

Sketching Millinery in Three Dimensions:  
A journey between physical and digital  
spaces

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## ABSTRACT

This doctoral investigation has explored innovative approaches to sketching millinery ideas in 3D using computer technology, the aim being to explore how traditional practices of paper and cloth can be transformed and result in the creation of a 3D sketch book. The research is situated in the field of millinery, a subset of the discipline of fashion. Millinery is core to my design practice, with the distinctly sculptural aspects of millinery designing and making having suitable structural aspects that link to other art and design practices. Millinery had its roots in the handmade and in craft and it is the field of 'model millinery' that has been the context for the study.


Through a series of digital and analogue experiments, I sought to discover how I could use 3D computer technologies for designing fashion and millinery; not just to make hats, but to explicate the sketching and design process that leads to them. Through a process of critical reflection integrated with observations on the practices of others and the literature, I have come to understand that the adaptation of the practices of designing and sketching is not a simple act of transition or translation across mediums. Rather, this study shows, that the practices of designing and sketching are dialogic; there is an on-going exchange between designer, material and method. As one transitions in to the space of 3D digital technologies, the practices of the hand on paper continue to inform and transform what is known, made and discovered within the framework of an evolving practice.

Although computer technologies for fashion exist, these favour production methods and not the creative designing process. Computer software designed specifically for creating millinery as a sculptural and typically one-off artefactual practice does not exist. It is on this basis that the research has drawn on the creative 3D computer tools that are used in the fields of fine art, animation, and engineering and industrial design. The technologies and tools were used in a new context and thereby offered new knowledge to the discipline of millinery.



## Declaration

I certify that, except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

  
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12<sup>th</sup> October 2012

Margo Barton



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## TABLE OF FIGURES

Figure 1 Action research cycles - Zuber-Skerritt (1992, p13).....	6
Figure 2: Designing cycles in this investigation.....	10
Figure 3: big picture mapping space.....	16
Figure 4: Cyclical flow of experiments.....	45
Figure 5: Influences on Drape and Stop Animation (1).....	49
Figure 6: Drape and Stop Animation, stills of garment draping in progress ....	52
Figure 7: Drape and Stop Animation, stills of completed garment for stop animation. ....	54
Figure 8: Andrea hat, digital sketch.....	66
Figure 9: Andrea hat.....	67
Figure 10: Influences on Digital Sketchbook part 1 (2).....	69
Figure 11: Top view, pumpkin hat.....	71
Figure 12: Front view, pumpkin hat.....	71
Figure 13: Sketch on head.....	74
Figure 14: Physical dolly.....	76
Figure 15: Digital dolly.....	76
Figure 16: Influences on Artificial Elegance (3).....	79
Figure 17: Artificial Elegance bonnet: 3D digital bonnet.....	81
Figure 18: Wire frame of Artificial Elegance bonnet.....	83
Figure 19: Artificial Elegance bonnet: digital collage; and pastel sketch.....	84
Figure 20: Artificial Elegance bonnet: 3D Studio MAX R3 render.....	85
Figure 21: Influences on Making with Light (4).....	87
Figure 22: Projection of two photos onto cylinder.....	89
Figure 23: Projection of pastel drawing onto moving fabric.....	90
Figure 24: Sketches drawn live while projecting onto a curved surface.....	90
Figure 25: Influences on Cube Installation (5).....	93
Figure 26: Crinoline bonnet stills from 3D Studio MAX R3 animation.....	95
Figure 27: White cube installation: Still images from film footage, crinoline hats, mannequin, charcoal drawings.....	96
Figure 28: Influences on Sketching Machine (6).....	97
Figure 29: Sketching Machine.....	98
Figure 30: Sketching Machine with ink drawing.....	99
Figure 31: Influences on Lucid (7).....	101
Figure 32: Printed acrylic millinery.....	103
Figure 33: Printed acrylic millinery.....	104
Figure 34: Lets Gather Here, Printed acrylic millinery, Margo Barton for Doris de Pont.....	105
Figure 35: Influences on Digital Sketchbook part 2 (2).....	106
Figure 36: Sketches in Rhinoceros.....	107
Figure 37: Rendered pipe, in Rhinoceros.....	108



Figure 38: Digital sketchbook, tracking in progress, top viewpoint in Rhinoceros .....	110
Figure 39: Influences on Buttoni (8) .....	111
Figure 40: Buttoni initial rendering.....	112
Figure 41: Profile images of Buttoni .....	113
Figure 42: Rendered image of Buttoni .....	113
Figure 43: Hand carved hat block for vacuum forming .....	115
Figure 44: Ian Barker, technician at Otago Polytechnic finishing the vacuum formed Buttonis .....	116
Figure 45: Vacuum forming, and Buttoni .....	116
Figure 46: Buttoni vacuum formed millinery worn with Carlson fashions, iD Dunedin.....	117
Figure 47 Influences on Hatistrophic (9) .....	119
Figure 48: Development of Hatistrophic screen shot.....	120
Figure 49: Hatistrophic, screen save of digital millinery pre unwrap. ....	121
Figure 50: Hatistrophic, screen-save of rendered digital millinery and the unwrapped pattern. ....	122
Figure 51: Still images from the Hatistrophic movie.....	123
Figure 52: Flow of experiments .....	129
Figure 53: Drape and Stop Animation still .....	130
Figure 54: 3D Sketch screen shot.....	130
Figure 55: Artificial Elegance rendered image .....	130
Figure 56: Making With Light, single projection of drawing onto cylinder....	132
Figure 57: The Cube installation hat piece and drawing .....	132
Figure 58: Sketching Machine .....	132
Figure 59: Lucid acrylic millinery .....	134
Figure 60: Buttoni millinery.....	134
Figure 61: Hatistrophic moving image still.....	134

# CONTENTS

## SECTION ONE: CONTEXT

<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
1.1	BACKGROUND TO INVESTIGATION	3
1.2	OBJECTIVES	4
1.3	EXEGESIS STRUCTURE	8
<b>2</b>	<b>DESIGN OF STUDY</b>	<b>11</b>
2.1	DESIGN AS A RESEARCH METHODOLOGY	12
2.2	RESEARCH STRATEGIES	13
2.3	PRACTICE BASED RESEARCH	14
2.4	INVESTIGATIONAL METHODS	17
2.4.1	Experimenting as a Research Process	20
<b>3</b>	<b>RESEARCH CONTEXT</b>	<b>22</b>
3.1	COMPUTER TECHNOLOGIES	23
3.2	FASHION COMPUTER TECHNOLOGIES	25
3.3	SKETCHING AND MODELLING	28
3.3.1	2D Sketching	28
3.3.2	Sketching conversations	31
3.3.3	Modelling	33
3.4	SKETCHING AND MODELLING	35
3.5	CONCLUSION TO CONTEXT	36
<b>4</b>	<b>MILLINERY AND FASHION</b>	<b>37</b>

## **SECTION TWO: EXPERIMENTS**

<b>5</b>	<b>PRACTITIONER AT WORK</b>	<b>47</b>
5.1	DRAPE AND STOP ANIMATION EXPERIMENT	49
5.1.1	Part One: Drape	49
5.1.2	Flow	50
5.1.3	Part Two: Stop Animation	53
<b>6</b>	<b>PRACTICE DISRUPTED</b>	<b>61</b>
6.1	Tinkering	62
6.2	3D	63
6.3	SKETCHING USING COMPUTERS	66
6.4	3D DIGITAL SKETCHES EXPERIMENT	69
6.5	DIGITAL MILLINERY MODELLING	75
6.6	ARTIFICIAL ELEGANCE EXPERIMENT	79
<b>7</b>	<b>PRACTICE INTERROGATED</b>	<b>87</b>
7.1	MAKING WITH LIGHT EXPERIMENT	87
7.2	CUBE INSTALLATION EXPERIMENT	93
7.3	SKETCHING MACHINE EXPERIMENT	97
7.4	LUCID EXPERIMENT	101
7.5	MODELLING AND THE DIGITAL SKETCHBOOK	106
7.6	BUTTONI EXPERIMENT	111
7.7	HATISTROPHIC UNWRAP EXPERIMENT	119
<b>8</b>	<b>PRACTICE REDEFINED – THE CONCLUSION</b>	<b>125</b>
8.1	FINDINGS FROM THE EXPERIMENTS	129
8.2	DIGITAL SKETCHING POSTSCRIPT	136
8.3	MATERIALITY	142
8.4	FUTURE DIRECTIONS	146
<b>9</b>	<b>BIBLIOGRAPHY</b>	<b>147</b>
<b>10</b>	<b>APPENDIX</b>	<b>156</b>
10.1	Glossary of terms	156
10.2	Critical Evaluation Matrix	159
10.3	Reflection using Csikszentmihalyi’s notion of ‘flow’ matrix	160
10.4	Conferences, journal, exhibitions and public seminars associated with this investigation	161



