

7. Comparative study

The previous chapter drew on literature on creative processes from other disciplines - writing and computer programming - to propose that differences exist between individual design practitioners which are more significant than variation arising from each designer's personal style, unique experience, or working context; rather they represent wholly different approaches to design. These differences in approach can broadly be described in terms of the nature and extent of a dialogue between practitioner and medium, and encompass a number of 'dimensions of difference' visible across a number of levels of practice.

This chapter describes an investigation into whether the differences between practitioners identified in other fields could also be observed in design practice, therefore testing my thesis,

that individual practitioners experience different relationships with the artefacts they create and work with in their processes, and that elements of these differences can be attributed to the nature and extent of a dialogue between designer and media

In particular, it is concerned with whether these differences could be observed in two groups of student 3D design practitioners from Glasgow School of Art, one working with digital media (final year postgraduate students on the M.Phil. in Advanced 2D/3D Motion Graphics - Figure 48), the other working with physical media (final year undergraduate Silversmithing and Jewellery students – Figure 49).

Design of study

Aims and objectives

This comparative study had two main aims: to establish whether differences relating to the nature and extent of a dialogue between design practitioner and medium could be observed within each group; and to establish whether similar differences could be observed within both groups. If similar differences in approach were observed within these two groups of 3D practitioners, a comparison of how each type of approach manifested itself in the material and digital environments could provide additional insight into elements of this relationship, arising from the similarities and differences between

these two environments (Chapter 4, *Difference as a means of enquiry* explains these different aspects of the method in more detail).

In order to achieve these aims, the study had also fulfil two primary ‘structural’ objectives: firstly, to establish the ‘dimensions of difference’ within groups, against which each individual’s practice could be viewed; and secondly, to establish a basis of comparison between the two groups.

Subjects

The two groups of students participating were:

- 12 final (2nd) year students on the M.Phil. in Advanced 2D/3D Motion Graphics course at the Digital Design Studio, Glasgow School of Art
- 11 final (4th) year students on the B.A.(Hons.) Design in Silversmithing and Jewellery course at Glasgow School of Art

These students represent two groups of 3D practitioners suitable for this comparative approach. Although the first group work predominantly in a digital medium, and the outcome of the work is quite different, in a sense they too are ‘designer-makers’, wholly in charge of the process from initial concept to final outcome. (Comments from previous students on this course suggested that similar differences in ‘global’ strategy to those observed in my prior study of designer-makers [McLundie 1998], may also appear in their design processes.) While the practices may be different, they share similar ‘traditional’ design processes – ‘design then make’.

Both groups were undertaking one full academic year of self-directed study, allowing a comparison of processes over time. The groups are similar sizes, and in both cases, nearly the whole year group took part. As the nature of the study is concerned with looking for dimensions of difference within groups, the small size of the groups was an advantage: I would have been reluctant to work with sample groups, as no basis for sampling had been determined at that stage.

Method

The design of the study incorporates all three principles that underpin the means of investigation used in this thesis: the comparative framework; the comparison of the individual against the collective (*difference*); and added insight from comparing phenomena which are similar-but-different (*distance*). These are reflected in the design

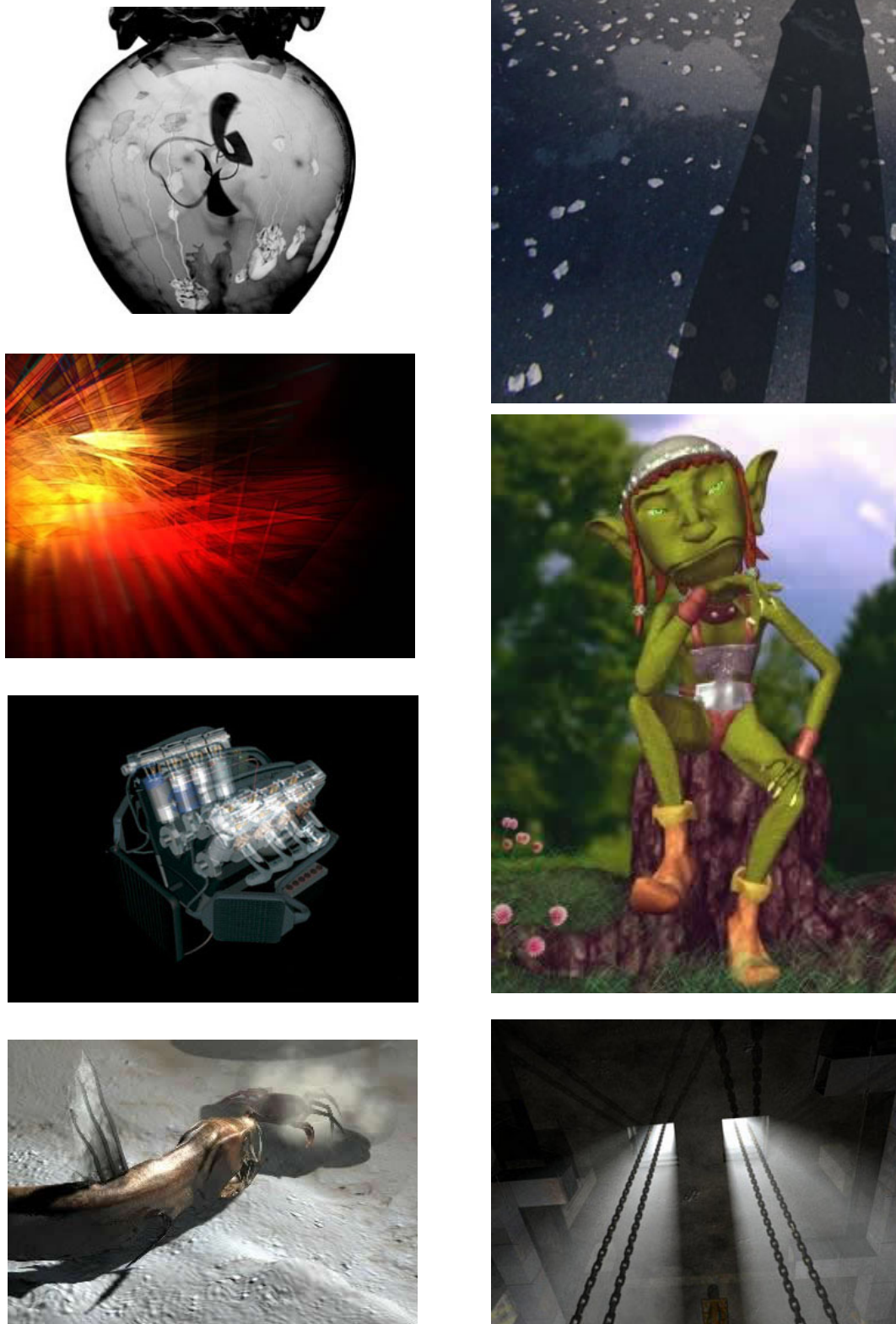


Figure 48: Still shots from a selection of the animations from the M.Phil. Degree Show



Figure 49: Selection of pieces from the Silversmithing and Jewellery Degree Show

of the data collection and analysis, where data from the individual designers in each group is compared and contrasted to build the collective picture against which individual differences can be observed; and in the choice of subjects: two groups of students in 3D practice, one working with digital media, the other working with physical media.

A study of 3D practitioners who have an established material practice and a substantial body of work in digital practice (see Chapter 8, *Practitioner interviews*) confirmed that this comparative approach is both useful and valid: while aspects of their practice may have changed in the move from the material to the digital medium, their underlying approach has remained the same, and forms the foundation for their digital practice.

Two different stages and contrasting modes of analysis were used in this study. First, a comparative framework was derived from a systematic analysis of the literature discussed in the previous chapter, which describes differences in individual approach in terms of the nature and extent of a dialogue between practitioner and medium. This analysis proposed the formal/concrete axis as an organising principle for differences in approach across a number of levels of practice. In a preliminary analysis, each individual's approach was categorised using this comparative framework, and an assessment made of the distribution of approaches within each group.

The second stage of the study involved both an examination of the collective variation within each group across a number of 'dimensions of difference' which emerged from the data, and a comparison of these dimensions between groups. (The term 'dimensions of difference' refers to distinct observable differences in aspects of practice; taken together these may indicate more fundamental underlying variation between individuals.) The process of identifying these emergent dimensions partly referred back to the framework used in the preliminary analysis, but did not assume that the relationships between these dimensions would follow the inherently 'two-dimensional' structure of this original model. It also allowed for the possibility that other dimensions might emerge.

Comparative framework

In order to develop a comparative framework, it was necessary to undertake a detailed examination of a number of publications which, although they describe various characteristics of individual differences in approach, do not list them in detail and explicitly. The review focused on publications discussed in Chapter 6, (particularly those by Turkle & Papert and Chandler); but also included [Levi-Strauss 1966] and

[Ackermann & Strohecker 2001] as they describe similar differences in approach (and are discussed elsewhere in this thesis). The examination was undertaken to elicit the distinct features of each approach, both the main dimensions of difference already discussed and the more subtle variations observable across different levels and aspects of practice.

This systematic analysis of the literature suggested the formal/concrete axis as an organising principle for differences in approach across a number of levels of practice, and identified a set of around thirty 'indicators' representing those aspects of a practitioner's process that can be examined to determine the nature and extent of the dialogue they experience with the medium (see Table 6). Together, these form a comparative framework which can be used to collectively determine whether a practitioner's overall approach is categorised as 'hard', 'soft' (to use Turkle & Papert's terminology) or somewhere in between.

In this framework, the 'hard' or formal approach is characterised by control and conscious purpose. It has a focus on explicit goals, and the form of the work is predetermined through planning and working with representations. The medium is viewed as a means to an end, and is used as a tool to express an intent. Materials are chosen to suit the overall purpose, and viewed for their formal properties. Risk is minimised, and mistakes viewed as problems. The relationship with objects is objective, formal and distanced, with an approach to thinking characterised by analysis, abstraction and reasoning in terms of rules.

The 'soft' situated, relational approach is characterised by negotiation and a willingness to 'forget yourself' and be open to experience. A tacit aim allows the form of the work to emerge through engagement with the medium. The medium is viewed as interlocutor, with unexpected events viewed as part of the process of negotiation. The practitioner works with the materials to hand, which are viewed for their concrete or tangible properties. The relationship with objects is subjective, concrete and situated, with a contextual approach to thinking characterised by transparency and a mastery of details, learning through interaction, and concrete, bodily and intuitive forms of reasoning.

Although the framework is presented in terms of these two distinct and contrasting approaches, it is recognised that these approaches, and each of the thirty or so dimensions across which they differ, represent two ends of a spectrum. Individual practitioners may appear at one end of the spectrum, or somewhere in between, as is reflected in the design

Indicators	'hard', distanced	'soft', situated
Orientation		
1. goals (how do you know when you've got what you want)	explicit goal	tacit aim
2. direction in work	conscious purpose	open to experience
3. process and product	emphasis on product	equal or greater emphasis on process
4. form and content	separate	developed together
5. constraints, limitations	working to go beyond constraints, freedom of choice	working within constraints, choosing to work within constraints
6. understanding, mastery through...	analysis & abstraction	mastery of detail
7. by...	break down, decompose, analyse	reorganise, rearrange
8. relationship to context	abstract, formal, remote	situated, contextual
Medium		
9. ends and means, 'medium and message'	medium is means to an end, means separate from end	ends become means and vice versa, means becoming end, ends developed through means
10. what is the role of the medium - tool or medium?	expressing, communicating ideas using medium, monologue	developing ideas through dialogue with medium, medium as interlocutor
11. how do you relate to the medium?	acting upon the medium	engaging with the medium, being acted upon
Process		
	control / distanced	negotiation / situated
12. outcome - when you decide this	pre-planned, predetermined goals	unforeseen consequences, discovery, goals emerge through work
13. how is this accomplished, how does this exhibit (process)	planned in advance, premeditated?	collaborative venture with medium, through dialogue with the materials and means of execution, repertoire
14. decisions	pre-planned e.g. through abstractions	keeping options open
Work/outcome/form		
15. organisation, form, structure	imposed, predefined, (premeditated, as in thought about before?)	emergent, arranging, rearranging, playing with ideas, sculpting
16. achieved by	e.g. hierarchy, abstraction	finding 'pattern', 'rhythm', 'form'
17. level of engagement	abstract, with representations, models, metaphorical	working with the medium, literal
18. relationship to details, material	opacity, distancing from details	transparency, keeping in touch with the details
19. dealing with complexity	abstraction e.g. decomposition, design-by-drawing	growing incrementally
20. choice of materials	brought in as required by 'project'	working with what's there, well-known materials, chosen previously, heterogeneous repertoire - not specific to project, brought in as need arises
21. implications of this...		speak through the medium of things
22. use of materials	used for predetermined purpose	used in 'devious' ways, 'truth to materials'?
Attitude to Events		
23. attitude to unexpected effects, surprise, risk	control	"springboards for how to proceed"
24. attitude to mistakes, problems	misstep, to be corrected	essential part of process of negotiation
Ways of relating to materials, objects		
	distal (distanced)	proximal (close)
25. type of relationship	distant, objective	intimate, 'connecting' with them, subjective
26. boundaries	distancing yourself	immersing yourself, placing yourself psychologically in their 'space', 'down in there'
27. awareness	selfconscious, conscious purpose	unselfconscious, forgetting yourself, 'hear what the material has to say'
28. experience, bodily participation	objects as formal, abstract?	experiencing objects as tangible, sensual and concrete
Ways of seeing objects		
	formal	concrete
29. attributes	formal properties ('what they are for')	concrete or tangible properties ('what they can do')
30. physicality	as embodying abstract concepts (e.g. sprite – computational object with variables)	as material objects, esp. non-material objects (e.g. sprite – object attributed 'physical' properties – can cover one with another)
31. relationship to context	abstract, in terms of properties, rules	situated, in terms of relationships, with each other
32. transparency	working with concepts, abstract properties, transparent e.g. words being used to express an idea	working with signs, resonances, material e.g. words as textual objects
Ways of thinking		
33. ways of explaining things, tackling problems	in terms of rules	'reasoning from within', bodily thinking, putting yourself in the situation
34. learning about things, understanding things	analytic, dissection, wanting to know how it's supposed to work, learning before interacting with it	through its behaviour, learning through interacting with it
35. what think with	thinking with rules of logic (abstract)	thinking with objects (concrete)
36. ways of understanding	formal, abstract	sensible intuition, perception
37. internal/external	mental	bodily thinking e.g. writing as a way of thinking
	<i>mental revision</i>	<i>physical revision</i>
	<i>composition takes place 'internally' then expressed</i>	<i>writing to think, ideas come through the act of writing</i>
	<i>internalisation</i>	<i>externalisation & spatialisation</i>
Other/Emerging Themes		
38. finding a 'voice'		

Table 6: Comparative framework with 'ideal types' and indicators derived from literature

of the Analysis Sheet (Figure 50), and the results of the preliminary analysis using this sheet (Table 7).

Design of data collection and analysis

Interviews were chosen as the method of data collection because the aspects of practice with which I am concerned involve people's experiences, opinions, and emotions, as well as accounts of their own process. The artefacts they create and work with are integral to this process, but cannot represent the whole process; an approach which uses an analysis of artefacts to gain insight into each individual's approach was unsuitable in this case.

To provide the basis of comparison required between individuals, and within and between groups, an Analysis Sheet was developed from the comparative framework (see Figure 50). A range of choices – strongly 'hard', hard, neutral, soft, or strongly 'soft' - was provided against each indicator. Each subject's interview responses were to be retrospectively categorised and recorded using this sheet from tape (a null response would indicate that no information against that indicator was forthcoming from the interview). A sheet would be completed for each individual, representing their individual 'profile' against the set of indicators. By comparing the completed sheets, it would be possible to compare approaches between individuals and between groups.

Semi-structured interviews were used, to allow questions to be adjusted to suit the different contexts within which they were being asked, or where an interviewee interpreted a question differently than I had intended. The interview schedules were designed in conjunction with the Analysis Sheet to elicit responses that would give insight into each individual's approach. The questions were broadly similar for each of the three interviews, adjusted in response to a review of the outcomes of the previous set of interviews. Copies of the interview schedules are given in Appendix I.

Three sets of interviews were held, once per term (December, March and June), to allow an examination of the development of the students' work and their creative processes over time: this was the first opportunity both groups had had for a full year of self-directed study; it was likely that their working practices as individuals would mature over the year, as previous projects had been of a few weeks duration, and to a brief. (While a number of M.Phil. students had previous established processes and practices in other areas of art and design, this was their first experience of producing a digital animation of this length.)

