, as well as sketching architectural pieces/parts, a coherent whole, architectural expression as well as abstracted and related aspects, related aspects and isolated aspects of site/client. Students are going about their sketching to respond to change, make a change and see the scheme can be different, as well as to know more along the same lines, propose and initially explore, as well as to indiscriminately search, doodle and recall. Associated with these defining features, the student is sketching to discover new directions and different thinking, and the sketching is integral with designing where the outcomes of the sketching sustains designing. There is an underlying understanding that sketching is concerned with initiating a rich field of architectural possibilities.

SKETCHING TO UNDERSTAND
Students are sketching related aspects and isolated aspects of site/client as well as sketching architectural expression, a coherent whole and architectural pieces/parts. Students are going about their sketching to initially explore, propose and know more along the same lines as well as to recall, doodle, indiscriminately search. Associated with these defining features, the student is sketching to see or to understand their thinking, where sketching informs designing and there is a partial engagement with the outcomes of the sketching. There is an underlying understanding that sketching is concerned with creating a path, a directed line of architectural thinking.

SKETCHING TO NOTE
Students are sketching aspects of site/client as well as sketching architectural pieces/parts. Students are going about their sketching to recall, doodle and to indiscriminately search. Associated with these defining features, the student is sketching to note their thoughts, the sketching is not related to designing and there is no engagement with the outcomes of sketching. There is an underlying understanding that sketching just happens, it is something that architects just do.

WAYS OF SKETCHING
a descriptive framework
The final chapter of this thesis explores the usefulness of this framework, seeing whether the framework in this form and with its associated understandings, can help to make new sense of how three students are sketching. The usefulness of the framework is expanded to serve as a basis upon which students can found improvements in their sketching and teachers can found improvements in their teaching about sketching.
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Introduction

The close of Chapter 6 presented a framework which described sketching in terms of three qualitatively different and increasingly complex ways of sketching; sketching to ‘note’, sketching to ‘understand’ and sketching to ‘discover’. This chapter looks at how this understanding, the findings of this research, can be used to make sense of students’ sketching and how it might be used by students and teachers in the design studio.

Using the framework in the studio is anticipated to make inroads into helping students in their learning about sketching in ways which deal with some of the difficulties raised in Chapter 2, difficulties associated primarily with sketching not being an explicit focus of teaching and learning in the studio. Recalling these difficulties, there is a lack of attention given to helping students learn how to go about their sketching and as a result students find it hard to learn to use their sketching as a means to progress their designing and of developing their architectural thinking. Learning about sketching necessitates seeing what lies below the surface of the sketching itself, to the drawers’ underlying meanings and their understandings of sketching, and students and teachers of architecture find it hard to direct their attention to something which is not readily apparent. Lacking an appropriate language, they are hard pressed to articulate how the act of sketching or the thinking related to it is used and as a consequence teachers struggle to teach and students struggle to learn something which lies fundamental to architects and their designing.

Identifying and describing different ways of sketching provides a foundation of understanding upon which these difficulties might be addressed. The descriptive framework is directed towards making this understanding accessible to teachers and students in the studio and in so doing, directly targeting some of these difficulties. Through each person’s interpretation, the framework becomes something different, is used in different ways and takes on different meanings. Yet common to all of its uses is that its role is to give underlying structure and support to different understandings of sketching as they

Figure 7a. A garden framework
Source: Author
emerge and develop, in ways not unlike how bamboo canes, secured at the top gives form and support to a bean plant (Figure 7a).

The body of this thesis has been directed towards giving rise to this framework, its features, hierarchies and overall form through the analysis of students' sketching and demonstrating the potential use and hence potential value of the framework brings this thesis to a close. After using the framework to make sense of the sketching of three participating students, I draw on my teaching experience to explain principles which might inform the way it can be used in the studio. Consideration of the ways students and teachers might use the framework follows and finally suggestions are given as to how teaching and learning in the studio might change were sketching to become an explicit focus for teaching and learning. The chapter closes by stepping back from the findings to consider how the study as a whole meets the terms of its brief and explores how this research might lead in to further investigations.

Making sense of students' sketching

At the close of Chapter 6 it was explained that students move between different ways of sketching. At times they sketch to 'note', at times to 'understand' and at times to 'discover'. They use different ways in different combinations, they use them at different points in their designing sequence, they use them to varying degrees and move between them differently. It is not as simple as saying a student sketches in one way or that they are sketching from one particular palette. These differences give rise to certain questions. For instance, what lets a student move from one way of sketching to another? Are more movements between different ways, better? Should a student progressively increase the complexity of their sketching? Why might a student persist in sketching in one way? Do students sketching in the same way, use the same aspects of sketching that way has to offer?

These questions are concerned with making sense of students' sketching. To look into how the framework can be used to make sense of students' sketching and indirectly, by way of example begin to answer such questions, we can look at how I am able to use the framework to make sense of CG's, KD's and JO's sketching, three students chosen in particular for the divergence in the ways they sketch. It is important to note that my interpretation draws on the depth of my teaching experience and as such will be different to how novice teachers or students might use it. However on the strength of this experience, certain principles are brought forward out of my usage, principles likely to be helpful to others in their use of the framework.
The students’ three sequences follow, along with a description of their sketching, and I have used the understandings, the distinctions and terminologies associated with the framework to make sense of their sketching and to make suggestions as to how each might complement and go on to improve their sketching.

CG’s sketching

![Figure 7b1. CG sketching, Page 1. Source: sketch held by author.]

![Figure 7b2. CG sketching, Page 2. Source: sketch held by author.]

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CG begins her sequence with three sketches (Figures 7b1, 7b2 and 7b3) which recall aspects of the landscape in a form almost identical to the briefing material. Her fourth sketch recalls in words aspects of the client she thought important in the briefing. None of these sketches involve interpretation. She is recalling isolated thoughts, consistent with sketching from the first palette of ‘sketching to note’. In her fifth sketch, she proposes an abstract idea of a box which responds on each of its sides to different aspects of the site. She explores this idea a little further in plan in her next sketch but goes no further. It is as if she cannot see how to take her idea forward. In her seventh and eighth sketch (Figure 7b2), she changes her concern to look into the paths the poet could take and in focusing on abstracted notions CG is ‘sketching to discover’ new directions. In her next sketch she searches her way through unsure and unformed architectural pieces (Figure 7b3), sketching which by its lack of direction is associated with ‘sketching to note’. In sketch ten she returns to her abstracted paths ‘sketching to discover’, and in the eleventh, she is ‘sketching to note’, doodling pieces of what could be a building and goes on in her final sketch to she doodle something to do with the slope of the ground.