# Sketching Millinery in Three Dimensions: A journey between physical and digital spaces

## **SECTION ONE: CONTEXT**

### **1 INTRODUCTION**

This exegesis outlines the projects and subsequent discoveries made through this doctoral investigation into new ways of conceptualizing and crafting millinery ideas using digital and alternative technologies. The initial aim was to establish an innovative way that I could use three-dimensional (3D) computer-aided technologies (CAD) to sketch fashion design ideas. Within a short period of time the investigation focused on millinery and I as I moved through the project I continued to refer to both fashion and millinery practices.

Although my practice is firmly based in the discipline of fashion and millinery, a conscious decision was made to concentrate on subverting generic design and art software, and not to use any fashion specific software. The method of purposefully reassigning existing technologies with the aim for a new use is a credible form of exploration. It is a practice utilised by designers of processes

and products, for example Gutenberg in the 1400's and the development of the movable type printing process.

In this research I drew on technologies and processes from other related areas of design (industrial design, architecture and engineering) and art practice (animation and sculpture) to enable me to avoid restrictions that I had identified within the fashion specific software.<sup>1</sup> The limitations in fashion CAD were designed to assist with more effective fashion production, however at the same time they somewhat constrained the designing potentials to known design solutions and to garments exclusively. By utilising technologies from other domains as tools for sketching, making and designing millinery concurrently, and by using them in a new context, I have been able to explore and critique the practices of millinery as design practices beyond the realm of hat making and have thereby contributed new knowledge to the millinery discipline.

There are three components to this PhD submission and together these communicate the experience and findings within the PhD investigation.

They consist of:

- Exegesis and associated project catalogue;
- Public presentation; and,
- Exhibition.

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<sup>1</sup> For more information on available fashion and textile softwares please refer to Apparel Magazine (formerly known as Bobbin) for the annual 'Guide to Software and IT Solutions'. This annual report includes a table detailing the functions of available fashion and textiles software and a summary of the capabilities. Reports available at <http://apparel.edgl.com>

## 1.1 BACKGROUND TO INVESTIGATION

In 1981 I was employed in the fashion industry as a pattern-grader in Sydney, Australia, a fashion industry employment agency informed me that the invention of computers for fashion designing was to be the death knell of positions like mine. On reflection this advice was both very misguided and very helpful. I promptly left the ragtrade factories of Surry Hills and commenced design studies. At that time I rather naively believed that computer software for fashion would offer fashion designers new and exciting ways of working. However I did not have the occasion to evaluate fashion digital technologies; this is because computer technology in the fashion industry (in New Zealand and Australia) was not in wide use in 1980s and 1990s for one key reason: it was very expensive and therefore not accessible to most fashion design businesses or to educational institutions<sup>2</sup>. Although I worked in the fashion industry and as a milliner in Australia and later in New Zealand following graduation, it wasn't until the mid 1990's when living in New Zealand that I had the good fortune to be introduced to computers for fashion, in a fashion education context. I anticipated that computer systems for fashion would offer 3D solutions for designing and was bemused and disappointed to find that the software and hardware merely replicated traditional physical two dimensional (2D) methods of creating production solutions and did not offer any designing by sketching options.

When I commenced this study I could not locate any 3D fashion or millinery sketching and designing software which mimicked the physical world experience of developing fashion design ideas through sketching. The fashion computer technology did not live up to my designing expectations, perhaps I expected to find something that I already knew, a process and product that I could recognize, and after a time I began to ask - why should the new mimic the past?

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<sup>2</sup> This was due to an economy of scale. The NZ and Australian design businesses were mainly small and due to tight margins could not afford to invest in the technology.

While I continued to survey the software available, I found it paradoxical that new technology did not improve the designing experience. Nigel Cross concurred with these sentiments in his comment 'Why isn't using a CAD system more enjoyable, and perhaps, also a more intellectually demanding experience than it has turned out to be?' (Cross, 2001, p46).

## **1.2 OBJECTIVES**

At the start of this research my objective was to use digital technology to sketch fashion and millinery in a 3D computer environment. This ambition was underpinned by four elements:

- my interest in computer graphics, albeit my experience at the time was limited to 2D computer software;
- my fashion and millinery practice, where I used the technique of draping to develop fashion and millinery ideas in 3D physically;
- my desire and need to sketch millinery ideas, as I am a compulsive doodler; and,
- the apparent lack of creative computer software for fashion designers and milliners.

The emphasis within the research project was on the design development or ideation stage of millinery designing. There was little importance put on finding a resolution for the designed object; or a final millinery piece. Using the fashion garment and then more exclusively millinery, I critically analysed the project potentials, challenges, and advantages of using digital technology; the result is a new understanding of millinery as a design practice.

I drew on my tacit knowledge of physical material practices of the past and on my imagination to project my consciousness into the virtual making space. By doing this I became immersed in the immaterial designing experiences in the same manner as when I designed in the physical space, I would discover that the terminology for this experience was that I was in the 'flow' (Csikszentmihalyi, 1997). Csikszentmihalyi's theory of flow was the initial



analytical tool for the project<sup>3</sup>. Early on the focus moved from fashion in the general sense, that is clothes, to the specialised area of fashion accessories, namely millinery. Both my fashion and millinery practices utilised designing in 3D in the design development stages, usually through the physical process of draping. I aimed to design in 3D using computer technology, and could have focussed on either fashion or millinery practice as my lens.

Millinery was selected as the focus as it was a relatively unexplored design discipline. Millinery was waning as a practice and as a fashion accessory (Barton, 2008b, 2011)<sup>4</sup> and therefore millinery offered a fresh place of investigation. Millinery could have been classified using the Baudrillard term 'bygone object' and I believed that by harnessing technologies developed for purposes other than millinery or fashion, that millinery as a practice and as a product had the potential to be re-invented.

It was not until I had completed *Artificial Elegance*, an experiment within the investigation and had the opportunity to further reflect on Baudrillard's writings in the publication *Simulacra and Simulation* (1994) that the notion of simulacra became the second key reflective and analytical tool. The objectives of the research evolved as the discoveries were made, there were two main objectives within this research, and the first was displaced by the second as the research progressed and the emphasis changed.

The first objective of the project was to discover if I could sketch designs in 3D using existing generic computer technologies. This phase of the experiments was described as the 'how'.

*How could I use generic 3D computer aided design software to sketch in 3D, thereby creating millinery ideas and possibly artefacts?*

As the project evolved so did the objectives, methods and technologies that were used. The second objective of the project was to understand if computer

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<sup>3</sup> Please refer to – *Reflection using Csikszentmihalyi's notion of 'flow' matrix*, appendix 10.3

<sup>4</sup> When the investigation commenced it was unusual to wear a hat, hat-less-ness was the norm. However over the course of the investigation hat wearing became more acceptable, as discussed in my 2011 paper discussing hat wearing trends – *Get ahead, get a hat: model millinery in the 21st Century*

software and alternative methods were satisfying and productive ways to design. This phase is best described as the 'why'.