Each interview lasted between 30-45 minutes, and students were asked, where possible, to bring examples of the artefacts they were producing, for discussion. Photographs of

Interview no.		Group: M.Phil / S&J			Date:		
Tapes used:							
Questions: (start) (end)							
Indicators	'hard', distanced	strong	neutral	strong	'soft', situated	tape ref	quote
Orientation							
1. goals (how do you know when you've got what you want)	explicit goal				tacit aim		
2. direction in work	conscious purpose				open to experience		
3. process and product	emphasis on product				equal or greater emphasis on process		
4. form and content	separate				developed together		
5. constraints, limitations	working to go beyond constraints, freedom of choice				working within constraints, choosing to work within constraints		
6. understanding, mastery through...	analysis & abstraction				mastery of detail		
7. by...	break down, decompose, analyse				reorganise, rearrange		
8. relationship to context	abstract, formal, remote				situated, contextual		
Medium							
9. ends and means, 'medium and message'	medium is means to an end, means separate from end				ends become means and vice versa, means becoming end, ends developed through means		
10. what is the role of the medium - tool or medium?	expressing, communicating ideas using medium, monologue				developing ideas through dialogue with medium, medium as interlocutor		
11. how do you relate to the medium?	acting upon the medium				engaging with the medium, being acted upon		
Process							
control / distanced				negotiation / situated			
12. outcome - when you decide this	pre-planned, predetermined goals				unforeseen consequences, discovery, goals emerge through work		
13. how is this accomplished, how does this exhibit (process)	planned in advance, premeditated?				collaborative venture with medium, through dialogue with the materials and means of execution, repertoire		
14. decisions	pre-planned e.g. through abstractions				keeping options open		
Work/outcome/form							
15. organisation, form, structure	imposed, predefined, (premeditated, as in thought about before?)				emergent, arranging, rearranging, playing with ideas, sculpting		
16. achieved by	e.g. hierarchy, abstraction				finding 'pattern', 'rhythm', 'form'		
17. level of engagement	abstract, with representations, models, metaphorical				working with the medium, literal		
18. relationship to details, material	opacity, distancing from details				transparency, keeping in touch with the details		
19. dealing with complexity	abstraction e.g. decomposition, design-by-drawing				growing incrementally		
20. choice of materials	brought in as required by 'project'				working with what's there, well-known materials, chosen previously; heterogeneous repertoire - not specific to project, brought in as need arises		
21. implications of this...					speak through the medium of things		
22. use of materials	used for predetermined purpose				used in 'devious' ways, 'truth to materials'?		
Attitude to Events							
23. attitude to unexpected effects, surprise, risk	control				"springboards for how to proceed"		
24. attitude to mistakes, problems	misstep, to be corrected				essential part of process of negotiation		
Ways of relating to materials, objects							
distal (distanced)				proximal (close)			
25. type of relationship	distant, objective				intimate, 'connecting' with them, subjective		
26. boundaries	distancing yourself				immersing yourself, placing yourself psychologically in their 'space', 'down in there'		
27. awareness	selfconscious, conscious purpose				unselfconscious, forgetting yourself, 'hear what the material has to say'		
28. experience, bodily participation	objects as formal, abstract?				experiencing objects as tangible, sensual and concrete		
Ways of seeing objects							
formal				concrete			
29. attributes	formal properties ('what they are for')				concrete or tangible properties ('what they can do')		
30. physicality	as embodying abstract concepts (e.g. sprite - computational object with variables)				as material objects, esp. non-material objects (e.g. sprite - object attributed 'physical' properties - can cover one with another)		
31. relationship to context	abstract, in terms of properties, rules				situated, in terms of relationships, with each other		
32. transparency	working with concepts, abstract properties, transparent e.g. words being used to express an idea				working with signs, resonances, material e.g. words as textual objects		
Ways of thinking							
33. ways of explaining things, tackling problems	in terms of rules				'reasoning from within', bodily thinking, putting yourself in the situation		
34. learning about things, understanding things	analytic, dissection, wanting to know how it's supposed to work, learning before interacting with it				through its behaviour, learning through interacting with it		
35. what think with	thinking with rules of logic (abstract)				thinking with objects (concrete)		
36. ways of understanding	formal, abstract				sensible intuition, perception		
37. internal/external	mental				bodily thinking e.g. writing as a way of thinking		
	<i>mental revision</i> <i>composition takes place 'internally'</i> <i>then expressed</i> <i>internalisation</i>				<i>physical revision</i> <i>writing to think, ideas come through the act of writing</i> <i>externalisation & spatialisation</i>		
Other/Emerging Themes							
38. finding a 'voice'							

Figure 50: Analysis sheet

artefacts were taken in support of the interviews, but no separate analysis of these was undertaken.

It was unlikely that data for every indicator on the Analysis Sheet would be collected for each subject. One of the strengths of this method is that even if one aspect of the framework or data collected is weaker, there will still be data from the other areas to

support the analysis. Indeed, an interviewee's silence on one aspect may be as significant as another's mention of it:

“In studying the nature of mediation, a powerful technique is the search for that which is excluded (or ‘conspicuous by its absence’), and that which is taken for granted (which goes without saying)” [Chandler 1995]

A pilot interview was carried out to test the Analysis Sheet, with an M.Phil. student from a previous year. Some small adjustments were made where the interview had clarified distinctions between categories, but otherwise the sheet appeared to work well.

Preliminary analysis

After the first set of interviews was complete, a preliminary analysis of the data was made in line with the original design: using the Analysis Sheet to code each interview directly from tape (an example of a complete Analysis Sheet is given in Appendix J).

A number of difficulties were encountered during this analysis. Some of these arose from the nature of the conceptual framework, which gives an abstracted view of individuals' processes against 'ideal types'. This abstraction is inherent from the way the framework was created: firstly, the indicators were derived from quite different fields of practice; secondly, although the indicators are specific in focus, they must be sufficiently generic in application to accommodate the different areas of practice being studied. There may not be a direct correlation between the concrete manifestation of the approaches in a particular context e.g. preplanning the form of a program using a structured approach of decomposition, hierarchy and black-boxing; and preplanning the form of an animation through storyboarding. Nevertheless, it is the act of preplanning, rather than letting the form emerge, that is of interest in this study.

Because of the abstract nature of the categories, and the richness of the data emerging from the interviews, in certain cases it was difficult to decide to which of two categories data was relevant. In other instances, it was not easy to see in which category data directly relevant to the study should fit: for example, some of the Silversmithing and Jewellery students worked with physical materials when they were designing, but they were using them as a means of manipulating 3D form, rather than working with the material to see what it would do. (This is discussed later in this chapter.)

The initial intention had been to code the interviews directly from tape, but this exacerbated the difficulties encountered. With no written data it was practically impossible, where there was any doubt about suitability of categorisation, to refer back to

decisions made earlier, or view a spectrum of approaches to make comparisons that would give insight into the categorisations.

The richness of the data generated from the interviews exposed the unspecified nature of the spectrum of responses under each category as too subjective. This, combined with the problems identified above – the abstract nature of the categories, and the inability to refer back to data – made it difficult to ensure that similar data were categorised in similar ways between subjects.

In the end, for most participants notes were made from the recording of each interview, and used to code retrospectively against the Analysis Sheet. As a consequence of these difficulties, results from this stage could only be relied upon to give an approximate indication, and an ‘abstract’ view of approach; nevertheless the results obtained were encouraging. They showed that differences, broadly along the lines of enquiry, exist within both groups and revealed a similar spread of approaches within each group (see Table 7).

	‘hard’	not definitive	‘soft’
S&J	3	5	3
M.Phil	5	2	4

Table 7: Different approaches within and between groups as revealed through preliminary analysis of the data

The category ‘not definitive’ indicates that across the range of indicators for which information was obtained for each individual, the overall profile did not clearly belong to either of the main approaches. While some difficulties in categorisation as discussed above may have exacerbated the situation, generally this phenomenon is to be expected when using the concept of ‘ideal types’:

“When we say that hard and soft approaches are ideal types, we signal that individuals will seldom conform to either exactly, and that some will be so far from both that it is impossible to assign a type. In other words our contention is not that the attributes in a cluster are exactly correlated, but that each approach has internal coherency in the way that a stable culture is coherent” [Turkle & Papert 1990]

These preliminary findings have two main implications for this study: firstly, useful comparison between groups is more likely, as similar approaches appear in both groups, i.e. one group is not heavily skewed towards one approach, and the second heavily skewed towards the other (it is particularly interesting, given that 3D modelling software might appear to favour an explicit approach, that ‘soft’ approaches appear in this

context); secondly, the broad spectrum of approaches within each group are likely to provide good ‘coverage’ of the collective picture against which individual approaches can be examined.

Despite the weaknesses in this preliminary analysis, the data emerging from the interviews indicated that there were significant differences between individuals along a number of dimensions, within both groups. For the next stage of analysis, the approach was modified to allow this information emerging from the data to inform the findings: not only to deal with the difficulties I had encountered, but as it became clear that valuable insight into the suitability of the original conceptual model could be obtained from examining where and how the data didn’t fit well within the framework.

Analysis of emergent collective variation

To maintain the principles embodied in the method, any modified approach had to enable a collective picture to be built up against which an individual’s practice could be viewed; maintain a basis of comparison between individuals, and within and between groups; and allow me not only to work around the original conceptual framework, and comment on its suitability, but also to draw on the detailed information obtained from the interviews. One of the main differences was therefore to work from transcriptions of each interview, as opposed to coding directly from tape.

This revised approach identified the main ‘dimensions of difference’ emergent from the raw interview data (still focusing on the underlying themes of the original framework, but allowing other relevant themes to emerge). Unlike the preliminary analysis, which focused on the individual, this analysis examined the collective variation within each group, by inspecting the variation of each dimension across individuals within the group. This was established primarily from the first set of interview transcriptions, with additional input from the later sets.

Although the revised approach was different to that originally envisaged, it is valid within a phenomenographic context:

“All of the material that has been collected forms a pool of meaning. It contains all that the researcher can hope to find, and the researcher’s task is simply to find it. This is achieved by applying the principle of focusing on one aspect of the object and seeking its dimension of variation while holding other aspects frozen. The pool contains two sorts of material: that pertaining to individuals and that pertaining to the collective. It is the same stuff, of course, but it can be viewed from two different perspectives to provide different contexts for isolated statements and expressions relevant to aspects of the objects of research...”

One particular aspect of the phenomenon can be selected and inspected across all the subjects, and then another aspect, that to be followed, maybe, by the study of whole interviews to see where these two aspects lie in the pool relative to the other aspects and the background... This process repeated will lead to vaguely spied structure through and across the data that our researcher/learner can develop, sharpen and return to again and again from first one perspective and then another until there is clarity" [Marton & Booth 1997]

The next section of the chapter deals with the first of these aspects: the collective variation observed within the two groups.

Dimensions of difference: digital media

Context of study

The M.Phil. in Advanced 2D/3D Motion Graphics is a two year masters course run by the Digital Design Studio at Glasgow School of Art. It takes graduates from a diverse range of backgrounds: past examples have included astrophysics, psychology, literature, product design engineering, mechanical engineering, fine art photography, sculpture and theatre design. In first year, students learn 3D modelling and animation techniques, including lighting and sound. In the second year, the students work on an Individual Programme of Study (IPS), a self-directed research project relating in some way to their first degree. The outcome of this IPS is a short animation, around 3-5 minutes long, and a dissertation. The group participating in this research comprised twelve second-year students working on their IPS.

The course follows standard practice in the animation industry. After the research and conceptual stage, a storyboard is produced: a 2D sequence of 'shots' which forms the basis for subsequent 3D modelling, lighting and texturing, animation, rendering and compositing. In industry, these stages are usually carried out by different people working on the one animation, and the storyboard forms a common point of reference for what will happen, and how long the action will take. It is a planning tool, both in terms of the form of the work, and as a basis for scheduling what needs to be done.

On the M.Phil. course each student does everything, from concept work to final piece of animation, and there is much more scope for individual approaches to emerge. It is within this context of individual practice that my research is based, and where clear differences in approach could be observed within the group. These differences exist across a range of different dimensions, the most significant of which are described below.

Planned or emergent approach?

One of the most striking variations in the group was the role of the storyboard in their process, relating to a preference for a planned approach, where the form of the work is predefined before beginning work in the digital medium, or an emergent approach, where decisions are made as the work progresses.

Producing a storyboard before starting any modelling is recommended practice, and for some students it played a crucial role in their process:

“I’ll work on the storyboard, work out exactly what I want to include, and that allows you to judge your time limits within the piece as well, 20 seconds for this shot here, 30 seconds for the next shot...”⁹

The student above produced a visually very detailed storyboard. Some storyboards were less detailed or more ‘schematic’ – “...not a storyboard in terms of how you see it, necessarily... it’s a sequential storyboard rather than by shot or perspective...”¹⁰ - but still a tool used to plan and guide what would happen. Others found that producing a storyboard didn’t suit their way of working:

“I have noticed other people turning up upstairs with these beautifully drawn storyboards, and I still have lots of pieces of paper with lists on it, and boxes of things... I prefer that, I think it’s more flexible... I find it incredibly hard to work to a storyboard, I don’t like it, I think it’s too restrictive, it really doesn’t support the way that I work at all... I prefer leave it more open to interpretation, so I can take that and change it. And I think things have to change.”¹¹

One student didn’t produce any storyboard, as her abstract piece of work was developed through exploring the effects that could be achieved with the medium:

“...there’s so little structure to the way I work... I know the basics of what’s going to be in it but I can’t do a storyboard because the program is so large and you find new effects all the time, you’re like, ‘oh I’ll do this and I’ll do that’, and that’s my approach”¹²

In my original conceptual framework, I had equated an emergent approach with a ‘dialogue with materials’, but it has become apparent that this is not an adequate distinction. In this group, two forms of emergent approach appear: one where, although decisions are made as the work progresses, it is more a ‘monologue’, a dialogue with yourself about a conceptual idea; and one which can indeed be viewed as a dialogue with the digital medium.

⁹ Digital student 2, interview 1

¹⁰ Digital student 6, interview 1

¹¹ Digital student 5, interview 1

¹² Digital student 7, interview 1

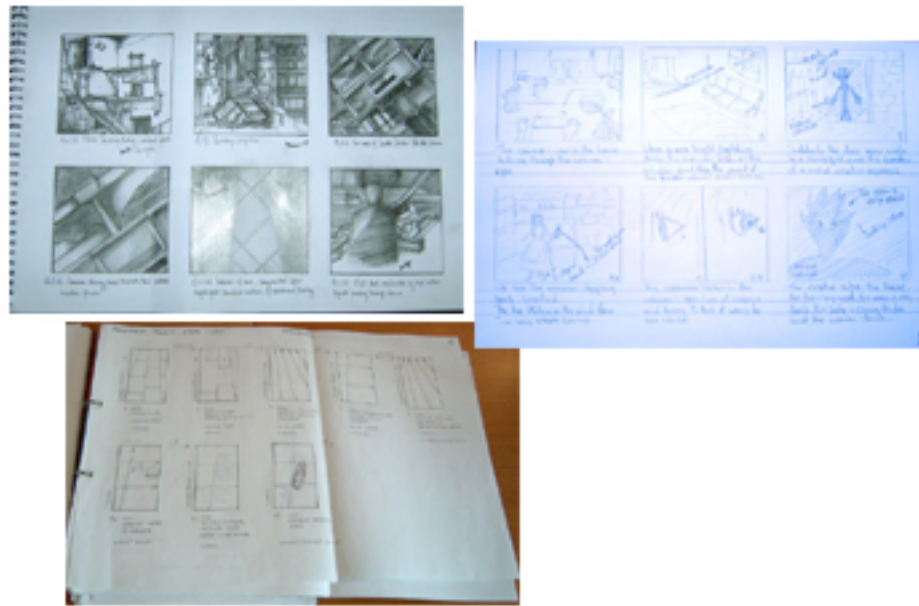


Figure 51: Examples of storyboards

Role of the medium

This distinction between emergent approaches relates to the ways in which the students viewed the role of the digital. Broadly it can be described as a preference for ‘speaking with things’ or ‘speaking through things’. At a conceptual level, there are those who view the medium very much as a means to an end:

“I see it as a tool like anything else. The way I look at a pencil and a bit of paper, they're just tools to produce something that's in my head, and I see the computer as the same”¹³

and those for whom the means become the end:

“...rather than using the editing and compositing as a means to an end, to follow a story, I want the compositing and the editing to actually become the end in itself, and through playing around with that, you've got a whole plethora of interpretive possibilities.”¹⁴

A similar distinction concerns the choice of materials: whether the materials are chosen to suit the design, or whether the design emerges from what materials are available. In the digital case, the medium would seem to a large extent to be predefined, being the software. But variation can be observed in the working processes of this group, for example in individuals’ attitudes to the compositing stage of the work. After modelling (building) objects and animating them (giving them movement) within the scene, the

¹³ Digital student 10, interview 2

¹⁴ Digital student 6, interview 2

rendering process produces sequences of 2D still images with full colour, texturing, lighting as created. The compositing and editing stages of the process allow you to combine these sequences of still images with other 2D images and sound, and manipulate them in various ways, to form the final animated sequence. The role of this stage varied between students:

“...some people have very fixed ideas of what it is that they want to do, and where they want to go, and they know exactly what shots they're gonna use... for them the editing process will be just putting them all together. Whereas I'm interested in the different interpretations you can get through how they're put together... I'm using Maya strictly as a tool, in order to build the elements that I need... Because I am very much more interested in the editing/composing side of it”¹⁵

Comparing this comment with the next underlines the difference between ‘emergent’ approaches. Although in each case the student is playing with the materials at hand to see what effects can be achieved, the above project involves ideas and concepts, a ‘dialogue through the medium’, while the next student is indeed having a ‘dialogue with the medium’:

“I don't really have a clear idea of a storyboard, I just go and make it... I haven't thought, right, I need to build a room so I need to know this tool, this tool, this tool, I've just went in and thought, right, what can I play with, and what can I produce. And then through each render, each result, I'll assess what else I want to do after that.”¹⁶

In the ‘soft’ approach embodied in the framework, where the choice of materials ‘determines’ the design, the systematic analysis of the literature suggested that this may take various forms: selecting from an existing and project-independent ‘repertoire’; ‘gathering’ materials together, from which the work then emerges; or ‘working with what’s there’. Elements of the latter two can be seen in the above ‘emergent’ examples, and ‘gathering’ in the next, in which a student describes how elements of his approach have transferred from the material to the digital environment:

“...I suppose it's the philosophy, the way of thinking that it carries on rather than the actual found things... you can't walk about looking for bits of animation and pick them up and roll them into a new animation, but definitely the way I approach things is to research-wise get all the things I think I need, and then sit down and just get on with it, and put all the bits together, and if it doesn't work like that then take it apart and put it back together another way. That way of doing things definitely carries on.”¹⁷

¹⁵ Digital student 6, interview 2

¹⁶ Digital student 7, interview 2

¹⁷ Digital student 3, interview 1

Control and risk

Another dimension of variation is apparent from examining students' attitudes to unexpected events in their work, or the inevitable problems which they encounter in their processes. Although these are different cases (the former open up choice, the latter reduce it) and were examined separately in the study, they broadly relate to a preference for control, or a willingness to be open to 'surprises', or take a different direction in their work. Differences encompassed both the ways in which the students react to things when they occur, and also what 'preventative measures', if any, they take.

One dimension of variation in this context is how much students are willing to do to try and get round the problems they encounter. Some students liked, as far as possible, to have their work as they had intended it to be:

*"If I've got something in my head that I want to get down then I'll keep chipping away until I get it... And I don't scrimp, or take short cuts or just miss things out, because I can't do it... if I can't do something, I'll sit and figure out how to do it"*¹⁸

Some were content to solve the problem if they could, but if not, to take a slightly different direction in the work. For others, while planning their work was important, they were open to changing their work in response to unexpected events if the outcome was better.

Another dimension is the measures, if any, students took to ensure that unexpected events or problems did not arise in the first place. These ranged from consulting with tutors before starting to ensure what they wanted to do was possible, and the optimum way of achieving it; to trying to "foresee as many technical shortcomings" by learning to use the tools that they anticipated they were going to need, "So I know quite quickly if I can do it that way and if I can't then I'll find another way to do it".¹⁹

Others were happy to play and experiment with the tools while they were producing the work to see what effects they could get. For one student, unexpected events formed the whole basis of her work:

*"somebody'll introduce you to a tool, and you'll start playing about with it... to get certain effects, and you'll think, 'oh, that looks pretty good', and then you'll combine it with another tool and then everything just starts going"*²⁰

¹⁸ Digital student 10, interview 3

¹⁹ Digital student 10, interview 2

²⁰ Digital student 7, interview 1

Ways of relating to objects

Other differences reveal aspects of a student's preference for a close or distant relationship with the objects they work with. Unlike the differences in approach already described, some of these differences become explicit only when they become apparent to the student: for example when they experience difficulties with the software, or express preferences for using one technique over another. The opposite viewpoint is rarely expressed by the interviewees, but can be inferred from the lack of explicit reference, and revealed by examining the collective variation across the group.