Looking at CG’s sequence as a whole, we know certain aspects of what she considers to be important about the site and the client, there is an idea of a responsive box, a second idea of different paths, then very uncertain sketching of unformed parts of a building, a return to the path idea and finally doodling. By the sequence’s end there is no poet’s retreat apparent. In terms of the palettes CG is moving from ‘noting’, to ‘discovering’, back to ‘noting’, to ‘discovering’ and again back to ‘noting’, in effect swinging between the two. Having noted what was important about the site/client, she apparently has no difficulty proposing some ideas which could be useful, but she does not follow these up and goes back to noting.
design fragments, noting with far less confidence than when she began her sequence. It appears she has trouble developing her ideas into a line of thinking, a feature consistent with her not sketching to ‘understand’ her thinking at any point in her sequence. It is by way of seeing what she is not doing that we can begin to make sense of her lack of direction. CG’s interview gives us insight into her own lack of direction as she explains what she was doing in her last few sketches:

And I think that at this stage I had my pencil sort of held, I was just like, yeah I dunno, I dunno what I’m doing I just sort of started...

And I don’t know whether at this stage I got a bit distracted and for some reason I was like, I wonder how everyone else is drawing, while I was drawing this...and I think I was trying to draw in a different style or something. But it was yeah, and then, yeah...

Yeah and then I sort of found this idea, I dunno, I just didn’t think this idea was as important as others, so I think I sort of stopped, scrapped it. And then this is number 12, my last one just before you called me over, which was..., I started thinking about the ground slope, the site slope and just drew. I just started drawing over and over again. Well just to think, I dunno. I think the fact that I was drawing made me go, well what does the slope look like. And I had no idea what it was, but the fact that I just kept drawing...

(CG interview)

We can ask to what extent is CG utilizing what each palette has to offer? When she sketches to ‘note’ her thoughts about the site or the client, she uses all of the different ‘hows’ associated with this palette, namely ‘recalling’, ‘doodling’ and ‘indiscriminate searching’, she sketches ‘isolated aspects of the site and/or the client’ and at times she sketches ‘architectural pieces or parts’. Her sketching uses the full array of ‘how’ and ‘what’ available on this limited palette. Noticeably she does not sketch things in relation to each other and as a consequence her thoughts remain isolated, unable to form into a line of thinking. While her thoughts remain isolated, she is unable to use the sketching associated with the more extensive ‘understanding’ palette. When she at times sketches abstracted notions, her use of the ‘discover’ palette is so limited because she lacks any deeper understanding to sustain her sketching. She fails to develop what would appear to be an appropriate, site informed idea of a responsive box because she has not developed any depth to her understanding of the design situation. In articulating what she is and is not able to do, it becomes apparent that if she is to improve her sketching she needs to learn how to develop understanding through her sketching. Once we know this is her problem, we can encourage CG to do specific sketching studies which target developing this particular ability. For instance she might through a series of sketches develop one line of thinking either from her own design
such as developing one wall of her site responsive box idea or alternatively, she could use her sketching to develop a line of thinking from someone else's design response, where often the fact that it is someone else's makes the task easier. The more particular we can be in identifying CG's difficulty the more finely we can tailor our guidance as to what she needs to do to improve.

**KD’s sketching**

![Figure 7c1. KD sketching, Page 1](source: sketch held by author)

![Figure 7c2. KD sketching, Page 2](source: sketch held by author)
KD’s first six sketches, (Figures 7c1, 7c2) half of her whole sequence, explore in depth a range of related issues associated with the site. She draws certain aspects together, interprets and explores their relationships to see new understandings, well beyond the extent of the briefing material and as such she is ‘sketching to understand’, sketching associated with the middle palette. KD sketches what you might see, feel and experience of the site. These are the tangible aspects as distinct from abstract understandings and she sketches them in her own terms, only once using the same visual expression as the briefing panels. In her seventh sketch (Figure 7c2) KD proposes certain additions into the landscape, additions which hint of a retreat beyond and she is the only student to extend her designing into the landscape itself. Her eighth sketch takes an early insight she had into the nature of the landscape and develops it, proposing a series of stepped terraces set within a clearing surrounded by trees. In her ninth sketch (Figure 7c3) two pavilions are proposed, harbouring a shared centre which again develops a previous insight into the landscape to the extent that all of which KD proposes is closely linked to her understanding of the site. Her final two sketches expand what she is proposing into a coherent whole and she describes her retreat it terms of its qualities in plan, in section and in elevation.

Making sense of her sequence as a whole, KD explores and develops her thinking in ways consistent with ‘sketching to understand’. Through her sketching she repeatedly brings issues into relationship, and develops a deep understanding of the site, an understanding which is uniquely hers. KD’s sketches relate closely to each other, where one informs another and in turn informs another and by the end of her sequence give rise to a poet’s retreat which is highly responsive to the qualities of the landscape.
and her understanding of how the client might dwell in the retreat. KD directs the path of her own designing, and by moving along this path, she generates and proposes a poet's retreat making substantial progress in the short time frame of the design task. If we consider where KD has arrived by the end of the task, she has a deep understanding of the site, she has made a place in the landscape, a sheltered place within which sits her retreat. She knows what her retreat is like, the way it works as a whole within the setting of the landscape, the ways people dwell within and she has identified its key parts.

KD speaks of the way she consciously weaves her sketches together. When asked about part of her sketching she replied:

\[
\text{I was just thinking about the trees and how I could use that as a natural screen or shelter, you know, a sheltering aspect and how that would um..., work with the path again…}
\]

\[
\text{I thought that was quite important the path, so I was trying to maybe meld these two ideas together, you know. How you could use the natural and the visual things of the screening of the trees and bring that back into the movement and the winding path…}
\]

\[
\text{This one was yeah, going back and visiting the shelter, the platform idea, the sandstone platform and how you could use them just for living. So I was trying to give it a bit more of a concrete, starting to give it a bit more of a structure. And also again using the screening idea, so a little bit of that… (KD interview)}
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KD's sketching can almost be seen as a foil for CG's. Instead of repeatedly and widely swinging between 'noting' and 'discovering', KD for the full extent of her sequence persistently sketches to 'understand' her thinking. She is one of only two students out of the fourteen who do this, and she develops an understanding deeper than any other. She sketches to weave complex and insightful relationships into a line of thinking, which results in a depth of understanding of the landscape and the poet from which she seeds and develops her design response. Sketching in this way, KD is using the full potential of what the 'understanding' palette has to offer.