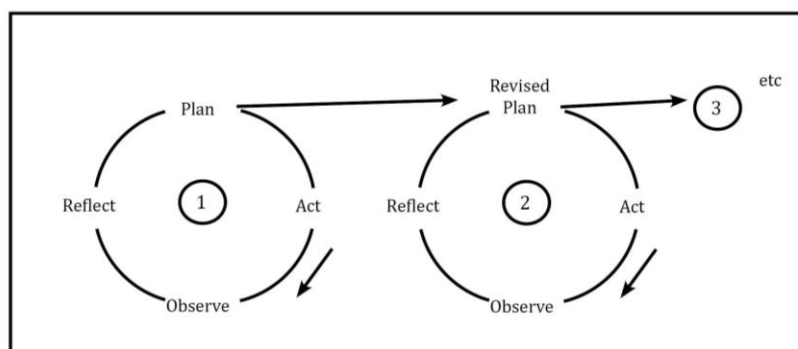
*Why would I use 3D computer aided software or other technologies in preference to traditional methods to sketch in 3D, thereby creating millinery ideas and possibly artefacts?*

The following research questions formed the framework of the enquiry.

1. How could I use 3D CAD for designing millinery?
2. How can I use physical and digital methods to explore a selection of designing experiences?
3. Why would I use 3D CAD for designing millinery?

In addition through my investigations I wanted to discover why computer technology for fashion<sup>5</sup> is not responsive and user friendly.

This practice based research was undertaken with a series of designing experiments, using a reflective practice (Schön, 1983, 1992) which results in an model informed by action research (Swann, 2002). When referring to Schön, Swann concludes that (Swann, 2002, p50) 'Reflection 'in action' and reflection 'on action' lead to action research.'



**Figure 2** *The traditional spiral of action research cycles*

Figure 1 Action research cycles - Zuber-Skerritt (1992, p13)

The experiments were devised to combine my fashion and millinery experience with new and unfamiliar design experiences. The processes were far enough removed from my traditional experience so as not to encourage or even allow me to fall into previous ways of working, but they were also close

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<sup>5</sup> Fashion computer technologies were investigated as millinery specific technologies did not exist.

enough that I could utilize my experience in the field as a starting point. In total nine experiments were used as the platform and context for the discoveries in the research.

## **1.3 EXEGESIS STRUCTURE**

This text is designed to sit alongside and support the experiments that were the method for undertaking the research. It is the dialogue which clarifies the motivation and forms the foundations of the entire project. The writing is the result of a reflective practice and shows the interconnectivity between theory and practice that is fundamental to the experiments; it gives the experiments voice, and demonstrates how I turned the discoveries into knowledge.

The exegesis is divided into two sections. The first section spotlights the background to the study, and the influencing factors. Chapter 2, Design of Study, follows this introduction and outlines how I utilised the design process as a research method, researching in, on and through the phenomenon of designing. In Chapter 3, Research Context, the key theories and practices which informed this study are discussed. While I commenced the investigation into fashion in a broad sense, after a short time I focussed on millinery exclusively. Millinery is the product I used as the lens to investigate sketching in 3D. It is unique and relates to the discipline of fashion; to put this into context, Millinery and Fashion is the focus of Chapter 4.

### **SECTION 1 - CONTEXT**

Chapter 1: Introduction

Chapter 2: Design of Study

Chapter 3: Research Context

Chapter 4: Millinery and Fashion

The second section focuses on the suite of experiments which were grounded in practice. The experiments are grouped into themed chapters which developed from the cyclical process of reflection in and on practice. Chapters 5, 6 and 7 are where the cycles of experiments are discussed in more detail. I offer conclusions and implications and plans for future research within Chapter 8. Dispersed throughout the writings are reflections which occurred while I engaged in the experiments, these reflections indicating the meaning of the experiments at the time and are shown in italics within the text.

## **SECTION 2 - EXPERIMENTS**

Chapter 5: Practitioner at Work

Chapter 6: Practice Disrupted

Chapter 7: Practice Interrogated

Chapter 8: Practice Refined

The catalogue contains images and details of the individual experiments, and includes a DVD of moving and still images.

The aim of the project was to use the exploratory process of sketching in 3D to generate millinery ideas and to utilise computer technologies for this purpose. It was not my goal to find a new way to mass produce hats through technology. The practice of making as a material process offered me the opportunity to analyse perceptions, and the potential of sketching and designing in the digital<sup>6</sup> and physical<sup>7</sup> environments. New themes, methods, and processes evolved as I moved through the experiments and interacted with environments, tools, and materials. Throughout the project I systematically investigated and critiqued my sketching and designing experiences within a 3D environment. I had a particular focus on the knowledge that I gained as a designer while designing and making millinery ideas.

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<sup>6</sup> Computer based

<sup>7</sup> Analogue based

The following are the experiments selected to analyse within this doctoral study<sup>8</sup>. There were overlaps and some experiments were reiterated following a period of time. Experiments below are listed in the order that they are addressed in the catalogue and the exegesis<sup>9</sup>, and identifying the chapter theme in which they sit.

Practitioner at Work

1. Drape and Stop Animation

Practice Disrupted

2. 3D Digital Sketches (ongoing)
3. Artificial Elegance

Practice Interrogated

4. Making With Light
5. Cube Installation
6. Sketching Machine
7. Lucid
8. Buttoni
9. Hatistropic

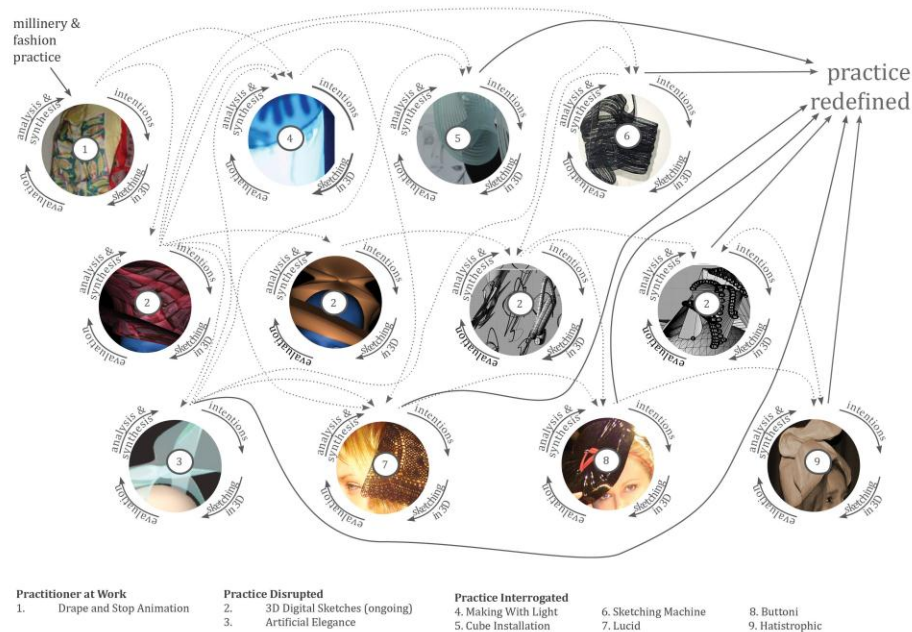


Figure 2: Designing cycles in this investigation

<sup>8</sup>Some experiments which were undertaken were not analysed within the exegesis, and these a full list of all experiments are detailed within the *Critical Evaluation Matrix*, Appendix 10.2

<sup>9</sup> the classification responds to the themes which emerged within the investigation, rather than chronologically

## 2 DESIGN OF STUDY

I am a designer, and I approach my research in a designerly way (Cross, 2006), the perspective that brought me to this project was that of the designer / maker<sup>10</sup>. I drew on my experience designing and making concurrently as is often the practice in millinery. I reflected on the previous multiple design conversations I have had with the materials, with the tools and making and with the artefact that is being made (Schön, 1983, 1992; Downton, 2006). These conversations occurred naturally as an on-going part of the making, and were used to inform the reflection and consequently the redesigning of both process and product.