The following example illustrates one student's approach to learning the software. In their second, self-directed year of independent study, a predominant way that students do this is by reading manuals, running software tutorials, buying specialist books, or getting help from the Internet or one another. However some prefer to work much more directly with the software, learning through interacting with it to see what it will do (as distinct from experimenting with the software to test their understanding of theoretical principles):

*"I should actually sit down with tutorials and the books, and say right, how does this tool, this manipulator or this modelling thing, how does it like to be treated, how does it like to be used, why does it do that when I press this? But I tend to just jump in there and go, well I want this shape, I'll pull that and see if that works, it's a bit more trial and error... I don't really understand how it works, I just know that it works so, I use it because trial and error's got me there."*²¹

These different approaches are in line with those identified by Turkle & Papert: 'learning by interaction' and 'learning through understanding'. The above example also illustrates both a distinction in the ways which the students 'saw' things – formally, as 'what they are for', or concretely, as 'what they can do'; and a subjective, as opposed to objective, relationship with the software.

Some students were driven by a conscious purpose in realising their work: "Same way as drawing, if you put a line on a bit of paper then you should really have a reason why it's there. And if you don't then it shouldn't be there."²² Others were more willing to forget themselves, and become immersed in the work:

"I always try and get really involved in a project, in terms of it becomes something I'm thinking about a lot of the time. And what I like about that is you're not being too careful about where it's going or how you're going to do it, you just get lost in it... every now and then something turns out really well, and totally unexpected from how

²¹ Digital student 3, interview 1

²² Digital student 10, interview 2

*you expected it to turn out... it seems like you've got this thing from nowhere, just like, 'wow, what's that?', I like that."*²³

While these characteristics relate to a 'mental' closeness or distance, another group of characteristics relate to an almost 'physical' closeness. These are frequently mentioned in students' comparisons of physical and digital media, and appear to comprise a number of distinct elements. Although these are very closely related (particularly when dealing with physical objects), for the purposes of my research, which aims to dissociate ways of working and knowing from their physical context, they are worth identifying individually. They include: being able to manipulate things directly; immediacy and responsiveness; 'physicality' of objects; physical, hands-on interaction; and tactile appreciation and sensation.

A number of students expressed preference for, or ease of working with, different software packages or physical objects, by the ability to manipulate things directly. Many found the 3D modelling software distancing, and themselves frustrated, by the often laborious processes required to do things. An aspect closely related to this is the immediacy and responsiveness of the software – in Maya particularly the time between 'cause' and 'effect' can be anything but instantaneous, and this was definitely a drawback for a number of students, who liked to get immediate feedback:

*"the sheer time that it takes to do things in Maya, and you do just want to grab the computer and just push and pull and squish and then go, 'Right, that's what I meant' but you can't do that."*²⁴

This was one reason why some students preferred the editing and compositing stage:

*"When you work in the compositing (software)... you get kind of instantaneous results, and you can build layer upon layer upon layer, and then take it all off again, delete as much as you go along as you put on. Whereas in Maya, you have to wait, 24 hours till it's done its render, until you can even see the effects of what you've done... When it's actually animating, you can't even tell that till it's rendered and then you could find that you've just wasted three days. And I find that very very frustrating, whereas in the compositing side of it, it's a much quicker result, and I feel much more comfortable using it"*²⁵

Other students found problems when manipulating the digital materials didn't 'make sense' in a physical way:

"... you can't get your hands in there... it doesn't work the way you would think, 'oh I'm going to do this and therefore I should just do that'... you're forced to go through

²³ Digital student 3, interview 1

²⁴ Digital student 6, interview 2

²⁵ Digital student 6, interview 2

steps to achieve something, which are really unnatural if you work with your hands a lot, it just doesn't make any sense why you should have to do that..."²⁶

A theme running through all of the above is the lack of physical, 'hands-on' interaction', but this does not preclude a sense of tactile awareness and appreciation. While software in general is quite different to working with physical objects, some students were conscious of a sense of tactility and the enjoyment of working with materials in this digital context, although,

*"...it's hard work, and especially using Maya, it just gets so frustrating. But the actual, seeing something happen and seeing the things that you want, or even happy accidents perhaps, or just experimenting with it... what used to be the actual tactile touching of materials and just the enjoyment in that respect, you still have through the computer, 3D. But I think you have to go through a real pain to get there... There's much more planning, there's so many calculations that you have to put in..."*²⁷

Relationship between thinking and doing

One dimension of variation which appears to run through and across the data on many levels, is a preference for 'internal' or 'external' ways of working. Some students could clearly visualise their work in their 'mind's eye': for them, thinking and doing appeared to be separate, and they used the medium to express an idea that was already clear in their mind: as one student described it,

*"it's like a film you have in your head, like you've already seen it on the television and you're remembering it."*²⁸

For others, ideas emerged through working with external media:

*"I'm not the type of person that can sit down with a piece of paper and sketch a character, or an environment, I have to have an area that I can look at and say well, I quite like this area of this building, this windowsill here and this doorway... That's the way I'm driven more than anything, a lot of going about with digital cameras, taking photographs and stealing doorways here and there... that's how I can compile my work... I've never been the type of person that can just produce an idea out of their head."*²⁹

Summary

In the group of students working with the digital medium a number of dimensions of variation can be observed in different aspects of practice. These include a preference for a planned or emergent approach; a preference for control, or a willingness to take risks; those who see the medium as a means to an end, and those for whom the means become

²⁶ Digital student 1, interview 2

²⁷ Digital student 5, interview 1

²⁸ Digital student 1, interview 2

²⁹ Digital student 2, interview 1

the end; distance or closeness in relating to the artefacts they create and work with; those for whom thinking and doing are separate, and others for whom thinking happens through doing.

Dimensions of difference: physical media

Context of study

The second group of students who took part in this study were eleven final-year B.A. (Hons.) students on the Silversmithing and Jewellery course at Glasgow School of Art. This course accommodates a broad range of students, from those who want to focus on design for industry to those whose aim is to become studio jewellers with their own workshop.

While the course is largely focused on the use of (particularly precious) metals, and the skills and techniques necessary to work with them, it embraces the broad range of materials and techniques used in contemporary jewellery and silversmithing, including wood, plastics, and found objects (as can be seen in the work of the students in this study). The ‘preciousness’ of the objects produced does not derive solely from the inherent value of the materials from which they are made, but from the unique skills and approach of each designer-maker.

The course combines a foundation of technical and practical skills with strong design and critical elements. This ensures that those wanting to focus on design have a solid grounding in material knowledge, while the design content provides a rigorous basis for exploring ideas to those whose natural inclination is to the making aspects of the discipline. In Second Year, students are given a programme of projects predominantly geared towards acquiring a range of basic technical skills, with appropriate elements of drawing and design. Third Year is structured around a programme of design projects (including external competitions), some of which are then made; there are also opportunities for learning additional techniques including enamelling, lathe work and acrylics through specialist workshops. At the end of Third Year/beginning of Fourth Year each student proposes an individual programme of study for their final year of self-directed practice towards producing a body of work for the degree show (a gallery exhibition of work) at the end of the year. For degree assessment, each student is expected to have, as well as the final body of work, supporting material including research, sketchbooks, technical samples, and presentation drawings (rendered

representations of pieces as they will look when finished, used to convey designs to a client, for example).

The course includes both design and making aspects, conducted in the design studio and in the workshop, and while there is certainly no prescribed approach for final year students, the model 'process' underpinning the course structure is 'design then make'. This approach has a strong practical basis in this field. In design for production, 'designer' and 'maker' are usually different people, therefore the design has to be largely worked out before it is passed to a craftsperson to make. (Although the craftsperson will be given a fully specified design to make, there will usually be elements between this and the realisation of the design which remain unspecified (intentionally or unintentionally), leaving scope for the craftsperson to exercise their skill in approaching the making in ways most appropriate to successful realisation of the piece.) If designing to commission, it will be necessary for the customer to agree the design at least to a certain extent before making commences (unless you are very well-established and people are prepared to accept whatever you produce!). If you are working with expensive or precious materials, knowing exactly how much you will need, and how you are going to make the object before starting, helps avoid costly mistakes.

Within this overall design and make process, there are a range of typical elements that may be included:

- research (e.g. gathering source material/technical sampling)
- design exploration/brainstorming (generating a number of ideas)
- design development (developing a design idea in more detail)
- technical specification of design (fully specifying a design for making)
- presentation of design (a rendered representation of a finished piece, usually before the piece is made)
- final piece

Many of the design stages above are typically carried out through drawing, often in a sketchbook or series of sketchbooks, but they may also, or alternatively, be achieved through the use of physical materials: samples, mockups, models, and prototypes.

Individual approaches to practice

Students in their final year work to an individual programme of study, agreed with tutors at the beginning of the year. The process and production of work is each student's own responsibility and, as for the M.Phil. group, this allows individual approaches to emerge.

Many of the students interviewed felt they were finally able to find *their* way of doing things, as this year gave them the opportunity to let their own processes develop and mature. In previous years each project had been to a brief, over a relatively short period of time, and with specified outcomes. While the students were glad to have this opportunity, it was, for some, quite a daunting experience.

Many of the students in the group were quite adamant that there wasn't a 'right' way of going about things, in contrast with a perceived ideal 'design process' that was taught within the structure of the course. The students themselves identified different approaches within the group, mainly along the lines of whether individuals worked predominantly in the studio, or in the workshop. Certainly in my experience as a student on the course some years previously, there seemed to be quite clear differences between individuals' approaches to producing the body of work for the Degree Show: those who were design-led, and those whose work was driven by, and based around, the exploration of particular techniques and processes.

Relationship between design studio and workshop activities

Variation concerning the relationship between studio work and working at the workbench could be seen in this group of students. Yet as became clear on more detailed examination, a superficial distinction between those who primarily design in the studio and those who primarily 'make' at the bench, or between those who are design-led and those whose work is based around particular techniques, misses more subtle variations in students' processes.

The nature of the relationship between these two activities included the extent of each activity; the integration of these activities (how much they influence one another), and the direction of influence between them (which influences which). Some students liked to keep them separate, quite distinct activities; for others there was a closer relationship between them, where students would work in their sketchbook while working in the workshop.

My initial categorisations of approach from the interviews, involving the above three elements, related to where the design or 'form' of the piece of work appeared primarily to take place:

- design primarily in sketchbook, then make
- design primarily in sketchbook, refine through 3D drawing, then make
- design primarily in sketchbook, informed by technical sampling at bench

- technical sampling at the beginning of the year, then working within those techniques/material constraints
- technical sampling as required throughout for pieces
- design evolves between sketchbook and workbench
- design primarily through working at bench, then recorded in sketchbook
- design primarily through working with materials ('making')

This spectrum reveals how for many students in the group, although working at the bench played a more significant role in their processes than simply to make up a fully specified design, their use of materials in each case was different, and certainly not all equivalent to my earlier categorisation of 'make-as-design' or 'negotiation with materials'.

Closer examination showed that the roles of drawing and materials were not the same for each student, and revealed more subtle variations, which are discussed below.

The 'sketchbook'

In my original distinctions about the relationship between working in the studio, and working at the bench, one aspect was the 'direction of influence' between studio and workbench. In the traditional 'design then make' process, a design would be worked up through sketchbook work/drawing, then made. For a number of students in the group, this appeared to be inverted: either the sketchbook/drawing was used to record ideas as they occurred at the bench; or more extreme, some students used the sketchbook 'after the fact' to record work that had been done at the bench. The latter in particular was seen as in contradiction to the expected approach: students talked about being 'found out' in this aspect of their work.

This may partly be due to students' perceptions of 'the sketchbook', and their relationship with it, which varied within the group. Some students considered the sketchbook a very important part of their work; some said they didn't find working in a sketchbook particularly useful themselves, but did it because it was required; and others didn't feel 'at ease' with their sketchbook, saying that they viewed it as primarily for other people, or that they didn't engage with it:

*"I think often, I see the sketchbook as for someone else. I don't know if it's just because I'm studying just now, and I really feel like this is what's got to tell people what I'm doing, rather than me using it- 'Cause I almost feel it's got to communicate to other people rather than just to me."*³⁰

³⁰ Material student 1, interview 1



Figure 52: Excerpts from students' sketchbooks

While sketchbooks may be an integral part of many designers' working process, in this context they also form an important element of assessment for the degree: a student is expected to maintain sketchbooks during their process, not only as a means of developing the work, but in a significant sense to illustrate this development to tutors and assessors. Many of the students were very aware that their sketchbooks were not 'for their eyes only', and for some, this appeared to influence their relationship with it. Some students

talked about ‘producing’ a sketchbook, almost as something they must be seen to have, rather than because they found it useful in their own processes. Some felt that it had to have a certain quality of drawing in it, or a certain ‘look’ to it. The student quoted above used separate sheets for the rough drawings which she found useful, and then copied these into the sketchbook in a more ‘finished’ version. In contrast to this, another student who very much enjoyed working in her sketchbook, and who used it to stimulate her own thinking and ideas, felt that this effort was looked upon somewhat askance by others in the group:

“I love designing, and I will sit and design for hours, and I will sit and draw for hours... I think maybe I'm different because of the amount of design work I do, and sketchbook work. I think I'm the only one that enjoys it (laugh). I always get scoffed at because of my sketchbook work that I do. Everyone's like, 'no, I don't agree with that, I think, you know sketchbooks are just books that-' 'Cause I try and make mine interesting for myself so I stimulate myself when I'm looking at them, so I think people think it's a bit of a show.”³¹

The nature of sketchbooks is personal and individual. Sketchbooks can be, and within the group were, used for a number of different purposes including collecting source, logging technical samples, brainstorming (both words and drawing), writing, design development, technical notes, ‘to do’ lists, collage, finalising design ideas, and more. A student may use general sketchbooks, keep a sketchbook for each activity, or use a separate sketchbook for each individual piece. They can range from notebooks, bound loose leaf pages, to books of samples, or books of source (see Figure 52).

A student’s perception of, and relationship with, their sketchbooks may be therefore quite different to their relationship with drawing. A student’s use (or non-use) of sketchbooks can give insight into ways in which they organise their work, and the relationship between different elements of their work. It has not been possible to pursue this aspect in the current study, but it could form an important part of any future research in this area.

Use of drawing

Drawing was used for a range of different activities within the students’ processes, and with a number of different purposes: as a means of recording, ‘ideating’, analysis, and communication and presentation to others.

Types of drawings do not fit exclusively into these categories: for example a designer may use technical drawings to work out how something will function, but they are also

³¹ Material student 2, interview 1

used to communicate the details of a design to others. Also, people may use the same types of drawing for different purposes.

In this study, drawing was used for generating ideas, through brainstorming and other techniques: some students found this aspect particularly useful when they ‘got stuck’, to get going again.

A significant use of drawing, in this group, was for recording ideas: often rough sketches to note things down quickly. For some students this was very important for ‘externalising’ ideas: ‘drawing down’ ideas, “get down everything that goes on in my head”³², “getting things out of my head”³³. Others used drawing to capture ideas that arose at the workbench.

Drawing was used to explore and develop ideas, through investigating shapes and forms, for example, and stimulating further exploration, as described by the student above who commented on her comparatively greater use of sketchbook activity.

An important use for drawing, even among those students who worked a lot with materials in the design phase, was as an analytical tool: to work out aspects of a design or piece, or work through problems. One student whose designs arose to a large extent from combining physical elements, described how she used drawing as a ‘thinking tool’ in this respect. While most students in this group had little need to produce conventional technical specifications for pieces, some students did use drawing to work out detailed technical aspects of their pieces (Figure 53).



Figure 53: Example of technical drawing

³² Material student 5, interview 1

³³ Material student 10, interview 1

Drawing is not solely a tool or medium for design, but also has a role in communicating ideas to other people. This may be formally, through presentation drawings (or in certain cases, technical drawings), or more informally, through sketches and design drawings. In the educational context of this study, both these elements are important. This role of sketchbooks has been discussed above, but presentation drawings also form an important part of the work that is assessed for the degree: students are expected to produce a number of presentation drawings illustrating designs for future pieces (Figure 54); this activity proved particularly challenging for some students for whom ideas emerged through working with materials.



Figure 54: Presentation drawings using a range of different techniques (hand drawn, collage, digital)

Use of materials

Students used materials for a range of purposes and activities other than to make up a fully specified design. I have identified a number of terms to distinguish different uses of materials (see Table 8); these are described more fully in Appendix K. Some of these terms are derived directly from the interviewees; others I have defined to distinguish between two superficially similar uses. Where appropriate, I have used my definition rather than an interviewee's to maintain consistency between individuals, as participants used different terms to mean the same thing, or the same term to mean different things.

technical sampling, technical samples	producing (often small) samples to test materials, find out their capabilities, try out techniques, textures, finishes etc.
3D sketching	'sketching' directly in 3D with materials to generate or explore ideas
3D drawing	using physical materials to visualise or realise ideas in 3D
physical model/mockup	a physical model to test aspects of a design to see practically how it will work
physical element	a physical element or component which is, or represents, part of an actual piece
prototype	a physical working replica of a final piece

Table 8: Definitions of uses of materials

While these uses of materials could be clearly discerned in students' descriptions of their working processes, in practice the distinction between them is not always clear-cut. Students worked with materials in ways which combine two (or more) of the above uses, as can be seen in the following examples.