Absent from her sequence is any apparent questioning of or seeing that her response might be different. This could be for a number of reasons. Perhaps she is not able to see her scheme as being different, she is not able to use her sketching to give rise to new directions or she has not got to that point yet in her designing as she timed her sequence to close around proposing a scheme. As in the case of CG looking at what KD is not doing gives us insight as to what she might do to improve. Improvement for KD is not an issue of her using more of the middle palette but rather one of learning to use her sketching to
'discover'. She needs to direct her sketching towards initiating, testing and discovering different ways of seeing her scheme and a likely turning point could be for her to see that her scheme could possibly be different. For many students this is not easy and involves relaxing their tight hold on their scheme, metaphorically placing it on an open palm and in so doing making it easier to see, to question, to test and find possibilities for change. Sketching studies could be devised which help KD develop this ability, one in particular coming to mind where for example KD hands over to another student the latest sketch she has done of her scheme with no words in the exchange. The other student is asked to sketch a response to what she sees and to hand it back to KD. KD reads the response and sketches again this time taking into account the other student's new reading of her scheme. These exchanges can be repeated any number of times but experience suggests they rapidly and repeatedly trigger new directions, again sometimes easier in response to what others see.

**JO's sketching**

![Figure 7d1. JO sketching Page 1](source: sketch held by author)
Figure 7d2. JO sketching
Page 2
Source: sketch held by author

Figure 7d3. JO sketching
Page 3
Source: sketch held by author

Figure 7d4. JO sketching
Page 4
Source: sketch held by author
JO's begins by proposing a coherent architectural whole, sketching associated with 'understanding'. The first four sketches (Figure 7d1) describe the sectional qualities, the approach and the way a retreat is organized in plan. His fifth sketch (Figure 7d2), taking up all of his second page is a large view depicting his retreat as a whole, its architectural components and expression, set in a generalized landscape of trees, a landscape noticeably more general than the retreat. He is one of two students who begin by proposing a retreat, without any initial exploring or noting of issues relating to the site or the client. Beginning with this scheme, he describes it in considerable detail across five sketches, more detail than most students have arrived at by the end of their sequences. Having described his retreat, JO sees his scheme could be different and proceeds to 'discover' different directions, new ways of seeing his scheme through a series of maze-like sketching covering his third page (Figure 7d3). This sketching at times makes a change and at other points responds to change, seeing new opportunities and alternatives. What is noticeable is that none are developed so as to take on any detail, instead they read one over the other, difficult to tease apart. In one sketch (top right hand corner of Figure 7d3), JO recalls to himself the client's movement between city and bush, and is the only sketch which relates to the design situation as distinct from his design response. His final sketch (Figure 7c4) like his fifth, sitting clear in a full page, is a sketch which settles his wide ranging alternatives of the previous page into a new whole, not substantially different from the previous but different in its expression, informed by what he discovered through his previous sketching.

In making sense of JO's sequence as a whole, it falls into two parts. The first, in proposing an initial scheme as a coherent whole is associated with sketching to 'understand'. The second half is concerned primarily with change, seeing it is possible, seeing what the changes might be and then making changes to his proposal, sketching associated with 'discovering' new directions. In proposing his scheme so early, it is as if he consciously and quickly stands it up and then proceeds to change it. JO's sketching techniques change in relation to what he is considering. For example he moves between exploring relationships in plan, in section and in elevation, to views which explore approaches, to diagrammatic expressions of hurried alternatives where he explains 'ideas are just sort of spewing out... '(JO interview), moving on to larger views of what his retreat would be like as a whole. What and how JO sketches varies widely through his designing and as such he sketches in ways which extend across a good deal of what the framework has to offer. However in the second half of his sequence where his attention changes from 'understanding' to 'discovering', what he discovers goes undeveloped. He does not seem to be interested in developing a deeper understanding of the changes he is making, seemingly preferring to skate across their surface. Also of note is that JO's entire sequence, with the exception of one sketch is associated with the architectural form of his design response, as distinct from developing
an understanding of the design situation. In marked contrast to KD and to a lesser extent CG, there is a noticeable lack of sketching which explores aspects of the landscape or aspects relating to the client. JO's repeatedly sketches a generic landscape of wiggling lines and circles around his response and in his interview he adopts this same generalized attitude, seeing the potentially rich landscape only in terms of trees.

Drawing 5 shows the basic idea of how the building fits within the landscape....How trees can now become.... how the interaction between like a building and trees can become a bit more like ahhh..., say, more dimensional, rather than just being limited to something very simple. (JO interview)

By the end of his sequence, in a similar way as KD, JO knows the form of his retreat as a whole, its parts, elements of its structure, materials and its expression. What distinguishes his sequence from both KD and CG is that JO's emerging retreat has been tested, questioned and changed in the light of discoveries made through his process of sketching. JO in his interview, explains how he consciously introduces new ideas into his response:

It's becoming quite a resolved scheme and I thought that I'd come up with it pretty quick and I though, oohh, maybe I should take a bit more time, so I tried to introduce some other ideas into it. (JO interview)

JO in his interview gives us insight into the ways he twists and turns his thinking from one idea into another. He recounts how in starting a sketch, by the time he had finished, it had been consciously turned into something quite different. He explains:

But what this drawing, the drawing 7 to 12 did do, was like, like drawing 10, its figuring out how something that is light can sort of push through another thing, which just happens to be solid. And then I guess drawing 13 is an extension of drawing 6 where something does push through in a more complex manner. Which umm..., I mean, I suppose you could interpret these in drawing 7 to 12, the solid element is a space rather than being something concrete I guess, and then how does something light which may or may not....I didn't really intend it at the time to be...

Yeah, I think because in the third sheet of drawings, um...., ahh, I went into it with an idea of something inside and with the idea of something wrapping through it or pushing. It was a light element but it could have been anything pushing through. And then the..., some of
the things I resolved in drawing 10 if you took the elevation of it and put it in plan, you’d get the roof of this with something pushing through it. (JO interview)

JO's sketching is complex in so far as how he sketches and what he sketches shifts and changes in response to his designing and what he discovers through his sketching loops back to inform further sketching and new directions. His shortfall appears to be that his sketching does not settle long enough, for him to develop a deeper understanding of his new directions and his sustained focus on his architectural response does not allow him to develop a deeper understanding of the site or the client to the extent that it could have a significant role in informing his design response. Improvement for JO could lie both in developing his understandings of the site and the client so as they can inform and guide his scheme and in deepening his understandings of the changes he is making. These needs could simply be pointed out to him or if he needed more structure to direct his changes, he could spend fifteen minutes and one full page of sketching intentionally focusing on developing one particular part of his response in some depth, for instance his understanding of the client's needs. Doing this, that is deepening his understanding of concerns other than those relating to architectural form would enable him to know more about the places he was designing and provide him with additional inputs by which he could inform his designing.

Seeing each of the three students in relation to each other it appears JO could well benefit by using his sketching in ways inclusive of KD's sketching to 'understand' and in turn KD could well benefit by developing JO's ability to use his sketching to 'discover' new directions. CG could benefit in developing both KD's depth of understanding and JO's ability to shift and change how he sketches and what he sketches in response to his designing.