The design of my investigation into the experience of sketching and designing fashion in a 3D environment is discussed in this chapter. A multi-methodological approach was used to structure and support the research and practice of this PhD by project. Hybrid research practice is common in design and creative disciplines; as it is difficult to reshape one discipline to fit another which is disparate in both culture and process (Gray, 1998).

In this study the designing centred on millinery practice, and when designing the millinery pieces the design experience was reflected on, critiqued and considered.

I am a designer, maker, wearer, watcher, and these different perspectives are all important in the area of fashion and millinery design. Each of these roles brought different expectations. My role in this study is that of designer / maker; however I acknowledge that the experience of being the wearer and watcher also had an influence on the study direction and results, albeit subconscious. I cannot separate what I design and make from my view of the world as a wearer and watcher of fashion and millinery. In this practice based research project I drew on my personal view as a legitimate and important element of the process and findings.

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<sup>10</sup> Designer / maker are seen as one in the area of model millinery, as these processes often occur concurrently

## **2.1 DESIGN AS A RESEARCH METHODOLOGY**

Designing is the practice of my everyday life. My everyday actions as a designer, maker and researcher. Therefore utilizing designing as a research methodology for this project corresponded with the way I preferred to work, that is in an evolutionary and reflective manner, which closely resembled action research loops.

At the beginning of the study I had not identified all the research directions that would emerge as important. Researching as a designer allowed me to draw on the design process as a research practice and assisted me to form questions and answers. While Schön (1983) discusses the importance of collaboration between researchers and practitioners to enhance both professionals, he also suggested several scenarios of working including the integration of both researcher and practitioner roles. Schön stated, “The practitioner may take time out to become a reflective researcher, moving in and out of research and practice careers” (1983, p324). Although collaboration was not a large part of this doctoral investigation, it did occur in some of the latter experiments, the ability to be both researcher and practitioner was a key element in its structure.

The reflective process sometimes resulted in changes of understanding and consequently shifts in the direction of the study. This included shifts in designing and making, as well as in the reading which surrounded and supported it. As the project evolved, so did my confidence in using action research to inform the research method. Over time, the direction became more fluid and flexible as did my expectations of the project. Like many who learn, deep learning often came from the unexpected, unplanned and unwanted experiences (Argyris and Schön, 1978). I courted serendipity and accidents (Ehrenzweig, 1967); I harnessed it by embracing the experience and subsequently analysing the investigations and findings, to reconsider and reframe the direction of the research.

Over time and over many experiments and readings the previously clearly defined objectives were questioned, technology advanced, new opportunities



were presented, personal skill and understanding was developed, and multiple reflections ensued in and on practice (Scrivener, 2000). I embraced these experiences as essential events on my quest for knowledge and understanding.

## **2.2 RESEARCH STRATEGIES**

The research approach was abductive, that is I followed a hunch, a direction that I felt merited enquiry (Scrivener, 2000; Rosenburg, 2000). Using an abductive research strategy allowed me to encompass new discoveries and directions in process and product and consider the implications these may have on the world around me. There was the possibility of multiple realities and unknown variables when following a hunch, therefore flexibility in course of action was crucial, as was trusting in the process and in my tacit knowledge and understanding. Given this flexibility in process I acknowledged from the start of the study that when I used this methodology there would be no right or wrong outcome, and as had been anticipated at the start there were cycles of various outcomes, some of which were unpredictable.

Utilizing the concept of 'Wicked Problems' as coined by Horst Rittel and Melvin M. Webber (1973), the designing was not in response to a clearly defined problem, but was an opportunity to explore the hunch freely without the end point clearly defined. The process of exploration was not linear: continued reflection and modification was beneficial to the development of new and engaging millinery processes and ideas; and the cyclical process of analysis, synthesis and evaluation was in line with the views of design theorist, Archer (as cited in Lawson, 2006).

I interpreted the data and experiences I found in a personal way, finding truth and meanings to me as a social actor within the study. The findings also have relevance to the wider group of fashion practitioners and academics as well as milliners. Given this standpoint the perspective of practice based research put me in the centre of the stage.

## 2.3 PRACTICE BASED RESEARCH

My design experience was a lived experience, whether it took place in the physical or in a digital realm and whether it resulted in physical or digital forms or a hybrid of the two. The experience was critically reflected on, with the purpose of constructing new understandings from my point of view, and I found personal meaning, themes and patterns within the findings.

The initial review of my past works and reading around the topic provided me with both justification and direction for the study. Instinctive directions were followed, reframed and repositioned; these evolving routes came out of reflection on past practice, as re-visiting and re-reflection on the past gave me the opportunity to authenticate and to challenge former meanings as well as to open possibilities for new meanings to develop.

I used knowledge and tacit understanding of the design process and the design; I built on this, reflecting on it and building further, I was drawing on sixteen years of millinery practice. Schön (1983) suggested that being unaware of what is driving one's behaviour could seriously inhibit the likelihood of increased effectiveness in the long-term. This doesn't negate the importance of the tacit knowledge the practitioner has, but reflective practice enables the reflective practitioner to make tacit knowledge visible to themselves first and then to have the opportunity to share it with the world. I believe that one person's assumed tacit knowledge could be another person's enlightening moment.

I am both the practitioner and the reflective researcher, and I recognize the interconnectivity between these two parts to my professional and creative being. Schön states "the reflective researcher cannot maintain distance from, much less superiority to, the experience of practice" (1983, p323). My practice, past and present, inherently influenced the research, and consequently these two elements influenced future practice. I engaged in reflective practice while designing, when in conversation with myself and with the artefact or idea via drawing, making and writing, and as shown in this exegesis and accompanying experiments.

The reflective process was undertaken in a structured manner. This consisted of regular workbook entries and included the use of various matrixes which

were used as tools to steer the reflection into a particular direction, in addition public reflections with critique and feedback occurred at the regular bi-annual Graduate Research Conferences at RMIT University. Scholarly writing and designed pieces were also presented at conferences, exhibitions and public seminars. I gained valuable critical engagement with the community of practice in these engagements.<sup>11</sup>

As is often the case in such an investigation the questioning evolved over the period of the study, and along with this so did the reflective questions. At the start of the study the prime reflective tool was the process of free writing and sketching, mostly in physical notebooks.

As time went on and I continued to use paper based workbooks, I also started to write more extensively in the digital realm. Using the computer was an easy place to write, I could edit easily and could save many versions of my writings in folders per month, per year, but there were problems with this. Interestingly, although my study primarily focussed on digital technologies and my interactions with them, that on reflection on the writing process I found that the digital and the physical reflective spaces offered me distinctive rewards and challenges.

When using digital tools to reflect, the reward was that I could free write and rewrite. Conversely the challenge came from the digital space was not a developmental space in the traditional sense of my practice, as it was not somewhere I would go back to and re reflect often. Using the digital tools to reflect could be likened to a final resting place for the ideas; and I am cognisant that some thoughts in the digital space could have been lost forever.

Alongside the digital space I continued to keep physical diaries, like the digital space, writing in physical diaries could be written and rewritten, but not edited and copied as easily. However, I had a most satisfying and also productive time when I spread all books and papers out on a large patternmaking table and to make a big picture mind map, to make links between the writings, the projects and the theorists or practitioners I was referring to, and to be able to do this many times over.

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<sup>11</sup> Please refer to *Conferences, exhibition and public seminars*. Appendix 10.5

It is productive for me to read and re read and trip over ideas almost by accident, using post it's to mark and remark indicating different ideas from or for different purposes, in order to discover what I was thinking what I was doing (Downton, 2003). Although these books are unassuming exercise books, and the paper for the mapping spaces butchers' paper, they are my most prized possessions. There is nothing as satisfying as sitting down for a week or so re reflecting over them, creating mapping spaces of the big picture as in the image below which elucidates the process, my process, and which allows me to identify and respond to a hunch and to best plan my next move. Reflection is the practice based tool I use to facilitate my research into what I do as a designer.



Figure 3: big picture mapping space

Conversely, there is nothing as frustrating as trying to find the writings I know are housed as digital files within in the computer in order to re-read them, and to then make further sense of them.