One student for whom a lot of the final design of pieces happened at the bench through arranging and rearranging physical elements, as her work developed, incorporated her technical sampling with the creating of design elements to form a library on which she could then draw:

"I do a lot of sampling in metal. And the little samples that I've got are actually quite complete in themselves. And I quite like to finish something off and go, right, and then I've got it there as a reference and I can use it again if I want, and if I don't, then I've not spent a whole week making a brooch in that style... I've spent an hour making a little sample that's in a library that if I want to I can go back and use it... And I do that... if I'm designing, I go right, I like this shape, and I'll take that technique, or that colour that I've used, or those stones that I've used, and then apply that to that. And so I'd kinda bring them together..."³⁴

Another student who liked to work very directly with the materials effectively combined the activities of technical sampling, 3D sketching and prototyping in the development of her pieces:

"...with things like this, the colours are good but the texture is good so then I will just experiment with that until I come up with something which I'm like, 'ooh, that would be really nice in the finished piece', or I can combine elements like the colour and the form. It's just things that to me is important about all my samples, I will then pop into one final piece."³⁵

"...the samples I use as a sketch. I'll begin to that and I'll put that at the side, and I'll go and focus with like this is precisely how I'm gonna make this final piece. And just sit down and make it."³⁶

³⁴ Material student 10, interview 3

³⁵ Material student 4, interview 1

³⁶ Material student 4, interview 1



Figure 55: Variety of samples, including some mounted for display in the Degree Show

Sometimes these ‘samples’ (which were in some ways more like prototypes) became final pieces:

“sometimes I’ll have a piece that I can’t recreate again, like either I don’t have the materials or I just carry on working in it as a sample and then it will just finally come to being a final piece.”³⁷

The following student’s description of her working processes combines elements of 3D sketching, 3D drawing and modelling to achieve her goals:

³⁷ Material student 4, interview 1

“I think it's important that I actually try and not just draw down what I'm doing, but actually see if it works visually and three dimensionally, because it's amazing how, when it looks like something on a page, when you actually make it up it can change completely. And obviously using the fabric and the metal together... I need to figure out ways of attaching the fabric to the metal, ways in which the fabric can become unattached from the metal, from the practical side of cleaning... So I'm trying to consider it from all angles, and I think that's why I definitely need to make up the mock-ups to see whether this connects well to that... And obviously fabric's got a life of its own, what I can't draw down with fabric, I can't- so I need to actually draw with the fabric directly, and the metal, and then use that information to perhaps draw down technical, so that's why I do it that way”³⁸

The same activity may have a different role within each individual's process: in this group, for example, some students used technical sampling at the beginning of the body of work, to 'scope out' a process or technique that would be used as the basis for all their pieces within the Degree Show. Once the student had perfected the technique or process, or at least achieved a level of confidence in working with it, they then designed the subsequent pieces within this scope. In other cases technical sampling was done as needed for a piece, as with one student who had decided to make a body of work based on the theme of brooches, where each piece was designed around a different narrative work. The materials, techniques and processes for each one were largely determined by the concept and design of the piece; the technical sampling was thus focused on a single piece, and to achieve particular ends.

The ways in which individual students use materials, or the emphasis on different uses within their process, may also change during the year.

Recognising the difference between these uses of materials is helpful in distinguishing between those who were 'making' – working directly with materials at the bench to create a piece – and those who, as revealed through further discussion, were actually using materials as a design medium: working at the bench seemed initially to be very important in one student's processes; however in later interviews it became clear that while ideas might be generated at the bench, they did not affect the piece she was working on:

“I go to the bench with my technical drawing, and if anything else comes out of that- for instance, my units that I've got, I noticed that they made patterns within themselves, so I recorded that and photographed it at the bench. And it's something that I've put in to go revisit but, I do not deviate from what I initially went in to do,

³⁸ Material student 5, interview 1

because I've found in the past that when I do, I then get confused and frustrated by it. So if I go in, I'm very focused with what I'm doing with my drawing.”³⁹

Drawing or materials?

A student's choice of drawing or working with physical materials may depend on a number of factors, relating to levels of confidence in each type of medium; practical reasons for choosing on or the other; or reflecting a more fundamental relationship with materials.

Some students felt less confident at drawing than others, particularly as a mechanism for visualising ideas that were quite clear in their minds; others were less confident at the bench. These feelings were more marked at the beginning of the year: by the end, many of the students had become more confident in both these aspects.

In some situations drawing was perceived as less useful than working with materials, for example when trying to render complex material structures such as wire mesh or French knitting; or for exploring and understanding movement within pieces, or how they will feel. It is necessary to work with materials to investigate their properties, as in technical sampling. It can also be beneficial where you want to understand the actual making process, such as in a prototype. Some students found that designing with materials was better to “see if it works visually and three dimensionally”⁴⁰.

While these are largely practical reasons, some students appeared to have a more fundamental need to work with materials. These ranged from those for whom a ‘3D sketch conveys the feeling of a piece’, for whom objects have a ‘presence’, or substance lacking in a 2D drawing, to those who play with physical elements to design pieces (the term ‘play’ has no derogatory overtones, but reflects the relatively unconstrained and experimental nature of this process), or for whom ideas for designs come through working with materials:

“I've definitely got to work with things. I've got to have them and play about with them before things will come. Sometimes I can sit down and draw it, and make it, but it really doesn't do anything for me. I feel I've got to have it”⁴¹

The students' preferences for different media for different processes may relate to a number of aspects of their approach, discussed below: to what extent the design is

³⁹ Material student 11, interview 3

⁴⁰ Material student 5, interview 1

⁴¹ Material student 4, interview 1

preplanned before making commences, or emerges after making has begun; the perceived role of the materials within each student's process; the extent to which an emergent approach can be related to a 'dialogue with the medium', or, as in the case of some M.Phil. students, whether it is more a 'dialogue through the medium'; a preference for control or a willingness to be open to unexpected events in the process; and whether idea generation or development is done largely 'internally', with media used to record this process, or happens rather through external means.

Planned or emergent?

This closer examination of the different ways in which they are used reveals the important and varied roles that materials play in all the students' processes. In this group, there was only one student who appeared to design primarily through sketchbook work and then make; a number of other students who designed primarily in their sketchbooks used 3D drawing or sampling to inform their design work. Interestingly, the first student was working with a particular technique, and as time pressures developed through the year and her confidence in working with materials grew, the balance of design activity moved towards the bench. For other students, the two activities were more integrated. Nevertheless, distinctions can be drawn within the group between those students for whom the design is largely preplanned before the final piece is made (whether through drawing or using physical materials as a 'design' medium), or whether the form of the piece emerges throughout the making process, with the design not fixed before making is started. The following student worked closely between her sketchbook and at the bench to develop the designs for her pieces, but,

“on the whole, the samples and the models and the drawings go towards what then is a finished piece. So I would model-make or model up in the workshop with metal or whatever, and I'd do my drawings and I'd sometimes do technical drawings, but ultimately when I go to start the finished piece, that is the finished piece”⁴²

This examination also revealed what appeared to be different types of emergent approach. In the first, elements of a piece are constructed, and then the final form of the piece emerges through arrangement and rearrangement of these pieces. This 'conversation' is largely concerned with shape, form and function, rather than the properties of the materials. The second type of emergent approach is typified by a more direct approach to working with the materials, and the exploration of the properties of the materials themselves as part of the making process (as opposed to in a 'sampling' phase earlier on

⁴² Material student 5, interview 1

in the process). These differences appear to relate to the extent to which an emergent approach can be seen as a dialogue with yourself *through* the medium, or a dialogue *with* the medium, which concerns the role of the medium within the process.

Role of the medium

One student, for whom working with elements at the bench seemed to play a significant part in her process, nevertheless made it clear that,

“It's not so much that the materials give me it. Well I suppose they do, but when I'm making something in the workshop, I get other ideas from it, from the shapes, it's not necessarily like how the silver functions.”⁴³

Another student, who had a very strong relationship with the materials, relied much more on what happened with the materials:

“More engage with it to see what can happen because- I think, from that, if you let a material do what it wants to do it can throw up some good surprises that can then help you to see it in a different way and use it in a different way. Which I think is very important, which you would miss if you just went, it's got to do this and it's got to do it now. You would miss that whole sort of process of it pinging exploding in some way or- like differing itself. ... a lot of my pieces are just by, 'oh, it's happened, but I really like the way that it has done, so I'll utilise that in a piece.”⁴⁴

Choice of materials

A related difference that could be observed concerns the extent to which the materials are chosen to suit a particular design, or whether the design is determined by the materials which are available.

Some students selected the materials to suit a design or a conceptual idea – “rather than designing to the material”⁴⁵ - where materials may be chosen for their physical, visual or evocative qualities:

“[the materials] convey a lot about the lyrics that I'm looking at as well, and making particular sense of a word or something, that the other materials couldn't. You've always got to try though, just to see which would work- it's got to have the strongest impact for you, how it matches with what you're trying to say”⁴⁶

For other students, the design was influenced (to a greater or lesser degree) by the materials. This occurred at different levels of process.

⁴³ Material student 11, interview 1

⁴⁴ Material student 4, interview 3

⁴⁵ Material student 11, interview 1

⁴⁶ Material student 8, interview 1

Repertoire or palette

A number of students based a body of work around particular processes or techniques. Perfecting these, and finding out the capabilities of the materials, was a very important part of their work: they spent a lot of time at the beginning of the year sampling and testing the technique and materials to see how far they could push it. However, for some of these students, after the period of refining a particular process or technique was over, pieces were generally designed before being made:

“it’s trial and error... you just have to see what works and what doesn’t work so it’s a case of producing loads and loads of samples and when I eventually find what does work, then it will be a design-based thing”⁴⁷

One student had a very large collection of materials which played a central role in her work:

“I have lots of components that I’ll just merge together. I have a room at home, it’s covered with bags, poly-pockets of everything I’ve been collecting, and I will go through it and say ‘that goes with that, that goes with that, I’ll create this’... that’s the main way I work.”⁴⁸

An interviewee from my earlier research had described the large collection of beads she worked with as a ‘palette’. This term resonated strongly with the student above:

“Yeah, precisely, that is precisely it... I try and colour coordinate them or keep all the pieces together but in different coloured packets... because colour is very important so I do always sort of categorise things colour-wise, and see how that works together.”⁴⁹

This material ‘palette’ seemed to differ from the ‘repertoire’ of techniques and processes in the sense that while the materials were selected by the student, unlike the repertoire they were not *defined* by the student.

Working directly with materials

For other students, the design was determined by the materials in a more direct fashion, specific to each piece. This again manifested itself in two different ways.

Some students created and collected physical ‘elements’ or ‘components’ for the work and played about with them to create the final piece or design (Figure 56). These elements appeared to have two different roles: either ‘samples’, which the student would work with to create the form of the piece, and then make it in the final materials; or actual

⁴⁷ Material student 3, interview 1

⁴⁸ Material student 4, interview 1

⁴⁹ Material student 4, interview 1



Figure 56: Elements

finished components, which would be made up into a final piece. (I have not included in this category those students who generated ideas while working with elements at the bench, but recorded them for later use, i.e. the form of the current piece did not change through what happened at the bench.) For these students, although some work was done in the sketchbooks, there was a strong sense that the form of the work came from working with these material elements.

“I think I do more play about and start to think about how they could go together but then I don’t just throw it together, I do do some sketches to see what I could do with it. But it is more sampling, definitely”⁵⁰

Other students seemed to work more directly with the materials to evolve the design of a piece. For the student who had the ‘palette’ of materials, the form of each piece seemed to arise very directly from working with these materials:

“I approach things in a very sort of ‘into the deep end’, I’ll start making a thing, and just really- It depends, I get a lot of different inspirations from other things but usually I will just go straight into a piece if I’m making a particular piece that I want to do, sketch it quickly and just get the materials going”⁵¹

Although she describes items in her palette as ‘components’, they are ‘selected’ and less finished than the physical elements which are largely ‘predefined’ or premade by the students. This suggests a similar difference to the repertoire/palette level above, with its distinction between having been made or selected.

⁵⁰ Material student 7, interview 1

⁵¹ Material student 4, interview 1

Difference upon difference

Running through these examples of two different ‘levels’ of working with materials – producing a body of work within a repertoire of processes and techniques or a palette of materials, and working directly with physical elements or materials to produce a particular piece – are a number of other differences which have already been discussed above: the extent to which the design is preplanned before making, or whether making commences before the design is finalised; and the extent to which an emergent approach can be seen as a dialogue with the medium, or through the medium. A related difference concerns the nature of each student’s relationship with the medium.

Relationship with medium

Within the group, students characterised their relationship with the medium in different ways. For some, they were very much “the boss”:

“I’m quite strict to what I’ve got in my head, I’m quite strict to what I’ve got on paper... I tell it what to do (laughs). As far as I can, I manipulate it, as opposed to there’s people upstairs who will very much work according to what the metal does or according to what happens, it’s that kind of exciting, perhaps not quite sure what’s gonna happen but we’ll give it a go. That comes in occasionally with me but because I’m very clean with certain shapes or forms, it tends to be me asking it to do something, and if it doesn’t work then I’ll try it again to achieve the same end product”⁵²

This is not to say that they weren’t sensitive to materials: rather, that once a design had been completed, they pursued that. Other students were more open to change their design if something happened while they were making it:

“...you have the idea in your head, and you go to do it, but while you’re doing it, the material’s doing something else, so that then changes what you set out to do...”⁵³

Although this dimension may relate to a preference for a planned or emergent approach, those are preferred ways of working; this aspect concerns a preference for control, or a willingness to be open to unexpected events in the process.

Internal or external?

One interesting distinction is the use of drawing/materials to develop ideas, or to record/realise ideas arrived at by some other means.

⁵² Material student 5, interview 1

⁵³ Material student 7, interview 1

Some students used their sketchbooks to record work done at the bench ‘after the fact’, but the term ‘record’ was also used in the sense of “draw down everything that goes on in my head”. A number of students gave the strong impression that much of the design work was happening internally, which they would then ‘draw down’ or ‘record’, as opposed to the sense that the ideas came through drawing. One student, when first interviewed, was aware of drawbacks with this ability, and was making a conscious effort to take more account of what was happening in her sketchbook, and what was happening at the bench:

“an awful lot, I have preconceived ideas of- you know when your brain conjures up this notion or this finished piece before you've even drawn anything down, then I'll almost be working towards that, instead of observing what's going on in the paper, what's going on in my drawings, or what's going on at the workbench”⁵⁴

Interestingly, when interviewed subsequently, she had discovered that she found it more successful to realise her ideas in three dimensions first, then record them on paper:

“I can sit there and quite happily go through the motions of a page in a sketchbook in my head... I can sit and I can rotate things in my brain and I can see things from every different angle. And actually when I draw it down, it loses something that was up here, and actually I think I'm now better making it three-dimensionally, and then recording that on paper, and recording the bits that haven't gone wrong.”⁵⁵

In contrast, another student seemed initially to work in very ‘external’ ways in her sketchbook. She photocopied drawings and photographs, cutting them up and rearranging the elements to see what design ideas would result.

I had originally thought that a preference for this way of working might indicate that the student did not have the ability to clearly visualise designs ‘internally’, and so used an external process. But for this student at least, that was not the case; her approach concerned her relationship with drawing:

“The drawing doesn't particularly come naturally to me. When I go to finalise the idea, I do it on the technical drawing. If I have rough sketches, it's done very roughly in a small sketchbook... But apart from that, most of it is actually done in my head. And I think that's where, as I say, I did struggle with the drawing because it wasn't something I did naturally. And the kind of drawing that the department wanted me to do, wasn't natural to me, and I did far more of the development process - like trying to figure out exactly how I was going to make it - in my head, rather than drawing it. I suppose I've had to do the drawing part, more than I probably would do if I didn't have to do it. And then I would just go straight to the technical drawing board probably. Although, because I was looking at fragmenting the circle, I've used it just

⁵⁴ Material student 5, interview 1

⁵⁵ Material student 5, interview 3

as a tool to experiment with pattern and things like that. Which you can't do freehand, because obviously it's not precise enough."⁵⁶

Her approach also relates to other notions of what 'drawing' can be:

*"In my second last sketchbook, it was working a lot with photocopied patterns. And it was deconstructing them... I think that reflects the training I had doing my portfolio, when we were taught that drawing wasn't just with a pencil, drawing was using scissors... I think that's really came back through my work in the last year, that I will just sit down and kinda cut things and remake them. And it kinda reflects the work, because, I've started to deconstruct the circle and then reconstruct it, same with pattern, you know. ...so, that's still quite a big part."*⁵⁷

This example illustrates why it is necessary to examine carefully the ways in which media are being used within a student's practice.

Another student's processes seemed more externally driven: she described the focus of her work as "the source material and the materials". Her description of her relationship with her source material was interesting, and may give additional insight into her approach. For her source materials, she chose "things which are inspiring to me, things I think that will relate to what I'm doing". A particular technique she used was to work into photocopies of visual source material,

*"just picking out elements in it which is the most interesting to me, like this, it looks as if it could be beads, and then how I can translate that into how I'm working, like how I can French Knit it or how it would look if it was French Knitted, and colours..."*⁵⁸

The idea of 'translating' the ideas from the source using materials and processes she had decided to use came through very strongly. As her work developed, while the influence of the source was still strong, a lot of the pieces were derived from the materials:

*"At the very beginning I was trying to find lots of visual research, but then once I started working with materials that just took on into it's own, and all my sketchbooks and everything went very much on the back burner. While I just started continually using like material and 3D sketches."*⁵⁹

Summary

In this group of students working with physical media, a number of dimensions of variation can be observed in different aspects of practice. These include the roles of drawing and materials within each student's practice; a preference for a planned or emergent approach; the extent to which the materials are chosen to suit a particular

⁵⁶ Material student 11, interview 3

⁵⁷ Material student 11, interview 3

⁵⁸ Material student 4, interview 1

⁵⁹ Material student 4, interview 3

design, or whether the design is determined by the materials which are available; their different relationships with the medium; and whether idea generation or development is done largely ‘internally’, or achieved through external means.

Comparison between groups

The previous two sections of this chapter discussed differences in approach that could be observed between the students within each of the two groups participating in this study. This part of the chapter demonstrates that similar differences in approach exist within each group, and that a comparison between similar approaches within two environments, physical and digital, has value in clarifying aspects of approach, and offering insights that arise from the differences between the two media.

Strong similarities exist in both groups: these relate both to a number of ‘dimensions of difference’ concerning various aspects of the students’ approach to their work or relationship with the medium, and to other more general aspects concerning design processes and the role of artefacts and media within these.

There were no points on which the groups varied widely, although there were instances where a comparison between similar approaches in each group clarified aspects of approach which might have been misinterpreted; elicited multiple phenomena which might have been misperceived as one; or brought things to light which were emphasised more in one group than the other, where they might have gone unnoticed.

‘Dimensions of difference’

Planned or emergent

Within both groups, differences could be observed between those students who liked to predefine the form of the work before starting to make it, and those who were happy for the form of the work to emerge during the process. However, closer examination revealed further differences in each case.

In the M.Phil. students who preferred a ‘planned’ approach, there were differences in the extent to which the visual appearance of the work (as opposed to its narrative structure, for example) was determined before starting to build it. Some students prepared a visually detailed storyboard; others prepared what one termed a ‘sequential storyboard’, planned in terms of what was going to happen, but not visually detailed (see Figure 51).

In both groups, more fundamental differences appear to exist between the two different types of emergent approach observed, relating to the role of the medium. For some students, the emergent nature of the work is related to working directly with the medium, and an exploration of its properties (a dialogue *with* the medium). For others the emergent nature of the work is related rather to the conceptual idea or design (what could be described as a dialogue *through* the medium).