**Complementing, learning and change**

If we look at what I am doing in order to make sense of CG, KD and JO's sketching, certain things come forward. Firstly I am describing the students' sketching, what and how they are sketching in the terms of the framework. I see from which palette they seem to be sketching and whether they move between palettes or not. I ask how much of each palette are they sketching with and whether they are sketching across all three. Perhaps most importantly I identify what a student is not doing both in terms of the three palettes as a whole and the specific details associated with sketching from a certain palette. A connection is then made between what they are not doing and what they need to do in order to sketch.
across all three palettes and to fully use what each palette has to offer. In this way improvement is seen in terms of complementing or making more complete a student's usage of sketching.

In a parallel identified in the synergies, the phenomenographic outlook sees the desire to make more complete partial understandings, that is the initial ideas, the un-integrated wholes which a learner holds when embarking on learning, which fuels the desire to learn (Marton and Booth 1997). With this view it would be CG's, KD's and JO's desire to make more complete the ways they are sketching which fuels their learning and to make more complete their understanding they need to be able to see their sketching in relation to the understanding of sketching depicted in the framework.

Shifting focus from students to the framework itself, to expand on this notion of partial and complete understandings, we see the framework as depicting three different yet increasingly complex ways of sketching. A fuller or more complete grasp of sketching is seen as involving students working across all three palettes, using the full extent of what each of the palettes has to offer as they progress from the design situation to their design response. In contrast, the sketching of students who have a partial or less complete grasp of sketching can be seen as sketching which is limited in the range of palettes used and uses to a lesser degree the extent to which what each palette has to offer.

In relation to students, we can appreciate the extent of a student's grasp of sketching by considering the degree to which a student uses the possibilities a particular way or a particular palette has to offer, and the extent to which a student calls upon the three different ways of sketching which make up the totality of the framework. This suggests teaching and learning about sketching can be seen in terms of helping students to make more complete the extent to which they are able to sketch from the framework in its detail and as a whole. Making more complete can also be seen as complementing and by understanding what a student needs to do to complement their current sketching we have a way in to identifying the particular improvements each student is needing to make.

Returning to our three students, if CG, KD and JO are able to identify what they need to do to improve their sketching, the question they face at the drawings boards is how do they go about making the changes?

In phenomenographic terms, changing a person's understanding so they are capable of going about something in a different way is considered to be learning, the kind of learning referred to as:

A change in the eyes through which we see the world. (Marton, Dahlgren, Svensson and Saljo 1977)
This suggests CG, KD and JO need to change their understanding of sketching if they are to be able to go about it in a different way. When learning occurs, the learner's awareness of the phenomenon has changed, the phenomenon appears different from before, the relationship between the person and the phenomenon has changed. For this to occur Marton and Booth (1997) explain:

*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)

So for a student to change their sketching, they have to become capable of discerning, that is, being simultaneously and focally aware of other aspects or more aspects of sketching from those they were capable of discerning before. Marton and Booth explain more specifically that to change our experience of some aspect of reality we have to:

*Break the natural attitude temporarily, thematize the aspect in question (in other words, make it an object of reflection), consider alternatives to what is the case, open our awareness to the possibility that something may be other than we thought. We have to raise to figural that which in the natural attitude remains in the ground.* (Marton and Booth 1997 p148)

For CG, KD and JO to change they have to consciously consider the ways they are currently sketching and bring these ways into the foreground of their awareness. Once in the foreground, they need to become aware that other ways and understandings of sketching exist and that these other ways might be more complete and if they are, change is desirable. In bringing these new and different ways of sketching into the foreground of their awareness they displace the previous less complete understandings which recede to the ground and in so doing make more complete their understanding of sketching.

What becomes apparent is that the process of learning is driven by a student's ability to see differences, and it is for this reason the phenomenographic viewpoint considers variation as the chief mechanism of learning (Marton and Booth 1997).

It is important then for students learning about sketching to see there are different ways of sketching and this is a key role for the framework because in being a visual depiction of different ways of sketching, students through their engagement with it have a means by which they can see there to be different ways, not just in name but also in detail. For a student to see these however they also need to be open
to the possibility that their sketching could be different and once they can, they can go on to use the framework to understand their current ways of sketching and by seeing their ways in relation to others they can start to consider making improvement. This is not to suggest though it is a linear process for it could well be by seeing other ways of sketching that a student comes to appreciate that their sketching might possibly be different.

Seeing CG's, KD's and JO's improving their sketching in terms of change, CG instead of sketching to note her isolated thoughts needs to sketch to bring her thoughts, one in relation to another so as they can develop into a line of thinking from which a developed understanding can grow. KD, sketching to understand, needs to see the possibility that her scheme might be different, and once she sees this, her sketching given her current use of it, will open a field of discovering. JO needs to see that sketching to deepen his understanding can inform his sketching to discover.

It would be possible to work across all fourteen participating students, as we have with CG, KD and JO, using the understanding depicted in the framework to identify changes each student might make to improve their sketching. A likely outcome being that the changes, in the same way as it was for CG, KD and JO, are quite particular to an individual student. It is the capacity for the framework to be applicable to and yet still be able to give specific and individual direction which will help make it useful across the teachers and students associated with the design studio.

In becoming part of the workings of the studio, the framework will of necessity be interpreted by students who sketch in different ways, are in need of different improvements and hold different understandings of sketching. It is also likely these students will see their learning differently and be open to the possibility for change to varying degrees. Similarly, the framework will be interpreted by teachers who sketch in different ways, understand sketching in different terms, see learning differently and have varying understandings of their role as teachers.

To look into how the framework might deal with such differences we can project ahead to a studio situation where the framework is being used by students and teachers and describe what might occur. This is not dissimilar to how an architect tests their designs by imagining people using or inhabiting the spaces they are designing. 'Inhabiting the framework' provides what you could say is a sketch of some of the possible and different ways the framework might be used by students and teachers in the teaching and learning design studio.
**Inhabiting the framework**

Any consideration of how the framework might be used by students and teachers should take into account the possibility for differences in understandings of a range of issues including sketching, designing, learning and the role of both student and teacher. Marton and Booth (1997) explain that how people go about learning relates to their understanding of what learning is. Making a similar association, how people go about sketching, go about designing or go about almost any particular act, relates to their respective understandings of what sketching is, what designing is or what the particular action is. This suggests how students go about using the framework relates to their understanding of it, which in turn is related to their understanding of sketching, designing, learning, teaching and so on. We cannot predict what these differences might be, but we can look at how the framework might be used on the basis of differences which have already been identified through the analysis process.