For reflection to be useful to me in the context of this investigation I also needed an evaluative tool that summarised and gave me opportunity to evaluate, analyse and synthesise the information which evolved from the mapping processes, the matrix<sup>12</sup> was a useful tool for this purpose. All of the above strategies informed the fundamental research methodology – practice based research.

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<sup>12</sup> Please refer to – *Critical Evaluation Matrix*, appendix 10.2 and *Csikszentmihalyi's notion of 'flow' matrix*, appendix 10.3

The design of this study reflected the design conversation, which closely mirrors action research processes, that is, the tooting and froing that is common in designing, and in action research, including reflection in and on action and practice (Scrivener, 2000). This method closely mirrored the designing process used in my studio practice – fashion and millinery design, an evolutionary process where questions were systematically explored, reformed, explored in an ongoing cyclical process.

Drawing on the principles of action research and on the design process, a cyclical and iterative process of problem diagnosis, action intervention and reflective learning was developed. Although action research is usually applied to community engagement or collaborative projects, in this project the basic processes of action research were used as a research method which closely reflected the design process, and while collaborations were not ruled out as an option within the study, they did not become a large part of it. Within the Buttoni experiment and Hatistrophic experiment, participation was garnered from a technician and within the Lucid experiment (Let's Gather Here), I was commissioned to design the millinery. While these were not collaboration in the traditional action research sense, I acknowledge that the conversations with the technicians and fashion designers did influence some decisions.

Through practice based research I was able to utilize “...doing and reflexive thought about that doing” (Downton, 2003, p98) to encompass new discoveries and directions of both process and product.

## **2.4 INVESTIGATIONAL METHODS**

Many methods and combinations of methods were used as techniques to explore links and draw connections between the various processes, tools and methods as well as the hunches and findings. The investigational methods used also assisted me in joining the dots between the experiments and the literature. The primary techniques used within the experiments were designing through sketching and making, and diagramming, these occurred in both physical and digital environments.

At the start of the project I believed that writing in the formal sense was secondary, however, through on-going critical reflection, it became apparent that writing was the key to extracting knowledge and understanding from the experiments and from the drawings and diagrams, as well as from myself. This thought was in accordance with van Manen who stated "Writing decontextualizes thought from practice and yet returns thought to praxis" (1997, p128). Writing gave me the occasion to distance myself from the sketching; it was a quiet and reflective space. Writing brought the subconscious to the fore and gave me a deeper understanding of my experience, and how it related to theories, and in turn it informed the development of a more cognisant practice.

Through reflective practice my aim was to find what was 'said' in and on the designing experiments. Firstly I looked within sketching, designing and making of the artefact, secondly I viewed the place that the artefact takes me to while I am sketching designing and making, and thirdly I considered how the experiments related to my conversations with the literature and my writing around the subject.

Write, rewrite, design, redesign - it took time to achieve depth in the writing. Van Manen (1997, p131) stated that,

... the process of writing and rewriting (including revising or editing) is more reminiscent of the artistic activity of creating an art object that has to be approached again and again, now here and then there, going back and forth between the parts and the whole in order to arrive at a finally crafted piece that often reflects the personal 'signature' of the author.

When I rewrote or redesigned, I passed over the subject or artefact with new eyes, and with the privilege of time, I had the opportunity to layer the new ideas over the past discoveries and create fresh meanings.

Prior knowledge gained through material practice informed the inception of the research. My previous practice focused on the objective of a finished product, and at the beginning of this project the fundamental question was:

*How could I create fashion ideas by sketching and designing using 3D computer technologies?*

To find out how to do this I designed a series of experiments which used the designing through making process to test various tools and processes. The research was guided by the experiments, which in turn were determined by the environments, tools or materials selected and by knowledge gained in previous experiments. The plan for the project that I developed at the beginning did reflect the order in which my practice occurred at that time, but as the investigations took various twists and turns it became necessary for me to step aside from the original plan and modify it to allow for further experimentation and progression.

While the figure above suggests that the experiments flowed in an orderly and sequential manner, this was far from the case, there were overlaps and backtracks both in the designing and making and via reflections. The project did maintain a clear objective, that is, to sketch fashion (and later millinery) ideas in 3D, however I considered and reconsidered the mechanisms of how this was to be achieved many times over. Pauses were necessary, they provided me with the opportunity to stop and think, to reflect and re – reflect on each experiment and on the project as a whole.

Like Downton (2004), making is an essential part of my designing process, in this project making is not merely a procedure the designer goes through to achieve a sales ready product. In this investigation, making is inherent in designing, as a research method.

Fashion and millinery are the disciplines I am most aligned with, and making in these disciplines infers that there is a made, that the process of manufacture has or will occur, that there was or will be an artefact, a final fashioned item, ready for use by the consumer or wearer in this case. Making also refers to the action of making. Making ideas, making diagrams, making mind maps, making digital and physical artefacts, making sense of the project through the making and, making the writings. Whether I am making words and text or fashion ideas and artefacts, and whether it occurred in a physical or digital space, in my practice making is always defined as a bodily process. Making indicates that there is an interaction between the designer and the made, it is a design

conversation, and it is a bodily experience, even when the experience is an immaterial one.

The techniques and procedures used could all be described as 'making'. These are discussed in future chapters.

- Sketching – making lines and shapes physically, digitally or in a transitory location, to explore ideas and concepts, 2D or 3D;
- Tinkering – being one with the design moment, not artefact driven, designing for pleasure;
- Modelling - making something 3D that appears to be an object. This could be physical or digital or a combination;
- Conversations - with the materials, with the process, with myself and with others, visual, textual and oral conversations;
- Diagramming – drawing out the ideas; and
- Reflection – what, where, why, next?

The above techniques and procedures occurred in one or both of these environments: Physical and Digital.

### **2.4.1 Experimenting as a Research Process**

This research was an exploration into drawing and designing in 3D using a selection of technologies. The process and how this process was experienced, was analysed through the lens of millinery. This occurred through an engagement with the design process, and by using a series of designing experiments. The experiments were the mechanisms to drive me towards a deeper understanding of sketching and designing in 3D. As the experiments progressed, they were also used as a means to reflect back on previous projects; new meaning was made from past events. Over time and as a greater understanding developed, interconnectivity between projects was identified and discoveries were made.

Within this doctoral investigation, the experiments are the core. The experiments inspired, they challenged, they guided, they offered a place of reflection, they offered a place to form new knowledge and understanding,



and they were and are the very centre of the project and of the making of meaning. The primary data was sourced from my bodily experience, this occurred while engaging in undertaking the experiments, as well as when reflecting in and on the process of designing. The experiments also created a structure to organize and reflect on the process and product, experiments were a thinking tool, a making tool and a reflective tool.

The series of experiments are the core of this project, all the learning has transpired through the making and reflecting that occurred during and came out of these events, and the readings which surround them. The primary means for reflection was through a process of diagramming, some of these diagrams feature within this exegesis.

In this project I have used the experiments to establish and then test the evolving questions. Having an open ended creative production project (Scrivener, 2000) allowed me to frame and reframe the doctoral investigation objectives to match my findings and interests. I was both effected and affected by the experiences I had and by the world around me. These internal and external influences and affects are acknowledged. They were integral and meaningful elements in the process of reflection in and on action and practice within this doctoral investigation and the resulting insights.

### **3 RESEARCH CONTEXT**

Relevant literature was read alongside the process to support, and to trigger questions and new directions in sketching design ideas. Literature to assist in the design of the study focused on design practices, as well as art, the humanities and sciences. There was little published specifically on the area of millinery as a design practice.

Millinery practice lacked documentation and academic writing regarding millinery design processes. Most writings in millinery concentrated on the practical skills of making millinery, both contemporary and historical. Some authors have focused on the social and environmental issues surrounding millinery as it was situated in the nineteenth and earlier part of the twentieth century. Areas investigated included millinery and dressmaking<sup>13</sup>, millinery as women's work, employment conditions for milliners, millinery as a trade, and millinery and the slaughter of birds for the fashion industry. The lack of literature on millinery was not viewed as a disadvantage or as an obstruction; it was viewed as a positive feature and an indication that millinery offered a fresh place for inquiry.