In the latter case there seems to be a further difference between (for example in the digital context) a dialogue with an emerging idea – “jumping into the void”⁶⁰ - and (in both physical and digital contexts) arranging and rearranging partially predefined elements to achieve a final piece; nevertheless the emphasis is on the ‘design’ as distinct from the medium.

Role of medium

This distinction between the role of the medium can be observed on two levels. At the conceptual level, there are those who view the medium very much as a tool, or a means to an end; their emphasis is on what they are trying to achieve through the work whether design, concept or message. Others engage with the medium, and work with the effects that arise through ‘playing about’ with what the medium can do.

Choice of materials

A similar distinction, but at a different level, concerns the choice of materials; whether the materials are chosen to suit the design, or whether the design is determined by what materials are available.

In the group of students working with physical media, some students selected materials to suit a design or conceptual idea: materials might be chosen for their physical, visual, or evocative qualities. For other students, the materials appeared to have a greater influence on the design. However, on closer examination, again further differences could be discerned within this latter case. These relate to the level of process at which this occurs - at the level of practice, or for each individual piece - and how the material constraints arise.

⁶⁰ Digital student 11, interview 1

At a 'practice' level, some students worked within a *repertoire* of skills or processes, while another student worked also within a *palette* of materials. The main distinction between these seemed to be that while the former was largely *defined* by the student, the latter was *selected*.

At the level of the piece of work or artefact, some students built elements of a piece, then arranged and rearranged them to achieve the final form of the work. For others, the piece largely emerged from working directly with the materials, and from what the materials could do. Again, the distinction between these seems to relate to how much the physical materials being worked with had been 'predefined' by the student.

Similar differences can also be observed in the group of students working with digital media. Although the medium is largely defined as the software package that's available, the observations concerning the use of a 'repertoire' or 'palette' may, on reflection, relate to differences between the 'digital' students' approaches to using and learning techniques or elements within the software. Some students chose processes and techniques according to what they were wanting to achieve ('chosen to suit the design', above). Others learnt a broad range of techniques in case they might need them, and incorporated them into their work as appropriate. A comment made by a number of students during the interviews (mostly about *other* students) was that some of the group appeared largely to use techniques with which they were already familiar through their previous year of study.

Similar differences to those observed at 'piece' level within the S&J students were also evident in this group. Some students used the compositing and editing stage of the process to put shots together according to the predefined plan. Others built elements using the modelling software, then used compositing and editing to experiment and explore different interpretations ('arranging and rearranging' elements). Another student worked even more directly with the software: the effects achieved through playing with the digital medium itself determined the direction of the work.

Control or risk

Whereas a planned or emergent approach reflects preferred ways of working, this aspect deals more with the students preference for control, or a willingness to be open to unexpected events in the process. Differences in this dimension could be observed within both groups.

In the M.Phil. group I had considered three different aspects: reaction to unexpected events; attitude to problems; and ‘preventative measures’. In the analysis of the S&J group, I hadn’t become explicitly aware of the types of ‘preventative measures’ such as observed in the M.Phil. group; however these could be reflected in the use of sampling, or of building prototypes, in the processes of some S&J students.

Ways of relating to objects

In the group of students working with digital media I had identified a number of differences revealing aspects of a preference for a close or distant relationship with objects. These appeared in two different contexts: a ‘mental’ closeness or distance, and another group of characteristics related to an almost ‘physical’ closeness. I had observed that some of these differences became explicit only when they became apparent to the student: for example when they experienced difficulties with the software, or expressed preferences for using one technique over another. The opposite viewpoint was rarely expressed by the interviewees, but can be inferred from the lack of explicit reference, and revealed by examining the collective variation across the group.

For the students working in the digital medium, a number of aspects of ‘mental’ closeness or distance could be observed: learning the software through manuals or by interacting with it; having a subjective or objective relationship with the software; seeing elements of the software in terms of ‘what they can do’ (concrete) or ‘what they are for’ (formal); and being driven by conscious awareness, or forgetting themselves and becoming immersed in their work. Although these aspects didn’t emerge as obviously in the group of students working with physical media, elements of these differences can be seen in the ways in which some students explore and stretch the possibilities of their materials.

In the digital group, a number of students made comments relating to ‘physical’ attributes of working with the medium (being able to manipulate things directly, immediacy and responsiveness, the physicality of objects, and physical ‘hands-on’ interaction) - largely concerning their lack of experience of these characteristics in the digital medium.

Comments along these lines were not as obvious in the S&J group, probably because the students were actually working with physical materials. However, similar characteristics can be observed in some students’ preferences for using physical materials over drawing in the development of their ideas (as opposed to solely a preference for working in three dimensions rather than two).

This reveals the benefits of a comparison between digital and physical environments: it is useful to view this ‘dimension’ through the prism of the digital medium, as it helps to split the different aspects of ‘working with physical materials’ into constituent parts.

Although in the one case a comparison is being made between digital and physical media, and in the other between drawing and materials, some of the underlying reasons for choosing one over the other may be similar.

Internal or external

For this ‘dimension of difference’, the elements of process that I’d identified as constituting an ‘internal’ or ‘external’ approach were slightly different in each group. In the M.Phil. group, I’d identified an ‘internal’ approach as having a number of aspects across different levels of practice. Some students could clearly visualise their work in their ‘mind’s eye’: for them, thinking and doing appeared to be separate, and they used the medium to express an idea that was already clear in their mind. For some S&J students media was used to record ideas generated internally, parts of the development process were done ‘in my head’, and many commented on being able to mentally visualise objects quite clearly.

A number of students in both groups commented that they could see objects, or sequences of events “like a movie”⁶¹, quite clearly in their heads. In contrast there were two students, one in each group, who particularly seemed to develop their ideas in an ‘external’ manner, in 2D via collage (Figure 57). I’d originally linked what seemed to be



Figure 57: Working with photocopy collage (left) M.Phil. student, (right) S&J student

⁶¹ Digital student 1, interview 2

this preference for working externally with an inability to mentally visualise objects, as the M.Phil. student had commented that she wasn't able to come up with an 'idea' straight out of her head. However, as discussed earlier in the chapter, the S&J student was able to visualise objects quite clearly in her head, and appeared to use collage techniques for other reasons. It cannot therefore be assumed that an apparent preference for working with external media necessarily equates to an inability to visualise ideas mentally in three dimensions.

However, there is an interesting comparison between the description which the above M.Phil. student gave of her process at this stage as 'compiling' her work from external sources ("stealing doorways here and there"⁶²), and the description by another S&J student, whose ideas emerged from working with source material and materials, of 'translating' ideas from the source using the materials and processes in her 'palette'. In both these cases - 'compiling' work from external elements, or 'translating' source material, there is a strong sense that the students are working externally. (This has resonances with the 'choice of materials' dimensions, above, and the distinction there between 'selecting' and 'defining'.)

Despite these variations, there appear to be differences between students for whom idea generation or development is done largely 'internally', with media used to record this process, and those who generate or develop their ideas using external means.

It is also important to note that an 'external' approach doesn't necessarily equate to an emergent approach, as the M.Phil. student above who worked with collages in the design stage of her piece planned her work carefully before starting work in the modelling software.

Design processes, and role of artefacts/media within these

In addition to these 'dimensions of difference', other similarities could be observed between the two groups. These related more generally to design processes, and to the role of artefacts/media within these processes.

For both disciplines represented in this study, in 'industry' design and making are often done by separate groups of people. This leads to an (ostensibly) 'design then make' process. When one person is doing everything, as is the case with these students,

⁶² Digital student 2, interview 1

individual differences in approach spanning the whole process can emerge. A number of S&J students particularly commented quite strongly that there wasn't 'a' design process. The experience of some students in both groups was that they were doing things because of the requirements of the course, rather than because it was useful to them. With the M.Phil. students these comments largely related to the storyboard; for the S&J students, most of these comments centred around the role of the sketchbook.

One of the valuable lessons learned from this study was differentiating the variety of ways in which students use the media with which they work. Particularly within the group of S&J students, it revealed the important distinction between those students who originally appeared to be what I have termed 'making' – working directly with materials at the bench to create a piece – but who, as revealed through further discussion, were actually using materials as a medium for design. Although it may not be possible to equate the use of physical materials in this way directly to using Maya (the 3D modelling and animation software) as a design tool, some students in the M.Phil. group did use 'animatics' when developing their work – simplified 'block' models to represent characters of elements of a scene to allow them to test movement, timing, lighting and camera positions within a scene. In a broader context, it highlights the fact that the same medium may be used in different ways and for quite different purposes by individuals, and that it is therefore necessary to examine the relationship between design practitioners and media carefully.

Conclusions

To recap, the aims of this comparative study between two groups of students, one working with 3D physical media and the other with 3D digital media, were: firstly, to establish whether differences in approach, relating to the nature and extent of a dialogue between practitioner and medium, could be observed within each group; and secondly, to establish whether similar differences could be observed within both groups.

In order to address these questions, this study focused on examining those aspects of practice which relate to the nature and extent of a dialogue between practitioner and medium. In the first stage of this study, a comparative framework was derived from the literature, taking the formal/concrete axis as an organising principle for differences in approach across a number of levels of practice; it comprised a set of around thirty 'indicators' representing those aspects of a practitioner's process that can be examined to determine the nature and extent of the dialogue they experience with the medium and

collectively determine whether their overall approach is categorised as 'hard', 'soft' or not definitive. In a preliminary analysis of the first set of interview data, each individual's approach was categorised using this framework, and an assessment made of the distribution of the different approaches within each group. Certain limitations of this analysis mean that it can only be relied upon to give a broad indication, nevertheless different approaches, broadly in line with those in the framework, could be observed within both groups, with a similar spread of approaches within each group.

The second part of the study - based largely on the first set of interview transcriptions, but with input from later sets - involved both an examination of the collective variation within each group across a number of 'dimensions of difference' which emerged from the data, and a comparison of these emergent dimensions between groups. One of the limitations of this second stage of analysis is that while it identifies differences in approach that could be observed, along certain dimensions, within the group, it lacks the formal connection between these dimensions within each individual's practice to allow a rigorous comparison between individuals across all the 'dimensions' of their approach (further analysis of the data will be required for this to be possible). It is also not possible to make a direct comparison between these results and the results from the preliminary analysis which categorised individual approaches as 'hard', 'soft' or 'not definitive'. However, despite these limitations, a number of observations can still be made.

In both groups, a number of dimensions of variation can be observed which appear to be in line with the original framework, relating to a 'hard' or 'soft' approach. These include a preference for a planned or emergent approach; a preference for control, or a willingness to take risks; those who see the medium as a means to an end, and those for whom the means become the end; the extent to which the materials are chosen to suit a particular design, or whether the design is determined by the materials which are available; their different relationships with the medium, including distance or closeness in relating to the artefacts they create and work with; those whose idea generation or development is done largely 'internally', or those who achieve it through external means. The dimensions emerging from the groups therefore seem to be broadly in line with those embodied in the conceptual framework. However, how these different dimensions logically relate to one another within an individual's approach does not appear to be completely described by the two-dimensional nature of the framework. (Although this second stage of analysis focused on the collective variation within each group, there are

relationships between dimensions that can be observed within certain individuals' practice which are not consistent with the framework.)

In the 'soft' approach embodied in the conceptual framework, I had equated an emergent approach to a 'dialogue *with* the medium'; however instances could be observed where an emergent approach could rather be characterised as a dialogue with oneself *through* the medium (in this case the differences relate to whether the emergence relates to the conceptual idea or design, or an exploration of the properties of the medium). Another dimension which is not adequately explained by the original framework relates to the choice of materials. In the framework, this dimension broadly distinguishes between whether the materials are chosen to suit the design, or whether the design is determined by what materials are available. On closer examination, again further differences could be discerned within this spectrum, relating to the nature of the material constraints.

Without a more formal means of comparing the relationships between dimensions within each individual's practice it is not possible to determine, at this stage, whether these differences in approach simply represent different positions on the existing 'hard'/'soft' spectrum, or indicate two wholly different spectra of approach, one at the level of representation, and one at the level of the artefact (this is discussed further in Chapter 9, *Discussion*). However, findings from the Practitioner Interviews discussed in the next chapter may offer additional insight. Comparisons between practitioners who had what at first appeared to be quite similar approaches, in terms of the original analytical framework, revealed distinct and significant differences relating to the role of the medium in each practitioner's practice. These interviews indicate that even between practitioners who appear to share a close relationship with the medium, this relationship may not be the same.

8. Practitioner interviews

Chapter 6, *Concepts of dialogue in design* proposed that significant differences exist between individuals in their approach to creative practice which can broadly be described in terms of the nature and extent of a dialogue between practitioner and medium. Further analysis suggested the formal/concrete axis as an organising principle for these differences in approach across a number of levels of practice and encompassing a number of ‘dimensions of difference’.

Chapter 7, *Comparative study* demonstrated that differences along these lines could be observed in the working practices of two groups of student 3D design practitioners (one working with digital media, the other working with physical media). However, it revealed that differences between practitioners could be observed which could not be fully explained by this ‘two-dimensional’ organising principle. Findings from the study discussed in this chapter offer additional insight into differences between individuals relating to the role of the medium in their practice.

This chapter describes an interview study of three 3D practitioners who have an established material practice, and a substantial body of work in digital practice. By drawing comparisons between each practitioner’s approach to material and digital practice it aimed to gain insight into key elements of their relationships with the medium they use and the artefacts they create. A primary aim of this study was to determine whether, in support of the principle of comparing material and digital practice which underpins the method chosen for this thesis, a practitioner’s approach is consistent across media. The emphasis of the investigation therefore had been within each individual’s approach. However, during the study it became clear that important insight could be gained from looking at differences between individuals. Comparisons between practitioners who had what at first appeared to be quite similar approaches, in terms of the original analytical framework, revealed distinct and significant differences relating to the role of the medium in each practitioner’s practice. These differences may help to explain the results obtained in the Comparative Study; this is discussed in Chapter 9, *Discussion*. This study of advanced practitioners complements the relatively early developmental stage of the students in the Comparative Study. The interviews also

provided an opportunity for issues to be raised that are important, but which might not be immediately obvious in the two 'single' environment elements of the Comparative Study.

Verifying the basis of comparison

One of the main principles underpinning the method chosen for this research is that insight can be obtained from comparing phenomena which are similar-but-different. In this thesis that is primarily achieved through comparisons between material and digital practice, either between individuals working in each of the environments (as in the Comparative Study) or within one individual's practice (as in this study).

In order for these comparisons to be valid and useful (particularly between similar approaches in different groups), it has to be demonstrated that a practitioner's approach is consistent across media. If, for example, there was a significant difference in approach between a practitioner's material practice and their digital practice, then it would not be possible to say which effects may be due to differences in approach, and which may be due to working with the different media. It would still be possible to compare similar approaches within different groups, and see how each type of approach manifested itself in each type of environment, but it would not support the thesis, as it would not be possible to claim that there are underlying differences in the way that individual practitioners relate to the medium they use.

Also, for this principle to be useful, insights into practitioners' processes must be gained from this comparison, i.e. the approach remains the same, but aspects of it are foregrounded by the differences between material and digital media.

This study verifies both elements of this principle: that a practitioner's approach is consistent across media; and that insights into their approach can be gained from examining similarities and differences that arise from the differences between the two types of media.

Design of study

Participants

My original intention had been to keep the areas of practice for this study as similar as possible to the groups proposed for the Comparative Study, and therefore that the 3D

practitioners concerned would be designer-makers/applied artists now working in digital practice. However, it soon became apparent that, while a growing number of designer-makers are using computer systems within material practice, very few are working in a digital medium, particularly in the UK. I therefore decided to broaden the search to include sculptors now working in a digital medium.

I had originally thought that this variety of backgrounds would make some elements of direct comparison between these practitioners more difficult, as they not only use different digital media but have backgrounds in different material practice (although it gives a broader view of the ways in which practitioners view and engage with digital media, complementing the Comparative Study which has a narrower focus in terms of the material and digital media being used). However, as noted above, during the study it became clear that important insights were to be gained from looking at differences between individual practitioners in terms of their approach to the medium and its role in their practice. These aspects are largely independent of the medium (particularly as this study demonstrates that the characteristics of a medium are not absolute, rather they are defined through a practitioner's relationship with it) and therefore a comparison between practitioners on this level is more straightforward.

Interview design

Each practitioner was interviewed to examine how their experience, perceptions, skills and working processes transferred from the material to the digital environment. The main aim of these interviews was to examine similarities and differences in their working practices across the two environments, therefore gaining insight into key elements of their relationships with the medium they use and the artefacts they create. (These might have explicitly come to the practitioners' attention through their move from material to digital practice, or be things that they may not be aware of, but which can be inferred from their accounts of practice or revealed by the types of comparison made during this study.) In particular, I was interested in how they view the digital medium, how they engage with it, and how their material practice relates to their digital practice. I was also keen to identify insights they had obtained into their own practice in moving from material to digital, and the differences they highlight between the two working environments. There are a number of levels at which this 'foregrounding' or 'distancing' between media may take place, giving insight into the practitioner's general practice, approach, and relationship with the medium, or the concerns, content or theme of their work.

A semi-structured design was used for the interviews, recognising that while there were particular aspects that I wanted to explore, some of the most important information was likely to emerge from the discussion with the practitioners. A copy of the interview schedule is given in Appendix L. In the event, the schedule acted as an aide-memoire during a broad discussion of practice, to ensure that all areas of interest were covered, rather than being rigidly followed question by question. Each practitioner was given the opportunity to review the excerpts from the transcriptions quoted in this chapter, to clarify points or tidy up phraseology, as they felt appropriate.

Analysis

A two-stage analysis was made of the interview data, in both cases examining themes that emerged from the data, but within the broad theoretical framework discussed in Chapter 6, *Concepts of dialogue in design*. Firstly, a comparison was made between each individual's digital practice and their material practice, to characterise their approach in each. Secondly, a comparison was made between practitioners, focusing on aspects of their digital practice, to identify any differences that could be observed between individuals in terms of their relationship with the medium and its role in their practice.

The practitioners

The three practitioners interviewed in this study come from a range of 3D practice. Practitioner A (PractA) is a maker with a background in textiles, now working with 3D computer graphics as a medium. Practitioner B (PractB) is a sculptor with a background in installation, now using a combination of immersive digital environments and real space as his medium. Practitioner C (PractC) is a sculptor, working in what he terms the 'cyber environment', using a 3D modelling package as his medium, with a range of digital and material outcomes.

Practitioner A

PractA's practice-based Ph.D. enquiry marked the move away from her established practice in constructed textiles to the use of 3D computer graphics (including motion capture) as a medium. This move was driven primarily by limitations she experienced in pursuing her material practice.