Three notional groups of students who see their sketching either as a means to ‘note’, to ‘understand’ or to ‘discover’ are used to structure the descriptions of how the framework might be used. It is likely that students who have a limited understanding of sketching may well have a limited understanding of learning, although this conjecture needs to be substantiated through further investigation. The description intentionally uses the language and terms of the framework to illustrate again by way of example, how the framework and its associated understanding can provide a means to express on the one hand the wholeness and on the other the intricacies of sketching, the different ways, the features, the relationships and the hierarchies, using simple terms familiar to the studio. The first group of students considered are those who primarily ‘sketch to note’ their thoughts and associated with their noting is that sketching is something for them which just happens. The second group ‘sketch to understand’ and for them sketching is associated with creating a path, shaping a line of architectural thinking into an understanding. The third group ‘sketch to discover’ and for them sketching is associated with initiating a rich field of architectural possibilities.

For students who associate sketching with noting aspects of importance, the framework might be interpreted as simply another thing to note. It could serve as an outline, a series of isolated things to take into account. They might have the framework diagram set off to the side of their drawings as a reminder of what it is they might sketch and how they might go about their sketching. Used in such a way, it can be seen as a source of sketching possibilities from which,
depending on their understanding of sketching, they might draw. Associated with their sketching to note, these students see their sketching as something which just happens, and because of this they might pick and choose between sketching possibilities on the basis of whim or fancy. Examining the framework more closely they might see the increasing complexities associated with each palette, and recognize by way of comparing how they are sketching against the framework, there are other ways of sketching they are not yet using which might be helpful to them.

By engaging with the framework as a list of possible things to do, students are beginning to consciously think about their sketching which was unlikely to have been part of their architectural awareness. In bringing their own sketching into the foreground, an occurrence which Marton and Booth (1997) see as one of the early steps in changing a person's understanding, a student moves forward in the development of their understanding of sketching.

What could teachers do to support these students in their learning? Firstly they could be briefed so as to familiarize themselves with the workings of the framework as it relates to these students. For example, what are the different ways of sketching, what and how are these students likely to be sketching and so on. They could also look more closely into the students' sketching and draw their attention to particular things to sketch or how they might sketch to complement what they are already doing. These suggestions can only go so far as they are only dealing at a superficial level with students' difficulties. Whilst ever a student sees their sketching in terms of noting, they remain hampered, only partially able to use the potential of sketching. The same may well apply to the students' understanding of learning, for if they see learning as being a matter of recalling methods or processes, they will look to the framework to depict a method and as it does not, may set it aside as something of little importance. To get to the crux of a student's learning, and experience suggests it is unlikely a student will do this of their own accord, the teacher needs to devise learning experiences directed towards helping the student develop a more complete understanding of sketching, in effect changing the student's awareness of their sketching from being a means to 'note', to being a means to 'understand'. For instance a sketching study could be set up which requires students to sketch a thought then pass it on to another. They receive a sketch, think about it and in turn sketch a response. Handing this back, they receive their own sketch responded to. In turn they sketch a response to the response and so the process can continue back and forth building up a series of related responses to the point where the student starts to see firstly that it is possible to sketch a response to something already sketched, and secondly by responding to what they see in each sketch they can develop a line of related thinking, a distinct difference to their sketching of isolated and unconnected thoughts.
Stepping right back, students who see their sketching in the most limited terms of noting could be the ones to gain the most from working with the framework. Their scope for improvement is large but they are likely to be the least able to do this for themselves and most needing of guidance and their teachers’ willingness to recognize the situation and to encourage and/or initiate change for them.

Students who associate their sketching with developing an understanding are likely to engage with the framework in a more complete way, using it consciously to help direct and deepen their understanding of sketching. With their ability to bring things into relationship, you would expect these students to be able to see their own sketching in relation to the framework, both in terms of how their sketching might relate to a particular palette and how the different ways they are sketching relate to the framework as a whole. By comparing differences a student can identify what it is they need to do to improve.

These students are likely to use the palettes in a more directed way, a way which deepens and extends their understanding of sketching. For this group using the framework would be concerned with knowing more about something they already know, expanding and extending a familiar path. When these students are introduced to the palette which associates sketching with discovering, the question arises as to whether they will be able to move beyond their present understanding to see new and different architectural possibilities. If they can make this move, if they can see that their scheme might leave its established path to become something different, new ways of sketching are opened up which give rise to unforeseen opportunities and different directions, and as a consequence the outcomes of their sketching sustains their designing. If they cannot make the move, the role of the teacher becomes to devise sketching studies focused on using sketching to see differences which help a student to make these changes.

It is important for students to be able to identify what they need to do to improve their sketching and experience suggests students are usually keen to do this. For this group of students, with the framework depicting different ways of sketching, it is likely that can use their ability to bring things into relationship to work this out for themselves, thereby directing their own improving, reducing their dependence on tutors and developing confidence in their sketching.

Relating their own sketching to the framework, students could use the terms or the language of the framework to explain how they are sketching to a friend or to see their sketching in relation to another
person's, making discussions and comparisons possible. Conversations about sketching could become part of the exchanges in the design studio, something which is currently problematic as people struggle without a language to do so. The simple and familiar terms used to describe students’ sketching opens the doors to conversation and in opening them makes sketching something which students can consciously consider themselves, can discuss amongst their friends, the design group and with their teacher. When ‘what’ a student sketches and ‘how’ students sketch can be named, when they can be talked about and expanded upon, sketching becomes an integral part of design exchanges and something which students and teachers can directly focus on. The task for teachers would be to participate in these conversations using the shared language and to direct their exchanges with a student towards and through the student's own sketching, a point we return to later.

Stepping right back, students who sketch to understand, could benefit by working with the framework. They do not have the same need for improvement as the previous group, but still need to take into account ways of sketching which are in addition to and expand on how they are presently sketching. Holding a more complete understanding of sketching, it is likely these students will be able to take a larger role in initiating, implementing and sustaining their own improvements and be far less reliant on their teachers for their learning. Teachers are likely to be needed more as support rather than as initiators of improvement.

Students who sketch to discover are likely to see the framework as a functioning whole because in sketching in this way they are likely to have a solid grasp of the different ways of sketching represented by the palettes. Where it is likely to be of use is as an explicit reminder of possibilities which sketching has to offer and despite these students holding the most complete understanding of sketching, it is still appropriate they engage with the full extent of each palette and the framework as a whole. Working with the framework could be expected to enable these students to bring their sketching into their awareness. In the same way as for the previous group, once they consider their sketching as a conscious process they can use the language of the framework to describe their own sketching and to discuss it with their friends, their design group and their teachers and in so doing make sketching an explicit focus of their learning, learning which these students are likely to be able to initiate and sustain themselves.