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<sup>13</sup> Millinery and Dressmaking were linked in the earlier part of the 20th century and have since become separate practices. This is discussed in more depth in the Chapter, Millinery and Fashion.

Academic writing in the area of fashion offered a much wider gamut of focus; these writings were a rich source of information and inspiration and were drawn on extensively. Themes included fashion as social indicator, fashion as performance, fashion as expression, fashion and consumption, making fashion ideas and designing fashion. Product / industrial design and architectural design appeared to be more advanced than fashion and millinery in their uptake of computer aided technologies as a design tool, and hence they were also more advanced in their critical dialogue around the uses of digital technologies. Therefore these disciplines outside millinery and fashion also offered a space for critical reflection.

The literature canvassed included the following broad categories - practice based research, reflective practice, millinery, making, architecture, engineering, product design, design theory, fashion, millinery, creativity, technology, art and technology, design and technology, the hat, perspective, computer science, sculpture, communication, and perception. Reading a wide range of literature was a way for me to understand sketching in 3D from multiple perspectives and to use these perspectives as a way to reframe my own designing perspective, and to identify alternative design methodologies.

### **3.1 COMPUTER TECHNOLOGIES**

In the early part of the 21<sup>st</sup> century, although computers had not yet become a universal piece of equipment that every household or every person owned, the computer was starting to make an impact in both my life and the lives of the wider public.

At the time of commencing this investigation I was exposed to art based 3D software through the Dunedin School of Art at Otago Polytechnic where I undertook self-paced learning in 2D software, and I also observed fine art colleagues creating 3D animations for art projects. 3D computer-generated animations were being popularized with *Toy Story* (1995) receiving acclaim as

the first mainstream animated movie which was made solely with computer-generated imagery.

3D computer software for fashion was not available commercially at the time, 3D was in my line of vision, and I saw the lack of 3D software for the purposes of designing fashion as perplexing.

Employing software used by other creative areas of design and art offered opportunities to develop new ways of working that could subvert, expand, question and multiply traditional fashion and millinery processes and products. There was a closeness to real (physical) world processes within the digital practice (Fifield, 2004), real world practice informed digital practice and vice versa (Parkes, 2006). When I first came to the digital environment I believed that real world restrictions applied, when they didn't (Sachter, 1991). The notion of the computer world expanding ways of thinking and working is highlighted by Sachter (1991, p. 335) who states.

When I first learned 3-D computer graphics, I wanted to rotate the 'eye' in one of my animations, in order to slowly move around and view a scene from the other side. .... He (the teacher) looked at me with great surprise and said 'just rotate the whole scene. It's the same thing.' This had never occurred to me! I had thought of the scene as a stable world.

Sculptors, for example, creating 3D artworks in a CAD environment have commented that the beauty of the new spaces and processes of working could be defined by the innovative way of working which often defied the laws of nature, within all areas of the object and the process, including making, materiality, world and perspectives (Fifield, 2004; Ganis, 2004; Sachter, 1991).

The predominance of computer usage which is more suited to technical developments rather than creative or design developments is not confined to the area of fashion, as confirmed by design theorist, Bryan Lawson (1997, p303) who stated: "Thus in spite of all the enthusiasm and spectacular claims, today CAD in practice still mainly stands for computer-aided draughting rather than computer aided design."

More than a decade on from Lawson's publication, I reflect on whether fashion or millinery digital technologies have lived up to the promise of a better way of working.

## **3.2 FASHION COMPUTER TECHNOLOGIES**

Surveying the available fashion digital technologies prior to commencing this doctoral investigation I discovered that although digital technologies were becoming a remarkable fashion production tool, they were ineffective as a fashion designing tool.

Even now, in 2012, clothes designed in much of the fashion industry are developed predominantly using traditional 2D tools and methods that are paper, pen, ruler, tape measure, and pencil<sup>14</sup>. Fashion is also designed using the traditional 3D practice of draping. Fashion specific digital technologies, sometimes called CAD software are on the whole 2D; and at this point in time there are limited developments of 3D software for fashion and millinery design developments. Fashion industry practitioners who use computers within their design process, by and large do so to achieve a production ready result; this is due to commercial necessities, where fast production is the key objective, and where resources dedicated to creativity are rated as secondary.

Most commercial CAD programmes created for fashion designers continue to be skewed towards the technical processes of pattern making and cutting and replicate 2D flat paper based methods of patternmaking. More recently 3D software for fashion has been developed, with industry software businesses creating commercial 3D software for fashion which aim to replicate draping on a tailor's dummy. The leading commercial fashion software developers all have their versions for example; Lectra – Modaris, Gerber - V-Stitcher, PAD System Technologies – 3D Simulation and Animation, and Haute Couture 3D, and OptiTex - 2D and 3D CAD/CAM Fashion Design Software. When the software is used in the manufacturing process it is a very helpful tool for the

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<sup>14</sup> Small scale of many businesses, with low margins, low budgets, meant there could be no great investment in high-tech equipment.

production team, however, the software does not contribute to sketching and designing fashion or millinery ideas.

Considerable discussion and research in the area of 3D fashion software has been undertaken by fashion academics (Gray, 1998; Hardaker and Fozzard, 1998; Stylios and Wan, 1998; Kang and Kim, 2000; DesMarteau and Speer, 2004; Volino, Cordier and Magnenat-Thalmann, 2005) and as discussion points within trade publications. Much of the current research focus is directed toward technical or production uses, such as virtual prototyping, accomplished by virtually stitching together flat patterns which are subsequently draped onto a 3D avatar (Volino, Cordier and Magnenat-Thalmann, 2005). In some instances 3D designs were unwrapped in a reverse engineering manner to become 2D patterns (Yang and Zhang, 2007), and as potentials for post-production sales tools; (Magnenat-Thalmann and Volino, 1997). 3D was becoming a popular theme within fashion research, this fashion related research was focused on computer-aided design for fashion that is on production of, or on communication of fashion. As a manufacturing augments, fashion specific softwares are vital to efficient production methods, and some allow a final checkpoint stage before production commences through the use of a virtual stitch up. Conversely, they do not contribute to the design development or the sketching stage. There are limited published materials on the use of 3D digital technologies as interactive designing and sketching tools for fashion or for millinery.

The quest to improve my potential designing interactions with 3D software was an irresistible design challenge. It was the impetus for me to find a way to use existing technology to sketch and design millinery ideas in 3D. This aim was clearly in my sights at the beginning of the study; however, I found that over a period of time the aims and questions evolved, and I began to seek answers to questions which were not anticipated at the start. These modifications reflected technological developments in software and hardware, and were in response to my learning and understanding gathered over the various design experiments, associated readings and writings.

I could not locate any research on using computer technology for millinery designing or making until late in 2011, the final stages of this investigation,

when Rebecca Leah Miller submitted a thesis on the topic.<sup>15</sup> Miller's Master of Fine Arts investigation had links to my investigation in that it focussed on millinery and digital technologies, and like me she aimed to explore (Miller, p2) "how can 3-D computer software be useful...". Miller's investigation concentrated on exploring digital potentials for a millinery costume technician, which was unlike my aim of exploring digital potentials for a millinery designer. Miller aimed to utilise the digital software to create models from 2D sketches supplied to her by three different costume designers, and appeared not to be interested in developing her own design ideas through using the software as a design development tool. Miller used some processes which were similar to mine, for example she used the software Rhinoceros, and she created a virtual dolly in the digital space.

Miller's process differs from mine, in that her primary objective was to use the technology to create 3D prototypes, in the form of digital models as well as physical half sized prototypes which would then be used either as a guide for a milliner to make a hat or to create a hat block, a traditional physical tool. While Miller used the technology in a way that imitated millinery traditions and resulted in a traditional millinery tool, a hat block, and somewhat traditional millinery, it was encouraging that another person was harnessing digital technologies for millinery purposes.