"I felt that I hadn't yet achieved all that I wanted from my work, and there was so much more to pursue, particularly in terms of the expression of movement within the



Figure 58(a): "Transcience" 1987-1990
 Reproduced by kind permission of the artist.
 Photography Pierre Guillemin
 Performer Jaqueline Duncan

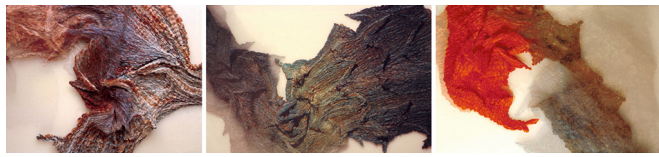


Figure 58 (b): "Kinetic" 1991-1994
 Reproduced by kind permission of the artist.
 Photography Shannon Tofts



Figure 59: "A'Dressing" 1996-1998
 Reproduced by kind permission of the artist.
 Performer Emily Bruni. Assisted by Mill Film, Soho, London
 Supported by The Arts Council of Great Britain, Channel 4

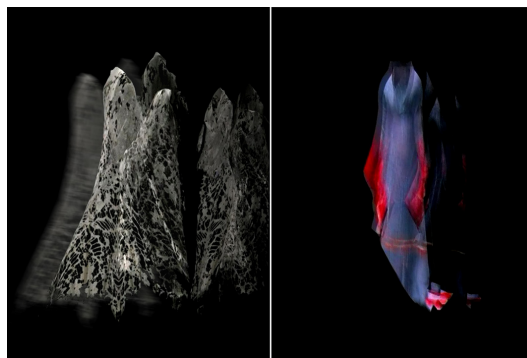


Figure 60: "Portrayal" 1998-2000
 Reproduced by kind permission of the artist.
 3D CG Mike Dawson, Performer/Choreographer Ruth
 Gibson. Supported by Vicon



Figure 61: "Potential Beauty" 2002-2003
 Reproduced by kind permission of the artist.
 3D CG Mike Dawson, Performer/Choreography Ruth
 Gibson. Supported by AHRB, Vicon

pieces, the presence of the body within the work. I was still really fighting to simultaneously incorporate so many different elements in the 'making' of any one piece. The material process that had brought me to this point and defined my practice and my palette, if you like, was very time consuming. Each piece took about three to six months solid time to produce. Each composed of very finely pleated forms, a by-product of an intricate three-dimensionally structured, tie-dye process. Resulting work was really quite fragile, which also made it difficult to exhibit as a three dimensional form, let alone define in a performative sense. The work on stage would have perished. Kinetics was an inherent characteristic of each piece and I needed to explore new ways of presenting and exhibiting the work as well as furthering development of the work itself..."

Unable to explore the kinetic potential of the work - "the characteristics in the body of this... the working of it, the happening of it, that inside-outedness of it, that sort of fourth dimension in it, the thing that you can't see, but it has?" - or the movement of the body

within the work; concerned with becoming stagnant; and frustrated by being limited in the number of ideas she could pursue while still maintaining the quality of the work, PractA moved towards digital practice. She knew visually and aesthetically what she wanted to achieve, but at that point had no idea of the ‘palette’ of tools she would end up using.

Initial exploratory work in two-dimensions, using software such as Flame and AfterEffects to manipulate video, started to reveal the potential of digital media, but PractA began to realise that to originate work, as opposed to working from existing source, it would be necessary to move to the medium of 3D computer graphics. At that stage in their development – “pre ‘Toy Story’ and ‘Bugs Life’” - 3D computer graphics did not have the tools that users of today’s high end packages such as Alias’s *Maya* take for granted. For a maker with little experience of computers, let alone 3D computer graphics and modelling, to be faced with such a move was daunting: nevertheless, PractA knew that it was the only way in which she would be able to achieve what she wanted.

Although it took time and considerable personal endeavour, PractA has now achieved fluency in what she describes as the ‘language’ of the medium of 3D computer graphics; she now has a palette which allows her to produce work of the quality and aesthetic she requires. Collaboration with a dancer in the motion capture element of the work, and a computer graphics operator, has allowed her to explore dynamic elements and themes within the work relating to “identity through movement narrative”, the communicative aspects of the body moving within a garment:

“A visual conversation or dialogue is evolving in the work, identities are explored through the motion capture. Kinetic reactions between body and cloth are manipulated using absent and present forms in digital space. There are many potential subtexts linked to the movement of material, cloth, fabric which can be drawn out in ‘performance’... viewed in dress in its every day form or function, its presence, walking down a street... there’s something more to it than meets the eye. Clothing can be very communicative and evocative, defining identities... an example being the enduring image of Marilyn Monroe holding her dress down around her knees, in an attempt to stop it from flying up around her body as she is ‘apparently’ caught out by an air duct... The digital arena proffers scope for different forms of visual play, which challenge perceptions formed by our experience of ‘physical’ spatial scenarios, however visual subtlety to this play is key. ‘Special effects’ are easy to use and all too readily recognisable, this is where the ability to ‘craft’ is of value.”

A major advantage of the move to digital practice is the ability to explore a number of projects simultaneously, “to really pursue the ideas as they come”:

“...core technology and tooling that we have developed can be used to support a number of different projects simultaneously, within a range of contexts. And that simply wasn’t possible, in my previous physical practice. The process remains time

consuming, however this is rapidly changing as technology evolves and will inevitably become more intuitive. It is the perception that working processes are instantaneous because the computer is now the predominant tool, but I view it less as a means of speeding up a process, more as a means to facilitate what wouldn't otherwise be possible. It's amazing the difference in viewpoint I now have, evolving new ways of thinking, new concepts for a variety of outcomes, thinking about different audiences. My perspective has shifted, there are almost too many possibilities - an established 'language' crucially assists in retaining a discerning focus. Although very much informed by working with physical material, digital media has broadened my practice both in terms of approach and application... research and in contrast work that is purely creative."

Finally, and importantly, it enables PractA to produce work that it wouldn't be possible to make any other way.

For the other two practitioners in the study, the driving force behind their move to digital practice was less the constraints of material practice, more a growing realisation of the potential of the digital as a medium.

Practitioner B

PractB is a sculptor with a background in installation: his material practice concerned the relationship between an installation and its environment, the viewer's relationship with the installation, and their experience of space. Earlier computers left PractB with an impression of how long it took to do even simple things. Although latterly he had begun to think about using computers in his work, the move to digital practice was not triggered until he saw and experienced work that fellow artists were doing in a school workshop, where they had used CAD to design large installation pieces: "when I saw their work, it just suddenly struck me that there was something to be done here...".

Initially inspired by an experience of 'Osmose', an immersive digital environment by Char Davies, PractB began working with immersive virtual reality, and exploring the emergent qualities of digital media. This practice was transformed by the realisation that digital environments could be dynamic:

"...I don't know why it hadn't struck me, but I just started thinking 'bloody hell, nothing has to be static... it's absolutely fluid what you can do with this stuff'."

His initial work used fully immersive digital environments, viewed through head mounted displays, which responded to the viewer's position; these allowed him to explore the relationship between physical and virtual space, and provided new insight into his previous themes of the viewer's experience of space:

"What was tremendously interesting about this whole process is how you actually started to see your environments through somebody else's eyes, because you could put



Figure 62: (installation)
Reproduced by kind permission of the artist



Figure 63: "Intersculpt", 2001 (immersive environment).
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Figure 64: (interactive/emergent behaviours)
Reproduced by kind permission of the artist



Figure 65: "Maelstrom" (multi-user interactive environment – tracking and projection)
Reproduced by kind permission of the artist

it through onto a monitor, you could see how people reacted... You are seeing through their eyes, and how they dwell in particular places and so on. So that was quite fascinating."

Combining these themes with an interest in the emergent complex behaviours of simple systems has led to his more recent work exploring dynamic real time interaction with digital environments. In his current work a combination of tracking and projection systems allows the digital and physical environments to merge: viewer-participants interact with and influence the behaviour of digital 'systems' by moving in physical space; their movement through the space acts as the interface to the digital environment, the 'cause' resulting in the effects in the dynamic digital environment:

"I'd always tended to think about things in relatively static terms, in spatial terms, and suddenly the notion of actually dealing with things to do with time, dynamic form, kind of things like that... when I showed you that stuff to do with the particles and the flow and stuff like that, that's all it's moving towards now in some senses, there's a kind of richness that can come from that dynamic aspect of the work."

PractB's work with immersive digital environments, particularly his more recent work with tracking and projection systems in interactive digital environments, has allowed him

to extend the themes from his material practice relating to space, and the body's relationship to space, in new and unforeseen ways.

Practitioner C

PractC is a sculptor whose practice concerns the nature of three-dimensional form and is characterised by a subjective approach which has run through much of his work since the beginning:

“I was fascinated by producing objects the like of which one hadn't quite seen before. In themselves they were then kind of problematic, and although I couldn't articulate it then, and possibly didn't quite fully understand what I was dealing with, in some ways, really I guess I was questioning the whole nature of representation and symbolism. And somehow, from those very early beginnings of revealing a possibility to explore the physical world, without a known outcome as such other than the object would somehow be finished to your satisfaction, whatever that means.”

Early experiences of computers left PractC with initial reservations as to the value of using the digital as a medium; however he did use a computer as a tool for 3D drawing, to allow him to visualise and plan large pieces of sculpture. It was seeing television documentaries in the late 1970s/early 1980s, just when 3D computer graphics was emerging, that triggered a move towards using the digital as a medium rather than solely a tool: he recalls “being just spontaneously excited about those possibilities initially”.

PractC produces his forms through working directly with 3D modelling software (3D Studio Max) as his medium. Taking the torus geometric primitive as his starting point, he engages with it directly as one might a physical medium, manipulating parameters and modifiers in a speculative way, exploring the possibilities inherent within the mathematical and geometric properties of the form to discover three-dimensional forms which are geometrically complex, although they can be deceptively ‘simple’ visually. This approach “makes possible entities that I don't think that I could conceive of by any other means”. This is an important feature of his work, and one which links to the subjective approach linking both his digital practice and much of his previous material practice:

“I want to see the like of which I've never seen before, and to respond to that, to try and glean from it some kind of understanding. At whatever level, I mean whatever understanding is, and for what that might mean.”

The move to what PractC terms the “cyber environment” has allowed him to extend his material practice in a number of ways, in particular by allowing him to discover/create ‘new orders of object’, forms that he could not have produced in the physical environment, with any other two- or three-dimensional media: “for me it offers, in my

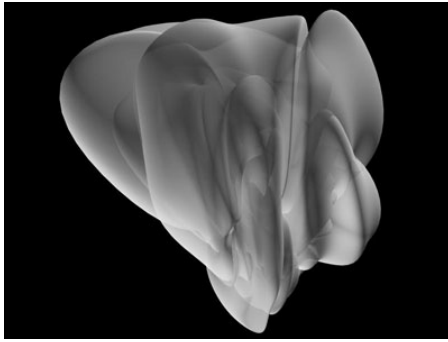


Figure 66: "Dayton 01" (cyber object)
Reproduced by kind permission of the artist

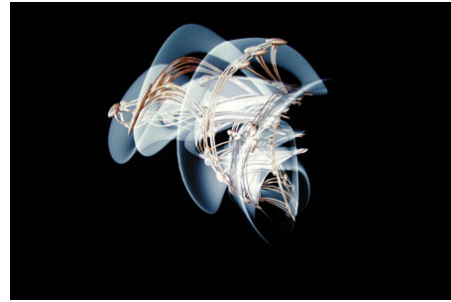


Figure 67: "Y-13-1" (large format print)
Reproduced by kind permission of the artist



Figure 68: "Shoal", side view (rapid prototype)
Reproduced by kind permission of the artist



Figure 69: "Geo_03" (bronze cast)
Reproduced by kind permission of the artist

own discrete discipline, tremendous possibility in terms of potential exploration". PractC's claim to a 'new order of object' arises from the critical dependence of these objects, and their aesthetic, on the 'cyber environment' and from the ability to "encounter the unexpected" within this environment generated by his spontaneous explorations within the software, through direct manipulation of geometric primitives.

"That facilitates something the like of which we've not had before, therefore I think I'd be prepared to call it the potential for a new order of object. If you produce a milk bottle with a 3D modelling application on a stereolithography machine then that's patently not the case, but if you produce an object the like of which hasn't been really possible, then I think it's fair to say that there is an element of paradigm shift happening within that."

PractC's move to digital practice has also allowed him to explore new forms of output – new ways of 'manifesting' the cyber objects, including large format high quality prints, 'cyberkinetics' (moving forms like animations), integral images (a form of autostereoscopic 3D image⁶³), rapid prototypes, and bronze pieces cast from rapid prototypes. This mix of digital and physical outcomes has led him to explore, more

⁶³ See Appendix B, *Visualisation and interaction in 3D* for an explanation of autostereoscopic displays

deliberately, the relationship between the two environments on a conceptual as well as practical level:

“...the reflections on the surface of the burnished bronze are exploring the virtual in the actual... So with the highly burnished bronze ones, I’m bringing it up to a mirror finish so that it reflects itself within itself, and that then develops a certain kind of visual ambiguity. One’s not able to quite determine what’s real and what’s reflected. What’s real and what’s virtual within the composition. Now, that’s a very deliberate application of the material in a peculiar sort of a way to generate an effect. I’m also going to give it a black patina tomorrow to emphasise the extremities of the ‘actual’ form and not the reflection within the form...”

For PractC, the possibilities of the cyber environment and the associated technologies he uses are tremendously exciting, and offer new ways of looking at the world:

“...at the moment it’s a little bit like how it must have felt hanging around those cafes by Sacre Coeur, just after the turn of the century when all these exciting artists were kicking around these new ideas of modern art to do with Cubism or Fauvism or whatever- Breaking the mould really in some senses, trying to find other ways through which we can understand ourselves and the world that we live in.”

The digital medium

As can be seen from these examples, the term ‘digital medium’ covers a broad range of systems and technologies. However all the practitioners interviewed stressed that they were not working in a ‘virtual’ medium. For PractA, this is because the term ‘virtual’ (as in ‘virtual reality’) implies simulation rather than origination. Although her work is informed by her previous practice and aesthetic, she is concerned with using the medium of 3D computer graphics to originate work, not merely to simulate real materials. For PractB, the term ‘virtual’ is not appropriate partly because of its connotations in the philosophical context that underpins his work, but also because he is not using the medium to represent the world, but rather as “a way of rethinking the world”. His work draws on the ‘sensible’ qualities of the experience in both immersive digital environments and his more recent work which combines digital and physical environments, which are real qualities, and real experiences. PractC has similar concerns, as the term ‘virtual’ implies a non-reality, but “the cyber... it’s there, you can see it, you can interact with it, it’s certainly real”.

This emphasis on origination rather than simulation emphasises a crucial element of each practitioner’s experience discussed above: their digital practice has allowed them to push the boundaries of their practice in ways that would not otherwise be possible, and to pursue work, themes, and objects that exploit the unique possibilities of the digital as a medium.

Approach

The desire to use the digital medium to originate rather than simulate is reflected in the approach each practitioner takes to the digital medium, whether it be 3D computer graphics, immersive virtual environments, or 3D modelling software. In each case this approach to the medium is in line with (and largely arises from) the approach they used in the physical environment. All of them are questioning the medium, pushing its boundaries, ‘finding its edges’, and crucially, using the qualities it can possess as a medium, not as a tool for simulating reality. This type of approach is frequently in contrast to ways that these media have traditionally been used, or are being used by other creative practitioners, and often results in the digital medium being used in ways other than for which it was intended, or beyond that for which it was designed.

The following sections describe each practitioner’s own way of characterising their approach to the digital medium.

Practitioner A

PractA regards 3D computer graphics not as a means of simulating reality, rather as a medium for origination. Her distinctive approach to this medium – to engage with it, push it, and understand it as a medium - derives from her background as a maker, with its characteristic ‘inquiry about materials’.

“I think that’s what makers particularly have, those that work specifically with material and are really inquiring... an ability to question the aesthetic of the material and how it’s perceived, how it’s used...”

For PractA, this approach to the digital medium is driven by an extensive experience of material practice and knowledge of materials, not with the aim of simulating reality, but because it gives her ‘questions and an enquiry’, aesthetic parameters within a medium which in itself has very few boundaries.

“There are certain elements I’m exploring which are defined by an established knowledge of material. I’m not interested in attempting to simulate this knowledge or convey how it was previously used, however it does provide me with questions, levels of enquiry, aesthetic benchmarks, which guide me through the software, defining certain routes that I don’t think I would consider pursuing or otherwise find.”

This approach to 3D computer graphics leads PractA to push the medium in many aspects far beyond what the computer graphics industry needs or is doing, not just in terms of the 3D computer graphics software, but also in the movement and motion capture.

“we’re pushing use of the technology to a particular level informed or inspired by earlier ‘physical’ process and its effect, which to some extent sets the key challenges relating to the medium. Particularly in terms of altering perception towards it as its potential, is I feel, little understood on some levels.”

This non-conventional use of the medium arises both from her experience of material practice – the ‘questions and enquiry’ she describes which lead her to challenge the tools – but also from the unusual circumstances in which she learned to use the software.

Provided with the opportunity to use the high-end computer graphics software ‘out-of-hours’ in a post-production company, PractA taught herself to use the medium. Whilst very difficult at the time, this ‘liberated’ her to engage with the software as a medium in her own way, rather than being taught ‘the’ way. While beneficial in many ways, one drawback of this approach was that, as she hadn’t learnt the conventional ‘language’, communication with industry users of the software was difficult.

“I wasn’t learning software in a way that would be used in a commercial environment, I wasn’t learning ‘their’ language. Left to my own devices, I found my own methods and would be asked about my process ‘oh, did you do that using this ‘path’, that ‘effect’... And I actually wouldn’t really know what they were talking about, because I hadn’t been taught use of the software in that [way]. I wasn’t using a lot of the software processes that they were using, which were often specific ‘special effects’ predominant in advertising at the time, I very much defined my own way, so... in fact, I had no means of retelling the process to operators if I wanted to. In some respects this was an advantage. I suppose in true research terms, it could be argued that this was maybe the wrong way to go about it, there are many reasons why I chose to work this way but just in terms of liberating myself from evolving convention in terms of software use, in order to develop use of the medium, this particular one being quite cumbersome, I felt to work intuitively was the right thing to do.”