I have observed that students who sketch to discover are so at ease using their sketching and their sketching so inseparable from their thinking and in turn their designing that they are seldom conscious
of what it is they do when they sketch, not dissimilar to the difficulties professional architects have in describing their own sketching. These students if they could see it, have much to offer the studio and their fellow students and would benefit in the process of sharing what they can do well. They are likely to be sketching in ways other students might not have thought possible and I have come to appreciate that for a student who is struggling, to be able to see how another student goes about sketching their way through an issue, is a lesson far more meaningful than if a teacher were to do the same.

Stepping back, these students probably have the least to be gained by working with the framework. These are the students who are most able to engage with their sketching and it could be expected they are the most likely to engage with the full extent of the framework. They are also the students who are the least reliant on inputs from their teachers, their teacher’s role tending to be more one of a sounding board against which students test out their discoveries.

**Possibilities for the studio**

In describing possible ways the framework might be engaged with by students and teachers, we touched upon a number of influences this understanding of sketching might have on the functioning of the design studio. We have spoken of the framework offering a means by which students can understand their sketching, how it can be used so as to see particular ways of sketching in relation to others ways and to identify what is needing to change if students are to improve their sketching. Being able to describe the ways students are sketching using the terms of the framework we have also shown how it is possible to speak about, to articulate, to name what is happening when students are using their sketching as part of their designing and this is fundamental if sketching is to be brought into being an explicit focus for teaching and learning.

In offering these new opportunities it is also possible that the functioning of the studio itself could change. Exchanges might happen in different ways, dynamics might adjust and teachers start to redirect some of what they do with students. Students might also change the ways they work, they ways they speak about their designing with others and slowly it is possible to foresee that the studio as a whole might be able to change.

Having conducted studios intentionally focused on helping students learn to use their sketching to progress their designing (referred to as the WSS studios), I have some understanding of the influence such a shift in focus can have on the studio in general. The following outlines changes which might
occur in the studio, differences which might be possible were sketching able to become the significant focus that this thesis suggests it should be. Although conjecture it is grounded in this research and uses where appropriate comments from students who have participated in studios where in the words of one student:

_The emphasis on drawing as a tool of developing and communicating the design helped to effectively develop and stand up the design._ (Anon A., student feedback, Design Practice 2B 2003)

Looking firstly at how the framework could be introduced, each student could be given a copy of the framework diagram, some larger versions might be on the studio walls. Being explained to design tutors it could be woven into discussions with design groups and exchanges with individual students, it’s functioning and terminologies spoken about and followed up in studio studies. In these simple ways the framework could have an initial presence in the studio. However in introducing it to students it would be important to make explicit that it is not a representation of a process or a recipe to follow, but rather a way of understanding, a way of making sense of students’ sketching, explaining that when students begin to see and use this understanding it opens up opportunities for them to direct their own improvements to their sketching.

Once students have a way of making sense of their sketching they can start to think about it, seeing their own sketching as something worthy of consideration. They can begin to look with a critical eye. Considering ‘what’ and ‘how’ they are sketching, it takes only a small step to work out what might be done to complement their sketching. Having got this far they are likely to take the next step of setting about making improvements and I have seen this willingness to improve many times in the design studio. For instance a student might make a sketch which is more meaningful or expressive than their others. Having a hunch it is better, they put it forward for others to see. You see their faces light up when another student picks up on that sketch, reading what it was the student had initially intended. You sense their confidence grow out from that sketch and, on the strength of the responses from others, they intentionally keep sketching in this way. Students appear to value learning from each other and in this case happening between students, the teacher has only, if nobody else has done so, to pick up on and support her new way of sketching.

When students can make sense of their own sketching, and have a language by which to express their understanding. They also have a way to make sense of other people’s sketching and their increasing confidence gives them courage to comment on and in so doing test out things they may have tried previously only on themselves. Students, when secure in their own sketching appear far more able to
comment on the sketching of others and, once they do, it is likely others will comment on their sketching and so the studio comes to life. One student succinctly refers to the relationship between the studio and helping each other:

Encourage the studio culture → students help each other. (WSS participant 2006)

Studio exchanges suggest it is often easier to see another's problem than one's own and students having trouble making sense of their own sketching, often appear to more easily make sense of others and could use the framework and its different ways of sketching to do so. In recognizing this ability, the teacher's task becomes one of turning her ability to see the sketching of others around, so as to see her own more clearly and once she can make sense of her own sketching and make sense of others there are many opportunities to practise benefiting her own sketching, her fellow students', the design group and so on across the studio.

Making sense of a person's sketching is closely associated with 'seeing' or 'understanding' sketching and as explained in the synergies, seeing and understanding are terms which in this context are interchangeable. Understanding a person's sketching involves not only seeing what is expressed in the line work but also what lies below the surface, and this study has revealed that within a particular sketch there are different things to the fore, different things in the background, associated understandings, intended purposes and meanings underlying the surface of students' sketching. In Chapter 2 we spoke about students having difficulties in the studio because teaching and learning predominantly focused on issues relating to the design itself, tangible issues relating to what could be seen on the surface of students' sketching and in so doing shed little light on how students were using their sketching to progress their designing. When students were left to work by themselves some had little understanding as to how to use their sketching and their designing stalled. One student explained:

I didn't know how to make it better, in what ways to improve it even though my tutor had already given me advice. (EH Evaluation of Designing, Design Practice 3A 2003)

The framework makes it easier to see below the surface of sketching by providing a terminology for describing sketching. Describing and discussing their sketching, students can bring it into student / teacher exchanges as a focus of discussion, balancing the typical and prevalent focus on design schemes. One student when asked what was helpful about the teaching of a studio focused on sketching explains:
Showing HOW to draw, but also WHY we use certain drawing was really, really, really
helpful in my learning of the design process. (Anon B, student feedback, Design Practice
2B, 2003)

Just as it is difficult for students to see below the surface it is also difficult for teachers. It takes time,
effort and a willingness to take a close and deeper look into students’ sketching. As in the analysis, to
get below the surface to see how students are sketching requires looking, not at an individual sketch or
what was expressed in the line work, but rather seeing each sketch in relation to another and in turn
another, up until the point where you can see what it was the student was intending. Being pressed for
time, often having only final drawings available and too many students demanding of teachers’
attentions, all compound to make this difficult. This is where the framework could be of help, offering
identifiable reference points upon which teachers might base a particular response to how their students
are sketching.