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<sup>15</sup> In 2011 Miller submitted her thesis 'Digital craft : handmade craft meets digital design' as partial fulfilment of the requirements for the Degree of Master of Fine Arts at The University of Texas at Austin.

### 3.3 SKETCHING AND MODELLING

Drawing on my experience as a fashion designer and milliner, I identified two physical world techniques which I commonly used within my fashion and millinery practice. These processes guided the planning and focus of the experiments.

1. Sketching – generally designing by using a 2D process, on paper, using pencil or pen or similar. The pencil created markings on the paper, creating images of ideas. The focus of sketching was to develop fashion and millinery ideas.
2. Modelling – generally designing by using a 3D process, with material onto the tailors' mannequin or milliners' hat block or form, using traditional materials, textiles or similar. The materials were moulded onto the form, the material and form responded to the touch of the hand and interaction between hand, material and tools, creating 3D models of ideas. The focus of modelling was to develop fashion and millinery ideas and sometimes finalize these.

#### 3.3.1 2D Sketching

*I knew what I wanted to do ... to sketch, draw and make ideas, thereby exploring and creating fashion ideas.*

*I knew where I wanted to do it ... in a 3D environment.*

*I knew why I wanted to do it ... because I believed that 3D digital technologies were under-utilized as a design tool at the time, and because I liked to work in a 3D physical environment,*

*What I didn't know was how this could be achieved.*

*Reflection 2002*



Understanding my existing sketching practice was an important first step in the research. I initially reflected on my past practice; on my past sketching and making practice as a fashion designer and milliner.

As far back as I can remember I have loved to sketch, doodle, draw and think about fashion and millinery items and to also make some of these ideas real. Sketching fashion and millinery ideas was engrossing, the process was satisfying, and the ideas that resulted were just that, ideas which were sometimes abstract and ambiguous and because of this, could either be left as ideas or developed any number of ways in the future. Ambiguous and unstructured early stage sketching were an essential element in my designing, and this feature was common to many designers (Purcell, & Gero, 1998) Hill (1966) went one step further as he posited that the ambiguous idea is not just an idea waiting to be developed further, but that its very ambiguity could encourage further ideas.

### **What is sketching in my practice?**

I use sketching as a designing tool, and not as a sales or production communication tool, and for that reason the term sketch is more accurate than draw. In my practice sketching was considered as a means to create ideas, sometimes the sketches would suggest an idea, sometimes they were quite ambiguous, and at other times they were quite descriptive. I was not concerned with drawing or sketching as a method to visualize ideas for the purpose of communication to others, to show details, for example for sales promotion of design outcomes. What I was concerned with was communicating my design thoughts and feelings (Ursyn, 2010), to myself.

For me the process of designing in my sketch book is an opportunity to have a design conversation with myself, and a place to record the conversations. These sketches, doodles, writings and diagrams weren't created for the benefit of anyone else; they were and are a record of my design thinking, they are living documents, they could be added to and developed further at any time. Through these sketches, design possibilities were explored, some of which were destined to stay just that, as concepts that never came to life in the real

world. To quote Paul Virilio when interviewed by Wilson (1996): “images don’t have to be descriptive; they can be concepts.”

The designer’s sketch book was a space to for me to tease out ideas which may have flashed into my head via something I have seen, dreamt, read, heard, touched, smelt or eaten, a bodily experience. The sketchbook was a space to explore something that I had experienced, something that I may use to inform my designing in the future. It was a propositional space, where sometimes problems were clarified, however, more often than not, it was a place where I teased out ideas, and where there was no expectation of final design resolutions.

### **Are sketches different to drawings?**

In an interview with textile and fashion designer, Zandra Rhodes, within the publication, ‘Drawing The Process’ (Duff and Davies, 2005), Leo Duff suggests that sketches are different to drawings, that drawings are an output in themselves rather than a process or step towards creating an idea which would subsequently be finalized in an additional phase. Drawing in an art context is often seen as the art itself, the finished drawing is the objective of the action of drawing, and this is corroborated by Duff’s thoughts.

Duff states:

Zandra calls this sketching, although her sketch books contain many drawings which have clearly taken much longer than the hour and a half she suggests as being the least time she would spend on one piece. The difference between ‘sketching’ and ‘drawing’ is a subject that we discuss briefly, mainly because the term ‘sketching’ infuriates me. I can assure you that none of the work in Zandra’s sketchbooks comes under the term ‘sketch’ as I or many others would use it, as there is a directness and clear focus with continued concentration of eye and hand on virtually every page. (p93)

While I have not seen the specific Rhodes' images that Duff refers to, I have seen images she has produced and would characterize those as fashion illustrations. These illustrations contained a lot of fine detail, are in colour, and are drawn in a very fluid and relaxed manner. However, I am nearly as infuriated with Duff's dismissive remarks about sketching as she is about the concept of sketching.

Rhodes' sketch could indeed be considered direct and focused, as fashion designers and designers of other products may sketch or draw in a different way to artists, as they focus so specifically on a particular subject matter, which is very familiar to them, in the case of a fashion designer the subject matter would be apparel. Through their understanding of the apparel they will develop a high level of expertise<sup>16</sup> and confidence in their sketching skills and will be adept at producing confident markings so that their sketches may resemble others perfected drawings.

### **3.3.2 Sketching conversations**

Within my mind's eye I could visualise fashion and millinery ideas in 3D, I could develop an object, and rotate it, one which is on the whole convincing and true-to-life. The ability to create a successful mental image can be contributed to my extensive knowledge of the object I was imagining.

As I thought about my sketching practice I came to realise that this is what also happens in our minds, that we all have a virtual mental sketching practice. For example, when I observed an object created in my mind, the object appeared like an authentic object. Finke stated in 'Mental Imagery and the Visual System' that "Then once the image is formed it can begin to function in some respects like the object itself..." (1990, p189). There was, however, one major difficulty with an object created through mental imaginings, and that was that the object remained as an idea, located in the mind's eye, residing there for as long as I could allow it to be there, which was usually a very short time until the next idea or thought took its place.

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<sup>16</sup> For example Karl Lagerfeld, who has the ability to indicate the details and proportions of a design through his fast and simple sketches. This was shown in the documentary Signé Chanel 2005. Directed by PRIGENT, L. France.

The image of the object that I created with mental imagery was realistic. I could sketch the image of the object in 2D to preserve the idea, and I could attempt to make the object in 3D, but I could not save the object which resided all so briefly within my mind. I could not deposit the object in a location where I could find it in the future, I could not save it. Finke (1990) goes one step further suggesting that what is in the mind's eye can influence the perception of physical objects and images, and that concept as interesting as it is, sits within the field of psychology, which is outside the scope of this investigation, and which will make ripe future research.

The mind's eye, and its relationship to sketching, design and art has also been investigated in a designing context by researchers as diverse as Fish and Scrivener (1990); Goldschmidt (1991, 1994, 2003); Oxman (2002) and to designing and making, notably David Pye (1968). In 'The Nature and Art of Workmanship', Pye discusses the gap between the design which was created within the mind and the reality of what can be achieved due to the transfer of information from mind to paper when he states.

The intended design of any particular thing is what the designer has seen in his mind's eye: the ideally perfect and therefore unattainable embodiment of his intention. The design which can be communicated – the design on paper, in other words – obviously falls far short of expressing the designer's full intention, just as in music the score is a necessarily imperfect indication of what the composer has imaginatively heard. (p49)

Pye noted that following the transfer of the design intention from mind to paper, there was a subsequent opportunity for misreading which could occur in the communication between the designer and the maker, if they are different people. Misinterpretation of intention came to light in this doctoral investigation, and is discussed within this exegesis in relation to the two experiments, Buttoni and Unwrap.