These two aspects – bringing what PractA terms an aesthetic ‘vocabulary’ from her material practice, and learning the software outwith industry conventions – result in a very different perspective to 3D computer graphics to those within the industry who have learned to use the software as a tool, tending to accept that ‘that’s the way it works’, rather than challenging why it works that way. Today’s high end 3D computer graphics packages, such as Alias’s *Maya*, are large and complex pieces of software which if you don’t have reason to explore (e.g. from knowing what’s possible with other materials), then you probably won’t:

“Generally a computer graphic operator has learnt how to work with software in a certain way, you can improve on that working process with use and with some relevant elements of programming. But the operator isn’t necessarily the sort of person that sits and really questions the construction or capability of the software or its interface for example, just as they are unlikely to have an idea about materials, the ‘surface’ of an object, visual perception of a material and what this communicates to the viewer. I suppose the connections that I’m making are because I work from a totally different premise. If 3D software packages were rewritten from the perspective of the maker, jeweller, glassmaker or painter for example, I’m sure it would be

possible to devise a very different, more intuitive interface or working environment, so that the digital working process were more accessible and interesting to a broader sector. However most of these tools have been developed with very different industries in mind.”

Even within the arts, PractA’s approach of engaging with the digital as a medium is very different to that of many practitioners who emphasise conceptual concerns:

“...few practitioners/artists connect with the digital media in a material sense. Most explore digital media from a conceptual perspective working with the mechanics of the medium and its creative potential through the web, live interaction, using tools in terms of location, communication, audience etc... As a maker there are of course conceptual considerations, the working process however is predominantly driven from an overall aesthetic premise of engaging with material. In discussion with a writer from a digital magazine there was great curiosity expressed regarding the ‘craft’ issue in digital terms as an emerging practice and how digital media, in this context, is being aesthetically challenged...”

The approach which PractA uses has been particularly important in enabling what might normally be perceived as software-imposed limitations or restrictions on the work to lead to new ways of achieving things, and new directions within the work:

“Early on, working with 3D software in particular, it was essential to bypass what appeared to be enormous technical and aesthetic limitations, compared to established ‘physical’ process... to access new levels or ‘mind spaces’ to work/think within. This directive generated such interesting results, that in the form of an acknowledged approach, I would add it to the ‘palette’. Consequently there are working methods currently in development which I’m convinced would never have evolved had we not had those restrictions early on. What could be perceived as ‘restrictions’, to what’s normally known. There is value in being challenged by the medium as well being in a position to challenge the medium, work against or beyond convention, this opens new doors, particularly in the digital realm which on many levels is still uncharted territory... It is important to view the software as a medium, a ‘material’ that is malleable with the capacity to function beyond perceived understanding... in this case established knowledge is useful.”

Practitioner B

PractB’s approach to the digital medium is also based on principles from his material practice: to question the material, find out its limits and exploit those limits; what he describes as ‘truth to materials’. Within the context of his work with immersive virtual environments, while there may be no physical materials involved, nevertheless there are aspects of materiality within the medium:

“obviously you might question the notion of material, so you might talk more in terms of sensuous qualities or a sensibility of digital media. But the point I’m in now, I’d really apply the same term to material things as much as things that derive from digital sources. D’you see the generic way in which I’m trying to use that notion of truth to materials?”

He continues to explore the themes from his material practice, enhanced by the possibilities offered by the digital medium. Despite the differences in the two types of media, PractB finds that his enquiry in terms of space, and the viewer-participant's experience of space, is not that distant from his material practice:

"...those sorts of events, I'm looking to involve people with them within installation environments, but now I've obviously got the power of a dynamic system to play with those things. And it's not the same as film, because you can involve the body. And in that sense it's very sculptural, for want of a better term. I don't see it as being removed from the stuff that I used to do- it's just slightly different and so I work with it slightly differently, but it doesn't mean to say that the underlying principles of say, something roughly described as a truth to materials doesn't lie behind it."

He is not concerned with using the digital medium to reproduce the physical world, rather he aims to explore "those emergent qualities that come from it, the dynamism that's involved in all of those sorts of things. Those are all absolutely real qualities that you're working with". He is particularly interested in exploiting unintended effects, or characteristics of the environment that might conventionally be perceived as problems or limitations. He describes an example from his practice, where 'performance limitations' led to a new area of work:

"...do you remember when the streaming video format first came out? You'd get these incredibly compressed files... When it's blown up, like I had my daughter, and bits of her dissolve in and out of the background. And like that notion I was talking about a body, and the coherence of a body. You've suddenly got this being played out visually. It's not a representation, or anything literal, but just this quality of these things going on within an image. And that's actually quite low-tech. It was designed in order to punt video across at low data rates. And it's like, look at that, look what you can do with these very simple means... You start realising, well, there are simple means of doing things."

This approach, making use of what PractB describes as 'minimal means', often produces work which is simple and elegant, qualities PractB admires in this area of practice.

"...this is where I think the type of work that I'm doing wants to be heading, very kind of minimal qualities, to do with light, where the richness of the piece comes out of the quality of the things that emerge, the dynamic aspects of the system."

He finds his approach contrasts with the 'won't it be good when' attitude of many practitioners towards digital media:

"...in terms of aspirations, like we want all this super-real stuff... won't it be good when we can have digital objects which behave like physical objects and stuff like that... You miss out on all the interesting stuff that can be done there and then, because it's always about aspiration. And that seems to me always the danger of it, and that's particularly I think one of the aspects to do with that notion of a digital ghetto, is that people get tied into those aspirations, and it's always tomorrow when it's gonna be better, and they miss out on the very stuff that I'm talking about notions of truth to materials, about what this stuff can do. All the things which informed them

as an artist, are suddenly sshh cut free, because you're looking to tomorrow, you know. Like it's gonna be better, it's gonna do this, it's gonna do that."

Practitioner C

PractC takes a similar stance to PractA and PractB: he is not using his chosen digital medium as a means of simulating the 'real' world', or of representing objects which have been predetermined, but is engaging with it as a material, playing with it to see what forms and effects emerge. A speculative, exploratory approach is fundamental to PractC's digital practice and, as discussed above, relates back to much of his material practice. Key to this approach is his very direct, immediate, spontaneous, free, intuitive, and playful way of working with the software:

"I've got nothing in particular in mind as an outcome. I could, in the next few minutes produce what I considered the best piece of work that I've ever produced, or I might not, you know. And all I do is I just fiddle with the dials (laugh) and watch what happens, you know. So, it's very much a sort of suck it and see."

Unlike the conventional use of 3D modelling software, PractC is not treating the geometric primitives within the software as abstract entities, mathematical representations of physical or imagined forms, but as material to be worked with, manipulating the primitives and modifiers in the software to explore the possibilities within this medium:

"I go to my software, I pick extended primitives, I pick a torus knot, and I generate a torus knot... Now, one of the wonderful things about a torus knot, is you can actually affect its P and Q factors to change the numbers of windings. Now, to be able to do that in real time... You know, that just happens to be 17.25 by 8.5, windings this way and that way that causes the various segments within the torus to align in this particular way. If I increase the number of segments... that's giving us something else. Now, that last one was kind of curious... But just look. I mean, this is where I'm using it as a material."

The ability to work with the 3D modelling software this way is supported both by an interface which, while it may be relatively complex in the context of building models of predetermined objects, supports this style of working - "it's not hard, you know, isn't difficult to actually interface with the software" - and by having a computer system with sufficient processing power to respond quickly enough:

"The tremendous facility now that's afforded with real time graphics... allows you that possibility to interact with it in a very immediate and spontaneous way. And because I'm working directly, it helps the flow of that direct, reciprocal thing that's happening between me, and what I'm doing."

Central to PractC's approach is the desire to encounter the unexpected within the medium. This leads him to not only use the 3D modelling software in ways not normally

considered, but to push this medium to its limits and extend its possibilities as a creative material:

“After working with it for four years, I realised if you went into the negative, it squeezed it this way instead of that way. And that for me was a little discovery that, whoever wrote this software didn’t expect someone like me coming along and distorting it to the extent that I do.”

PractC’s experience of engaging with the cyber environment is one of excitement, discovery and wonder, but so far it is shared by few sculptors:

“It’s an adventure, for me, really and I’m really truly amazed that there are so few of us who have actually engaged with that cyber environment. You can almost count on one hand the number of serious sculptors in the world who are using this technology. But of course some of them are using it and not telling us. ‘Cause I can spot it, in some artists, that aren’t saying how they’re arriving at the forms that they’re producing. Fairly major artists, and I can see the traits of the computer aesthetic. I can see the computer aesthetic in the work, because I know the generic tools that are there to manipulate the medium.”

While PractC’s approach is certainly speculative and exploratory, as will be discussed more fully later it should not be misconstrued as arbitrary.

“It’s pushing my art form to its edges, and I guess that’s what’s always fascinated me about what I’ve been doing, whether it’s in fact with a bag of clay, a lump of wood or the cyber environment”

Role of medium in practice

From the above descriptions, it is clear that the three practitioners’ approaches are broadly similar: they are all actively engaging with the medium, and using its inherent qualities, rather than using it to represent or simulate reality; they are all exploring the digital medium in very different ways from its conventional use; and what might normally be considered limitations actively contribute towards their developing practice.

Yet although there are strong similarities, there are also differences. Some of these arise from the different digital media that are being used, or because the practitioners, in a sense, are all looking at the digital medium differently because of where they’ve come from. Yet there are more fundamental differences than this between practitioners, which concern the role of the medium within their practice, and relate to whether their approach could be characterised as a dialogue *with* or *through* the medium, and whether the medium is closely identified with the ‘self’, or viewed as ‘other’.

Practitioner A

PractA describes her relationship with the medium, and its role in her practice, using strong metaphors of language. Her approach to each medium she uses – questioning it, understanding it – is related to the idea of becoming familiar with it as a language: how it works, what its characteristics are, what you can do with it, what you can say with it. Part of learning a language is learning or becoming familiar with its vocabularies – those elements of it that give it meaning, flavour, and nuance (in a sense as distinct from grammar, which gives it its structure):

“Direct contact with physical materials enforces intuitive enquiry, driven by the hand and eye, directly manipulating the media, which takes in or assesses the cause and effect, i.e. the vocabulary of the material in any one particular set of hands.”

Each medium yields different vocabularies: in PractA’s digital practice these arise not only from the 3D computer graphics software, but also from collaborating with a dancer whose movements are made available to the digital environment through motion capture:

“...how the pieces are driven by human movement is key. The ‘choreography’ has been considered in a very different way to how it would evolve performatively, it has to respond to the capabilities of the software for example. There have been limitations, which have proffered a new vocabulary of movement, affecting the ‘cloth’ form in unusual ways kinetically. Different participants provide different movement and indeed identities through the gesture and ‘characteristics’ that are apparent when placed within the digital garment form. The contribution this element makes is one that I have only begun to explore.”

This aspect of language is to a large extent defined by the person using it. Choice of vocabulary is one of the ways in which, as individuals, we each make language our own. Another aspect of language defined in relationship to the individual is the notion of ‘voice’, a term that PractA uses in describing her practice. Far more than style or technique, ‘voice’ relates to personal, individual expression. While ‘language’ and ‘vocabulary’ are defined in terms of a medium, this aspect of practice runs through and across media:

“...the sensibility that one has as a maker, a consistently recognisable ‘voice’ that evolves during one’s practice, a fluid line of connection between all you produce over time... Makers’, painters’, sculptors’ work is generally identifiable regardless of the medium or variety of media employed in pursuit of their practice...”

Another metaphor PractA uses for the medium in her practice is that of the painter’s palette:

“...as I accumulate and define processes, tools, concepts, aesthetic values, I tend to define these collectively as a ‘palette’. I do feel literally as if there is a palette to hand filled with a range of gooey squishy colours, splurged and being mixed, the paint colours slowly changing as they become mixed. With the digital medium, I wonder if

this is to counteract what is in fact quite a rigid interface, have I used the term and the visual that it conjures up to dupe myself into believing that the environment I currently engage with is more fluid than it in fact is? Or is the visual metaphor in fact a more fundamental and flexible bridge to what would otherwise be a rather rigid working environment?"

Similarly to the notion of ‘vocabulary’, a painter’s palette is defined in its relationship with the painter; a painter selects a palette from a much wider range of paints at their disposal. PractA’s development of her ‘palette’ within the medium of 3D computer graphics is informed by her previous material practice, not because she is concerned with simulation, rather because it gives her what she describes as ‘questions and an aesthetic enquiry’ in her exploration of the software. For many people who approach the software without such “an enormous bank of knowledge that makes something”, the experience can be bewildering.

“...the working parameters of function and possibility within certain 3D software can be vast. Without experience of the tool and an objective, engaging with the medium can be overwhelming, it’s not really possible to imagine the potential depth of the tool.”

The metaphors of language PractA uses when talking about her relationship with the medium, and its role in her practice, might convey a strong impression that PractA has ‘something to say’. Yet her process is not driven by an explicit aim or a predetermined outcome, but is tacit and organic, where the work evolves:

“It is hard to explain an essentially tacit process. I have a passion for the work, particularly the elements that I have less control over, such as the movement, which will contribute more and more in the future to the narrative of a piece... That becomes a focal point to producing the work, guided by a fine line of what ‘feels’ ‘right’ or ‘wrong’ which defines much of the ‘making’.”

In PractA’s approach, a close relationship between the practitioner and the medium is very important to the development of the work. This can be seen from this description of her process:

“There’s an element of beauty in the work... beauty is a very a subjective term and philosophically loaded but the pieces do have this quality on completion, although it is not something I consciously aim to achieve... And I think that’s not only the tacit knowledge issue, for me it’s also the tacit aim. I’m not sure if I can really define this, it is complex and further complicated by combinations of physical and digital languages that may be misinterpreted, perhaps require redefining. Ultimately I think I initially work very organically, playing with the medium, pushing and pulling at it almost in a very physical way until the journey is clear, driven usually by the ‘feeling’ described earlier of what is ‘right’... Guided by form, colour, movement, structure and the effect of this combination of elements... The work belies perception of the medium ‘computer graphic animation’, which is generally driven by a commercial aesthetic... This wasn’t necessarily an aim but it is interesting to have an effect on a medium and how it is perceived.”

Although 3D computer graphics software has an interface which invites descriptions such as ‘grey’, ‘linear’, ‘rigid’ and ‘boring’, which contrast starkly with the above description of her process, nevertheless PractA found that through familiarity with the medium, and with her “prior knowledge” of the “fine line of what ‘feels’ ‘right’ or ‘wrong’” from her material practice, she did achieve a sense of ‘immersion’ (“when you really forget all of those menus”) characteristic of a maker’s relationship with their materials, with this medium.

“Again, I think that is also due to my prior experience of physical material... I know instinctively what I’m looking to achieve, driven by a ‘feeling’ and ‘effect’, which comes through familiarity of the medium.”

Practitioner B

PractB’s relationship with his chosen digital medium appears to be qualitatively different from PractA’s. PractA sees her relationship with the medium in terms of language, making it almost part of herself. In PractB’s work and practice, the medium’s role is to reflect back our ways of seeing, ways of thinking, ways of experiencing, to make us aware of our unconscious assumptions about the world. In this way PractB appears to relate to it as something ‘other’, a means of doing “interesting things” and of “rethinking the world”.

This role which PractB ascribes to the digital medium, or more broadly new technology, has two aspects, one outward-looking and one inward-looking. Firstly, it enables him to challenge the viewer-participant’s assumptions about the world; secondly, he believes it must challenge the nature of an artist’s practice. Both of these aspects relate to the indefinite nature of digital media – their ability to be many things - which allow them to be used in very different ways, and for very different purposes. A digital medium can be used in a representational or simulatory sense: a practitioner may want to use it to represent reality, or to be able to work with it in the same ways that they would work with physical materials. Alternatively, it can be used in the way that PractB approaches it, exploring and exploiting its inherent qualities and limitations, very much in the spirit of ‘truth to materials’.

In the first of these approaches - the desire to simulate reality through representation, or through devising systems whereby it is possible to work with digital media in the same ways as we can with physical media - the digital medium embodies our assumptions about how we see, experience and relate to the world. In the second of these roles, it has the potential to reveal our assumptions about the world, and to allow us to rethink our

experience of and relationship with the world. Virtual environments, for example, can allow you to experience things it would not be possible to experience in the physical world such as the ability to move through objects that appear to be solid.

“If you play with that quality of being able to pass through things, it becomes quite physical. You almost feel things when you move through. It’s probably some interesting bit of psychology going on there to do with assumptions, but it’s interesting that you disrupt the assumption by being able to pass through it, and so it becomes a physical quality anyway. So the notion of reality and stuff like that’s not really an issue, because the quality of the experience is still real, and it’s assumptions which are being overturned. I think often that’s what good practice does, is it challenges one’s assumptions about the world. And that’s what’s interesting about using these dynamic systems, you can look at things in other ways...”

Much of PractB’s practice concerns our embodied relationship with and experience of space, and with the world. Disrupting these “habitual relationships” with the world (such as playing with our experiences of absence and presence, above, where absence is made physical) allows PractB to reveal and challenge our assumptions about it, providing us with new ways of looking at the world:

“You look at some of the interesting assumptions that are made about qualities of experience, and tinker with that. That’s why I think this thing about challenging assumptions is interesting as well, because so many of those habitual assumptions stop us seeing the world. And you think about major experiences in your life, it’s normally when those assumptions are overturned and you see the world in a new light.”

PractB has found this true in his own practice with digital media:

“I’m far more interested in some ways in what’s going on with it, than I ever was before. That’s doing myself down, I was very interested in it before, but- I can’t quite put my finger on how to describe it, but it seems to reveal more of the world than my work used to. I think my work used to reveal more of my assumptions, whereas this stuff seems to be fundamentally about questioning assumptions and trying to really push beyond habitual relationships.”

He has reservations regarding practice which views digital technology as a solution to existing problems or concerns, rather than as a medium in its own right. Whereas PractB is exploring the possibilities inherent within digital media to question assumptions,

“... they’ve got a set of assumptions and strategies that work in one particular field, and they are expecting to move them across to another, and to do things quicker, to do things slicker, all those sorts of things using digital means.”

PractB’s view of the role of the digital medium is quite different:

“I’ve had some students who’ve come in and they’ve thought that new technology is the solution to their problems, whereas actually, it’s the thing that precipitates the crisis, because they’ve got to examine the core of their practice and how that relates to this technology, rather than being a package of solutions which solve their problems. So it’s not a bolt-on. People think it’s something that’s gonna bolt on and

change things or speed things up. It's actually something I think which needs to radically challenge assumptions and transfigure things in that way."