A wider issue relating to reading below the surface is that in order to do so it requires a teacher to place
what a student is doing at the centre of their attention. What a student is doing is designing and their
means of designing is sketching, so they need to place the student's design sketching at the centre of
their attention. Two points here, firstly it needs to be the students’ as distinct from the teachers’
sketching and secondly it needs to be their sketching, that is the verb, the act or the doing, not the
sketches themselves or indeed the scheme depicted in the sketches. This sounds deceptively easy but
again and again I have come upon teachers unable to do so. Their architectural training has led them to
consider the design response as the central focus of their teaching and the design of the buildings of
more concern than the people doing the designing. Consequently they see the attention of the design
studio as needing to be directed towards the design teacher, because they are the ones who know
about buildings and designing. One student reflects on the difficulty this attitude caused him:

    I think I followed my tutor too much last semester, lost my own creativities, sometimes I
    just need to ask the tutor 'why you like my scheme' or 'why not'. (Anon participant WSS
    2006)

The descriptive framework in presenting different ways of sketching, has the potential to open the eyes
of teachers as to the importance of how students use their sketching. If teachers were to make this a
focus, it would significantly shift teachers’ attentions away from the design scheme and towards the
ways in which students progress their designing. Teachers might benefit by seeing that there are
different ways of teaching in the studio just as there are different ways of sketching and a study similar
to this one, looking into different ways of teaching architectural design in the studio, could be of assistance.

We have mentioned a number of times the desirability of students being able to identify for themselves ways they might improve their sketching, and this is where the descriptive framework could have significant impact, helping to build students' confidence in their sketching. They can do it at their own pace and in their own way, ways which are meaningful to them, and gain confidence through the process, confidence far more substantial than what might be gained by following directions from a teacher. One student reflecting on her own improvement and developing confidence, pulls together a number of the points being made.

Getting my work out, was the biggest lesson. In the past, I have hesitated with doing drawings and making models because I felt they were wrong. For this reason my ideas stayed in my head and I tried to work them out internally. I have realized that I have to get things out so I can then improve them. I have also realized that if I do this I can then receive feedback from my peers / tutors / consultants. In this way I can develop my work to become richer and more resolved. My confidence has improved. (Anon participant WSS 2006)

Providing a language perhaps lies at the core of what an understanding of sketching as expressed in the framework has to offer the studio. Simple terms such as 'noting', 'understanding', 'making a path', etc name quite particular aspects of sketching, which without a name would be hard to identify, difficult to refer to and not easy to understand. Naming gives each part of the framework a presence and in so doing it becomes something students can be aware of, talk with others about and direct their improving and their learning towards. Once students can make sense of their own sketching and make sense of other's and they have a language to speak about it, it is likely they will want to talk to others about their sketching in relation to their designing. A series of students explain how they value being able to talk with their peers, each one for a slightly different reasons, but it is the value they give to it which is significant. One student speaks of how helpful it is to:

Talk through schemes of peers and my own with peers to see different ways of approaching problems with designing. (Anon participant WSS 2007)

Another comments:

The other thing I feel so strongly is the help through other students and the feedback to other students really helps your scheme develop. (Anon participant WSS 2006)
Another explained that group discussions:

*Allowed (her) to develop analytical skills, much more easily learned on other peoples schemes and can then be applied to how to move on your own scheme.* (Anon participant WSS 2007)

Another makes the point that comments from fellow students in the studio are particularly useful because they too are designing:

*The feedback from each student really helps because each one of them works with me and knows of the work I have done during the whole day.* (Anon participant WSS 2006)

With exchange taking such an important role in design teaching and learning, it is interesting to consider how exchanges between students and teachers might be conducted and what they might concern if sketching was an explicit focus of the studio. On one level we might expect sketching to be talked about in a manner which takes into account both what and how students are sketching. Talk could be about sketching as a means to progress designing, for instance, discussions might reveal how a student might use their sketching to develop a plan from a diagram or a particular room from a corner of a plan. They could also talk about a design scheme in terms of what is sketched, for example asking what is this sketch telling us about a design, what do we notice in this sketch about the section or the entry? In asking of the sketch, at times it may make suggestions in return. One student speaks of her learning:

*I also learnt that through drawings and models that 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 I may or may not have intended...* (Anon participant WSS 2007)

So it is not just a matter of talking about sketching as an end in itself, for as our analysis findings show, with a more complete understanding of sketching, sketching becomes integral with and indeed sustains designing. It becomes then, a matter of talking about, seeing and understanding sketching as an integral part of and a means to sustain designing, and because in the studio, learning takes place through doing, learning to ‘do’ designing involves learning to ‘do’ sketching.

Instead of talking about sketching there is the possibility to sketch about sketching and this could involve teachers sketching alongside students at their boards, putting their words to the side and centreing on what is drawn. This means students could be progressing their designing then and there. For the teacher, it means they have the opportunity to see first hand how students are using their sketching to progress their designing and once they can see this they can direct their teaching towards what could be
improved in order to complement the students’ sketching. Working with the students at their boards places the students and their sketching at the centre of the learning exchange. A student makes the comment that when:

_The tutor walks around the table and talks to me over my drawings, my models, in a much better way (i.e. I understand her much more), compared to normal individual tutor consultations._ (Anon participant WSS 2006)

Looking closely at the students’ sketches, the teacher could direct their comments and questions towards what the sketches say of the scheme and leave what students have to say about their schemes off to the side. In preference to talking about the students’ design, the teacher could also draw with the student and in so doing the student is able to see how their teacher might sketch the student’s ideas. They would certainly do it differently but I know students appreciate seeing how others sketch through their ideas. One student spoke of one such experience I shared with her:

_SR helps me to learn about the process of design: invaluable. She is good at explaining things graphically, which prompts me to draw more, which I think is good. She helps draw out my key elements and clarify them so that I can progress in my work with a more solid understanding._ (Anon, S2 2nd Year Design Evaluation 2003)

By teachers consciously sketching alongside students, watching what students sketch and how they sketch, by looking closely to see below the surface of students’ sketching, by considering students’ designs as they are expressed in their sketching and by centering on how students are using their sketching to progress their designing, the studio could change. Change which makes possible the sort of learning Stephen is referring to:

_This studio has seen me realize more about the way that I design and the points about this method that can be improved in order to be a better designer and start to think through my drawings and draw through my thinking._ (SG, S2 2nd Year Design Evaluation 2002)

So with a means to see, to make sense of, to complement and to discuss the different ways students are sketching provided by the framework, sketching could become an explicit focus of teaching and learning in the design studio. From the strength of students’ comments arising out of the WSS studios centred around sketching, it would seem that such a change in focus is likely to help students to develop their sketching to become an integral part of their designing and fundamental to their thinking in an architectural way.
In contrast to previous semesters, I found that throughout the design process this semester I was, instead of writing down my ideas and communicating with words, I learnt to draw my ideas. It is fascinating to watch a single lined diagram transform into an almost indistinguishable scribble once several ideas get applied in pencil to the diagram. It was a far more effective and efficient method of working through an idea. I found that previously I would attempt to explain a concept and get lost in myself when exploring new avenues within that concept. When you have it in front of you, you can't get lost! (JG, S2 2nd Year Design Evaluation 2004)

In relation to the brief and wider research

To bring this thesis towards a close we can take a step back from the findings, to look at how the investigation as a whole has met the terms of its brief and stepping back further again, look briefly at the possibilities for wider research which this investigation could seed.