In comparison with PractA, PractB's process does not seem to be quite so closely related to his relationship with the medium - there seems to be less explicit focus on process, more on content, or 'intent' - but he does nevertheless have a process in which the medium is allowed to play a important role: firstly in the sense of 'truth to materials', where he is exploring and exploiting the inherent qualities and limitations of the medium; secondly, where he is developing work which uses the emergent qualities of dynamic systems, where complex behaviours can arise from interactions between individual items with simple behaviours; and thirdly, where although he has certain objectives in mind for the work, he is open to risk and discovery during the process. This can be seen in his description of his process of developing code, which he likens to his previous experiences with carving. Software packages tend not to address this well, because they are 'risk averse', which is one of the reasons PractB likes the coding process:

"if we go back to the thing about carving, you'd be down there, you'd be doing your carving and what have you, and then you'd want to assess your work, so what do you do? You stand back and you look at it. So when you think about running code or writing code, there are certain objectives you have in mind when you're writing the code, and you want to look at what it does, so you run the code. It's not as if the two are so intimately bound that you cannot separate them. Do you see what I mean? There is some distance between the activity. And when you get used to working with code, you're getting an idea of what's gonna happen with something, and how things ought to feel, you know? There's a certain degree of experimentation. Much in the same way as when you're kind of going to bend a piece of steel or you've got to split a piece of stone or you're gonna do this or you wanna do that, you don't know exactly what results are gonna occur. And part of the joy is actually doing it, and seeing what does result. Now, that's what's frustrating I think about a lot of packages, is that because they want to reduce the risk involved with certain things, and they want to take away the effort involved with certain things, you get very predictable results. So you can look at some student's work say, and say, they've used this PhotoShop filter or they've used that PhotoShop filter, or there was a lot of criticism about the generic feel of a lot of sculpture that would have been developed out of CAD."

Practitioner C

For all three practitioners interviewed, the medium plays a significant role in their processes, yet its role in PractC's practice is again subtly different from PractA and PractB. PractA's relationship with the medium is one of language; PractB's one of challenging assumptions. But PractC is very definite that he 'doesn't have anything to say'. He describes his process as speculative and disinterested: he's not asking questions, or looking for answers. Rather,

“I’ve always seen myself really more concerned with the business of exploration and discovery. Rather than representation, interpretation, or translation. Those things involve, somehow language very much more, and language is something that bothers me. Maybe it bothers me initially because I’m dyslexic and I have a mistrust of words, I have just as much a mistrust of numbers as I have of words because somehow you can do anything you like with them. Perhaps you can do anything you like with all media, it’s somehow, I guess trying to get beyond that to make some kind of connection with something that for me goes very deep - it’s somehow beyond language.”

This defines the medium as ‘other’ rather more markedly than PractB. In his subjective explorations of the medium, with its emphasis on discovery rather than invention (“you don’t have to invent what you discover, you simply find it in the world. Whereas to invent it you would probably need to have a purpose, some question to resolve in some way”), realisation rather than recognition, PractC sees himself not as looking for something specific, but responding to things he sees, not giving meaning through creating objects, but deriving meaning from the objects he finds and brings into being through his explorations. This sense is particularly strong where he describes his pursuit of ‘objects the like of which haven’t been seen before’, and the notion that they are somehow waiting to be found:

“...it’s just really the joy of coming across something you’re pretty convinced hasn’t been encountered by anybody else before, and just simply saying ‘Look at what I’ve found. Make of it what you will’.”

This position is reinforced by his reluctance to predetermine the outcome, rather exploring the potential of the material, to “relieve myself of a certain responsibility for making choices”. PractC is happy to work within and explore the possibilities of things that other people have determined, and in this respect, likens working with this digital medium to working with found material in the physical world.

“...I treat [3D Studio Max] in the same way as I would treat a piece of found material in the world. Because I don’t want the responsibility to pre-determine. I don’t mind working with pre-determinates that others have specified, and within that exploring possibilities, but I don’t feel that I want to take the responsibility and add something to that... it just perhaps brings something into the equation that I don’t actually require, and it would be cumbersome if I had to justify the inclusion of something in particular, rather than perhaps choosing from what’s already there”

This ‘otherness’ of the medium, together with his speculative, exploratory and responsive approach, defines the reciprocal relationship between him and the medium which is fundamental to his practice, and to the form of the work which is, in a sense, not created but ‘realised’: “wrestled into being” through working with the medium. This distances his practice from the criticism of being purely introspective and self-indulgent:

“However, whilst it might be seen by many as some sort of masturbatory type activity, some sort of self-satisfaction, I maintain that that’s not the case, because masturbation’s a completely introspective activity. What I’m involved with here has an external element which is to do with a reciprocal exchange, interaction between me and the medium. And, through exploring that, it’s revealing to me, often the unexpected.”

His spontaneous way of working, supported by the responsiveness of this particular digital medium, allows him to generate many iterations or explorations from which the work evolves. Like PractA and PractB, often it is when the medium ‘breaks down’ in a conventional sense that interesting possibilities are revealed. But perhaps more than for either PractA or PractB, the medium plays an immediate and crucial part in PractC’s practice. The torus geometric primitive within the software provides him with a foundation, a secure starting point from which he is free to explore. His work is realised through direct interaction with this medium, and is the result of what he finds there:

“I know, although I’ve not seen it, that there’s a great deal more waiting for me in there, as it occurs within that spontaneous act of engaging with it, very much in some senses a playful kind of a way. Sometimes at the end of a fruitless evening of struggling away modelling, I just grab a bunch of vertices in an object and delete them to see what happens, and sometimes that serendipity aspect throws up something really quite unexpected, that invariably isn’t quite acceptable. You need often to tweak it to bring it in within the bounds of your own sensibility.”

Of all three practitioners, PractC’s approach is the most open-ended. Both PractA and PractB have an objective in mind, albeit tacit, whereas PractC’s approach is defined around the ability to reveal the unexpected.

“I have a design on the notion of producing another form the like of which I haven’t seen before, by the end of the day or by tomorrow or next week or however long it takes, there is a desire to want to encounter something there. But I can’t for the life of me see what it is, it’s not like I have a vision.”

But while his approach is speculative and exploratory, it is not arbitrary: “Whilst on the one hand the immediacy and the spontaneity of possibility within the cyber environment makes it easy, at the same time that makes it very difficult, because anything won’t do”. As what ‘will or will not do’ has not been explicitly predefined, PractC’s process is one of ongoing evaluation – “taking stock” throughout the creation of a piece of work – not against specific criteria, but guided by a sensibility of what is ‘right’, the resolution of what PractC describes as ‘cognitive tension’.

“And yet there’s something about it that’s niggling, that I guess is certainly what Peckham refers to as cognitive tension. And it’s not until you relieve that tension that you’re somehow in receipt of an understanding of the meaning of what it is... You somehow feel that it’s not right. What’s not right about it then? You know, what is it about it? And that goes beyond logic for me...”

Related to this sense of going ‘beyond logic’ are tacit ways of knowing associated with making practice, the ‘thinking with your hands’:

“it’s not an automatic, involuntary activity like an instinctive response to something is - it’s considered. You squeeze it this way, you squeeze it that way, you look at what you’ve got. You then assimilate what you’ve got and you determine a further outcome beyond that in some way...”

Underlying this sensibility is PractC’s requirement for coherence in the pieces he produces: “that coherence indicates to me that I’ve included all the bits that are necessary to it and not included aspects of information that are irrelevant to it”. As his work concerns the exploration of three-dimensional form, it is the form that must satisfy his criteria of coherence within the piece. In his digital practice, working with the ‘generic primitive’ (currently the torus form), provides him with “the coherence of a logic”, even when he produces forms that, produced by other means, would not meet his criteria: aspects that would be arbitrary in other circumstances are the result of his manipulation of the underlying mathematics and geometry of the objects, and are therefore acceptable:

“What I find absolutely fascinating is, how the geometries behave in the cyber environment... {discussing example} I’m fascinated by it, because, if I were carving this or modelling it, I wouldn’t put that bit there, and I certainly wouldn’t have put this subtle little element of form here. Or maybe this change in plane here... Because it would be arbitrary. I might choose to, say, put another bump on there, but what for? I couldn’t do it- Unless I had good reason. By good reason I mean if it made sense, I mean if it felt right, I could put one there, but I wouldn’t have put these bits where they are, is what I’m saying. [And do you think you’re happy with where they are, because it’s true to the geometry?] Absolutely. It makes a sense.”

The realisation of a digital object into physical form, through rapid prototyping and casting in bronze, adds a requirement for coherence on that level as well, adding another element to the work.

Comparing material and digital practice

From this examination of the working processes of these three practitioners it is clear that, in all cases, their approach to the medium in their digital practice is in line with (and largely derives from) the approach they used with physical materials. This is not to imply that they use similar techniques in both media, but that their overall approach to the medium is consistent across both.

One of the principles underpinning the method for this study, and the thesis research overall, was that insights could be drawn from the comparison between the practitioners’ material and digital practice. These might have explicitly come to the practitioners’

attention through their move from material to digital practice, or be things that they may not have been aware of, but which can be inferred from their accounts of practice, or revealed by the types of comparison made during this study.

My original rationale for this element of the study, as described in Chapter 4, *Difference as a means of enquiry* was based on the perceived similarities and differences between the two environments. It proposed firstly that in many respects the indeterminate nature of the digital medium (its ability to be many things to many people) would make it an ideal environment for delving deeper into the nature of this relationship, by examining the ways in which people choose to use it; secondly, that because it typically is viewed as being less immediately intuitive to use, this should bring to the foreground aspects of practice which might otherwise remain unseen; and thirdly, through this comparison, it would be possible to dissociate some of the ways in which design practitioners work from the physical artefacts that they use, and to gain insight into ways of working and knowing that are not embodied in the material context of the real world (although the significance of a context is recognised).

While the comparison between material and digital has undoubtedly borne fruit, findings from this study suggest that it is necessary to examine more closely the assumptions behind this rationale, regarding the nature of the media.

The nature of material and digital media

Characteristics conventionally attributed to the digital medium (or at least those attributes which may be most immediately apparent) are immateriality; intangibility; the need to work to a large extent with abstract, formal representations; working at a distance from the 'real' world; and freedom from material constraints. For example, digital media such as 3D computer modelling and animation software require, at least on first examination, users to be very explicit when creating objects, working with geometric representations and operations. Material practice, on the other hand, is frequently regarded as 'hands on'; rooted in physical materials; with a concrete and intuitive approach marked by a close relationship with the materials.

However, the descriptions of the working processes of the three practitioners above indicate that a medium's characteristics cannot be derived from the medium in isolation but are, and must be, defined in relationship to the practitioner. For example, geometric primitives in 3D modelling software are normally regarded as abstract entities, but PractC

treats them like materials, albeit with mathematical rather than physical properties, manipulating them in a direct, spontaneous and intuitive way. This way of approaching the software is possible because he is not using the medium as a representation of ‘real’ objects, rather he is working with the qualities of the medium as they reveal themselves through exploration. Despite requiring considerable effort to achieve sufficient familiarity with the medium, PractA is now able to experience an ‘immersive’ feeling with the computer graphics software she uses, even though it has an interface which is very rigid and linear.

Both PractB and PractC regard the experiences within the digital environment as real. For PractB, digital environments have sensible, sensuous qualities, and the experiences you have in them are perfectly real, albeit ones which challenge your habitual experiences of the world. In PractC’s case the cyber environment, while ‘virtual’, is still real; he now sees little difference in ways of working between physical and digital media:

“I’ve worked with it for so long now that it’s difficult to really identify too much difference in ways of working between, say, taking a bag of clay and pushing it around in a disinterested way, or taking a torus in the cyber environment and pushing that around. The difference is in the difference, because physical materials behave in the way that they do, depending on what you do to them I guess, how you interact with them.”

It is possible therefore to work with digital media in ways usually attributed much more to physical media, so the conventional ways of regarding digital media may seem inadequate. Nevertheless there are differences between the two types of medium which give insight into the practitioners’ working processes. Indeed, in the cases examined in this study, it is each practitioner’s very act of approaching the two media in the same way, and the implications which this has had, which has yielded the most insight.

‘Foregrounding’

There are a number of levels at which this ‘foregrounding’ or ‘distancing’ between media may take place, giving insight into the practitioner’s general practice, approach, and relationship with the medium; or the concerns, content or theme of their work. Table 9 lists elements of foregrounding that have been examined within this study. Many of these have been discussed earlier in this chapter.

One area not previously discussed in great detail is the degree to which elements of their practice have, or have not been transferred between media (as distinct from their actual approach, which was broadly consistent across media). Perhaps the most striking aspect

of this is that not being able to be physically ‘hands on’ with the medium, nor working with physical materials, doesn’t appear to be a big drawback. For PractA, there are certainly elements of her material practice she doesn’t miss:

“... ‘don’t you miss the fabric, or feeling of material in your hands?’ is a common question. In actually working the material physically, the fabric would be wet or in the process of being dyed or stitched.... the physical nature of which I didn’t particularly enjoy ... My hands were often in agony using a repetitive fine stitching process, sitting or kneeling to make work affected knees and back over many years... however I enjoyed the anticipation of the result and the effect of experiencing the final work..... In terms of the process, the cause and effect of physical process is ingrained in my mind and somehow readily transfers itself to the digital experience, contributing to an immersive state...”

Although the medium still plays an important part in PractB’s process, it plays a less predominant role in his digital practice than previously:

“I still like working with materials, and it seems to be something that comes quite naturally when I need to, but it’s not the be all and end all it used to be.”

Touch was an important part of PractB’s process when carving, but in his digital practice the lack of touch isn’t an issue. Moreover, he feels that trying to emulate that aspect of work for interacting with digital media, as in systems which allow you to ‘sculpt’ digital clay using a force-feedback stylus, can be problematic:

“...when you carve a particular form, at a certain point I’d stop using my eyes quite so much and use my hand, so you’d pass your hand over a form and feel where the irregularities were as far as the shape you were trying to achieve was concerned, mark it up as a guide to the eye when you were then using the tool. And also what would happen is the tool gives you a hell of a lot of information by touch through it. Now this is the frustrating thing for a lot of sculptors who come to this stuff, is that it won’t give you any of that information. So something like the [haptic stylus clay modelling] system is trying to emulate that, but what’s problematic about it, is of course you’ve got a series of servo motors, and it’s like a series of magnets and so what does it feel like? It feels like putting two north poles of magnet’s together when you get the resistance, you know? Its- what’s this? And then of course you want to put your hand over something, and you can’t.”

PractC has no particular desire to work with his hands in the digital environment, although he does enjoy it. His experience as a sculptor has made him familiar with mechanical processes, and for him, working with the software is, in a sense, a mechanical process.

“I don’t know that I have any great desire to want to work with my hands as such. Although I do enjoy, and have always enjoyed, working with my hands. When I slice my trees up I use a chainsaw. You know, you don’t actually take it apart with your hands, you use a machine to do it. Mechanical processes are something that I’m quite familiar with as a sculptor. I guess to some extent computer graphics is another sort of a mechanical process, but, it makes possible entities that I don’t think that I could conceive of by any other means.”

<i>Medium</i>	Differences and similarities identified by the practitioner between the two types of media
<i>Work</i>	Differences and similarities in the nature of the work produced by the practitioner in each environment
<i>Approach</i>	<p>Differences which the practitioner noticed in their approach between medium</p> <p>Anything the practitioner finds difficult to achieve in the digital medium that, because they nevertheless struggle to do it, may be considered important to their practice (this does not imply that things which are easy are not important, but it could be argued that things would not be done which were difficult and not important)</p> <p>Alternatively, things which the practitioner finds easier, and things that were not possible before that are now important to their work</p>
<i>Practice</i>	<p>The degree to which elements of practice are transferred between media</p> <p>Elements from material practice that deliberately or unconsciously were brought into digital practice because the practitioner found them lacking in the digital environment</p> <p>Elements from material practice that deliberately or unconsciously were 'left behind', because the practitioner found they didn't want/need/miss them in the digital environment</p>
<i>Other</i>	<p>Observations made by the practitioner about ways that other people work in the digital environment</p> <p>Other aspects of practice that have been brought to the practitioner's attention by an aspect of the medium</p> <p>More general insights the practitioner has received from their move to digital practice</p>

Table 9: Elements of 'foregrounding' in this study

In terms of those aspects of material practice that have been brought to the digital medium, PractA in particular emphasises the importance to her digital practice of her prior making knowledge and her extensive bank of experience, not with the intention of simulating this work, but in terms of informing her enquiry of the medium. All three practitioners are using the digital medium to extend the aesthetic and conceptual concerns from their material practice, and push the boundaries of their practice in ways that would not otherwise be possible.

Conclusions

For each practitioner interviewed in this study, their approach to the medium is in line with (and largely arises from) the approach they used in the physical environment demonstrating that, at least for these practitioners, their overall approach is consistent across media, therefore the basis of comparing approaches between physical and digital material appears to be sound.

The three practitioners' approaches are broadly similar. In terms of the original framework all three exhibit elements of the 'soft' approach: a focus on exploration or

tacit aims rather than explicit goals; an openness to unexpected possibilities; the importance of the medium in their practice and their approach to it - actively engaging with the medium, and using its inherent qualities, rather than using it to represent or simulate reality; exploiting unpredictability and unexpected effects; and using the medium in ways other than for which it is intended, or beyond that for which it was 'designed'; exploring the digital medium in very different ways from its conventional use; and what might normally be considered limitations actively contributing towards their developing practice. Yet a more detailed examination revealed distinct and significant differences between what at first appeared to be quite similar approaches, concerning the role of the medium within each practitioner's practice, and relating to whether their approach could be characterised as a dialogue *with* or *through* the medium, and whether the medium was closely identified with the 'self', or viewed as 'other'. These subtle yet significant differences between practitioners confirm that in the investigation of a practitioner's approach to and relationship with their medium it is necessary to examine carefully a number of different aspects.

The comparison between material and digital environments revealed interesting aspects of this relationship that might otherwise be overlooked. It also revealed the degree to which elements of their practice have, or have not been transferred between media (as distinct from their actual approach, which was broadly consistent across media). For these practitioners, the lack of being physically 'hands on' with the medium or working with physical materials was not significant; other things, such as achieving a sense of 'immersion' characteristic of a maker's relationship with their materials, were more important. The practitioners worked with digital media in ways usually attributed much more to physical media, emphasising the limitations of some conventional conceptions of digital media. Comparisons between practitioners showed that what one practitioner highlights as differences between the physical and digital media they are using may be quite different from what another practitioner would be aware of. These latter points lead to one of the most important conclusions to be drawn from this study: that the characteristics of a medium are not absolute, resulting from notional inherent properties, rather they are defined through a practitioner's relationship with the medium.

The conclusions from this study complement the findings from the earlier studies, confirming aspects of and providing additional insight into the nature of the relationship between practitioner and medium. The next chapter, *Discussion*, draws together the results from the various studies within the thesis. It argues that important underlying

differences exist between individual design practitioners, concerning their relationship with the medium with which they work, and its role in their practice. However, it concludes that while elements of these differences in approach can indeed be mapped directly to a formal/concrete axis, others cannot, and proposes avenues for further exploration.