One of the principal aims was for the findings of this research to be useful in the design studio and this intention played a significant role in the design of the research and in the form and expression of the findings. The findings serve a range of uses for both students and teachers, uses which have been expanded on at length in this chapter, and guiding these uses is that they are directed towards helping sketching become an explicit focus of teaching and learning in the design studio. As called for by the brief, the understanding expressed in the framework has grown directly out of students' sketching. The analysis placed students' sketching at its centre and this sketching arose out of the students' normal designing. Taking into account what students had to say about their sketching as well as the sketching itself, helped found the analysis on as faithful a reading of the students' sketching as I could make, bearing in mind there is always interpretation involved when a person reads the sketching of another.

The data gathering and analysis phase of the research came as close as this researcher knows how to seeing sketching through the eyes of students; watching what students do, observing what they sketch and what makes them sketch, asking them what their experiences of sketching are like and analysing what sketching is for them. With the brief calling for the research to make explicit the variation in students' sketching and to describe the features of this variation, the analysis revealed there to be collective differences in what students were sketching and how students were sketching and these
differences were described in terms of their features, their differences and the relationships and hierarchies present. Bringing together what students were sketching and how they were sketching through consideration of the interactions between the two, gave rise to three qualitatively different ways of sketching, ways which were given visual representation in the form of a descriptive framework.

The descriptive framework 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 allows students' to learn about sketching so as it becomes an integral part of their designing and a fundamental aspect of their emerging architectural disposition.

This partnership between architecture and phenomenography has been a productive one. Could it also be productive in helping understand other issues related to sketching or to the broader setting of learning about designing in the studio?

In terms of issues which relate to sketching, this research has not addressed the issue as to whether certain sketching relates to better design outcomes but it would be useful to know if this were the case. While experience suggests that it might, the research approach would need to find ways to establish what was a better or good design outcome, something which I know to be problematic in design studio assessment. Could a phenomenographic viewpoint deal with this by way of establishing an hierarchical understanding of different design outcomes? Extending this another step, could this same viewpoint help identify different ways of designing? The close association between designing, sketching and thinking, suggests that this might run a course parallel to this investigation, with emphasis given to the act of designing as distinct from the outcomes of designing. If different ways of designing are identified, might there be a relationship between the ways students are designing and the quality of their design outcome? This would be particularly useful for students because it is clear from the design studio that certain students repeatedly produce designs of a high quality.

A factor impacting on students learning about sketching or designing in the studio is the different ways architect teachers teach. It would seem likely that how teachers teach relates to what they think sketching or designing are. Finding the variation in teacher’s understandings of sketching or designing and seeing the relationship between their understandings and their teaching would help students appreciate the differences between teachers. The phenomenographic viewpoint could be the basis for a
number of investigations into concerns relating to the teaching and learning design studio, concerns for which we have had neither a means to make sense of nor a language to articulate.

In relation to the findings of this investigation into students' sketching, the question arises as to whether additional palettes within the framework, perhaps a way of sketching not attainable by students, would be found by extending the sample to include practitioners and eminent architects, or alternatively might these architects sketch in ways so different that the framework concept itself is no longer appropriate?

As sketching offers us a window into a person's understanding, a view quite different to one gained through words, it seems that sketching could be featured far more frequently in research, not as an end in itself but as a way into understanding notions, ideas and feelings which struggle to be given expression in words. Although this would involve taking sketching out of its architectural setting, it may open new opportunities for researchers previously unseen.
Epilogue

Returning to a personal voice, this body of research offers a window into the fundamental importance sketching has for architects. Acknowledging difficulties in the studio and finding need to improve students’ learning about sketching, we have analysed what and how students’ sketch, given rise to an understanding of different ways students go about their sketching and in expressing this understanding as a visual framework, it is intended that the findings of this investigation are accessible and useful to students and teachers in their efforts to improve their learning and teaching about sketching in the design studio.

It has been research closely related to and extending both by way of its findings and by what I have learnt as a researcher, what I do as a teacher and as an architect. The study has moved a long way from its beginnings and so too has this researcher since the earliest days of my candidature. If I were to make a sketch which characterized my progress through the research, it would not be unlike the sketch I made for students who were using their sketching to discover (Figure A).

Figure A. Researching is like sketching to discover
Source: Author.
In my case the sketch depicts my researching across a field of multiple paths and serpentine ways, occurrences, direction changes, relationships, obstacles, boundaries, trajectories, way points and so on, and across all, a sense of moving forward by way of initiating the discovery of possibilities.

In discussing this sketch with my supervisor Simon Barrie, he made the point that perhaps the end point was not so critical, rather what mattered was the richness of the field discovered along the way and this has certainly been the case for me. Working across the field of this research has involved coming upon occurrences such as my sketching of the frangipani, initially understood as simply coming to see the significance of an exotic tree set against the Sydney bush, more richly understood as coming to see something in a new way. Direction changes have been taken such as the shift from studying the sketching of masterful architects to the sketching of students. Certain discoveries seemed like turning a key. I recall an animated phone call to Simon explaining that it was obvious, sketching was ‘an expression of an experience’. Parallels have built my confidence, for instance seeing my own learning as paralleling that of my design students, or how time and time again I have drawn inspiration and guidance from the close parallels between sketching and learning. Boundaries have been scribed to clarify and define, for example separating students’ understandings from my own and sketching from designing.

All of these have taken place and have been overlayed on a background of doing, a sense of working away at the research over an extended period of time; talking, meeting, explaining, asking, presenting, articulating, listening, writing and of course, drawing. What matters is not any individual instance but the rich nature of the field, a field I understand as being associated with designing and now know to be associated with researching.

This research has, to use the terms of our new understanding, been a process of discovery, of understanding and of noting and it is possibly not circumstance that these different ways of sketching, that is, ways of expressing our emerging understandings have parallels with research. Most significantly, like sketching, this research has been an opportunity to learn and to come to see things previously familiar, in a new way and this has been made possible principally by two things. Firstly, by taking the time to look with care and consideration into the sketching of students and by being open to it, their sketching told us things we didn’t know. Secondly, the unforeseen synergies between architecture, sketching, learning and phenomenography, which through the course of this research have enabled discoveries to be made not possible by each on their own.

Having come to the close of this thesis, I am finally able to grasp it as a whole. Were I asked to describe its most salient lesson, it would have to be that the close relationship between designing and
researching has given an architect's ability to see and think in terms of wholes where others might see parts, an important role, influencing the very nature of what is able to be discovered through research. I am yet to appreciate the influence researching will undoubtedly have on my practice of architecture and this I look forward to.
References


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