Communication between the mind's eye and the physical world is a type of conversation, in the context of this investigation, it is a design conversation. Designing conversations through sketching is a theme that I investigated

within this study; I drew on the work of Schön, Goldschmidt and Arnheim as the three key thinkers on the act of sketching as a designing conversation. Rudolf Arnheim stated in his paper, 'Sketching and the Psychology of Design' (1993, p15);

... because sketching does not consist simply of representing on paper the images held in the designer's mind; it consists rather in a dialectic process, ...

Sketching is used as the starting point in other design disciplines such as architecture where 'study sketches' (Goldschmidt, 1991, p123) are undertaken and in industrial design where designers go through a stage of ideation, which is often a collaborative sketching process. Sketching is an activity that is common to all designers and artists (Lawson, 1997; Pallasmaa, 2009).

### **3.3.3 Modelling**

Drawing or sketching in this study was not confined to the 2D surface; furthermore, the act of sketching could be undertaken using any medium. Over time and through a self-aware designing process I had come to know that I understood the fashion or millinery object that I was designing more when I had a physical experience with it. To touch it, move it, for me to move around it, in a process of making ideas and the object concurrently. As I worked with the physicality of process, I relished the lived experience; again this was a designing conversation.

At that time I furiously attempted to design recognizable fashion and millinery objects, and after some years I re-read Biggs writing and it resonated with me. In his paper, 'Knowledge and Advancement through Models', Michael Biggs states that physical models can have two uses, firstly as a "visual resemblance" and secondly as a form of "structural similarity", and he goes on to say that however "the main knowledge-content of a model is meaning rather than its properties as a physical object", and furthermore states that "the use of physical models represents something outside itself" (2000, p 139 - 140).

My fashion and millinery designs were acceptable as they were, they did not need to resemble the structure of the object, act as prototypes of an idea, be made to scale, be created in the ascribed manner using appropriate material, or even created within a physical environment. Biggs's notion of a model representing something other than what it is was rang true, my fashion and millinery ideas were able to be ideas, they represented design potentials, as well as the designing process. The value in making a model or sketch in this investigation is in the design conversation.

Delving into and reflecting on my existing fashion and millinery practice made me aware that when I sketched or created ideas for designs, I did not make use of a pencil, pen and paper exclusively, and that a large percentage of my design thinking came through the process of modelling or draping as it is called in a fashion context, and within this exegesis.

Draping is a 3D idea development tool used in fashion practice which involves the use of a physical material to develop and trial ideas in the physical realm. Through draping I teased out ideas using cloth or similar on a tailor's mannequin or hat block. Draping was the closest I came to creating fashion ideas via sketching in 3D with cloth, and in addition the draping process was a relaxed iterative experience which I found to be closely linked to doodling with a pencil or pen on paper.

Draping is utilized as a designing tool in fashion and millinery practice. Draping is a process that involves the designer using cloth to 'draw' or 'sketch' a fashion design directly on the tailor's mannequin or millinery head / hat block. I can describe draping as a method of sketching with cloth. In fashion design practice draping is employed by many practitioners, either as an element within an extended design process or as the entire design process.

Firstly, draping is often employed in the higher end of the fashion market by designers such as Karl Lagerfeld and Valentino who engage specialist drapers for their studios to interpret their 2D sketches so that they can critique and modify the draped idea, which is in effect a 3D sketch. Draping in this sense is undertaken to achieve a particular fit as well as to test design ideas through a scale prototype, it is a step in the design process with the aim to culminate in the creation of a resolved piece of apparel. Secondly, individual designers use

drape to test ideas for an element of a whole fashion piece, for example, draping a collar to test the roll of a fabric as it wraps around the mannequin's neck. Thirdly there are designers, who drape their ideas directly onto the mannequin, and in this way they design in 3D. It is this method that I refer to as sketching in 3D within the Drape and Stop Animation experiment.

Whether draping a section of a larger fashion item, testing a design through prototyping, or drawing the entire design from scratch on the mannequin, the process the designer undertakes when draping is approximately the same. The designer will typically utilise a traditional flat textile or cloth, which is off the roll, a cloth which is either an innocuous textile, for example, muslin, calico; or a textile which matches the final selected cloth in the properties that the designer desires, for example a match in weight, drape, tone, texture. In some cases the designer uses the actual cloth that is intended to be used on the finished garment, as was the case in this drape experiment.

### **3.4 SKETCHING AND MODELLING**

Sketching to me is a very valuable and useful occupation. One that cannot be missed in the design process, as ambiguous as it may be, it will often also show clarity and directness in the mark making as well as a keen hand eye aptitude. A sketch will often be very relaxed and free, and that looseness can be viewed in the sketch, it is part of its beauty, and this looseness or apparent roughness could be the element that makes it desirable as a finished piece in itself. A sketch can also be useful as a technique to reach a distinct conclusion. Fashion or millinery sketches could be ideas or could be finalized into wearable items. I speculated if there was a general expectation that a designing through sketching process would result in a finished fashion or millinery item. Millinery and fashion are discussed in the following chapter.

### **3.5 CONCLUSION TO CONTEXT**

Sketching to me is a very valuable and useful occupation. One that cannot be missed in the design process, as ambiguous as it may be, it will often also show clarity and directness in the mark making as well as a keen hand eye aptitude. A sketch will often be very relaxed and free, and that looseness can be viewed in the sketch, it is part of its beauty, and this looseness or apparent roughness could be the element that makes it desirable as a finished piece in itself. A sketch can also be useful as a technique to reach a distinct conclusion. Fashion or millinery sketches could be ideas or could be finalized into wearable items. I speculated if there was a general expectation that a designing through sketching process would result in a finished fashion or millinery item. Millinery and fashion are discussed in the following chapter.



## 4 MILLINERY AND FASHION

Millinery was both the process undertaken and the object designed in this investigation. Millinery was the protagonist, it was the genre of fashion I designed in my personal practice and as the central character in this study, and millinery became the lens which I viewed the designing through.

Fashion is an area of the creative disciplines which everyone is involved, to varying degrees, on a daily basis. Elizabeth Wilson (2003) believes that fashion is the most accessible form of applied art, that it is the product we interact with the most closely, because regardless of our culture or our time in history, it is a way to express ourselves and the identity that we communicate to the world around us.

The field of millinery sits within, but is separate from the discipline of fashion. Millinery is all about making hats; millinery is both verb and noun, the making of the hat and the hat. Millinery is an accessory and the very notion of accessory suggests that it is a supplement to something else, something extra, usually an addition to a fashion look made up from clothes. In this study, millinery is not the addition or the supplement, millinery is the object that is the centre of the study and is not an accessory to something else.

Fashion accessories have a long tradition of being conceived and made using methods and tools associated with the handmade. The customary materials used and processes undertaken have their basis predominantly in the real world utilizing paper and fabric to mould and construct. Because millinery is so closely associated to the handmade both in perception and reality, millinery offered a fresh place to view designing fashion using technology. Millinery is a novel object, and brings with it a unique sense, one which is tied to occasion and to old worldliness. These attributes sometimes charmed and side-tracked the outsider into thinking that the project was 'all about the hat' but it was not. The project investigated the designing experience, the designing phases that occurred prior to the resolution of the design, the playtime, and the space for creative flow (Csikszentmihalyi, 1997; Runco, 2004).

My millinery practice at that time was one that was aligned with model millinery. Model millinery is a practice of designing and making traditional physical millinery artefacts which were usually individual hand-made pieces that were created through the blocking or modelling process, using a hat block or similar as the base to work on, and using the final materials or very similar materials, to achieve this end. Reproduction was often impossible.

Draping millinery was a spontaneous and fluid experience, similar to the process of sketching. Draping is a practice where the practitioner uses her knowledge of the materials to bring the designing process to a successful conclusion, to resolve the idea. While I designed the millinery in the 3D physical form, draping, many ideas emerged only to be lost as the physical hat took its shape. The fleeting glimpses of millinery design ideas vanished as I focused on the piece at hand. These transitory ideas were relegated to a distant memory, as if hidden under layers of feathers and net.

The resolved physical millinery resided in the physical world; its physicality possessed a genuineness which was permanent and easily understood by me, the designer, and all who experienced its physicality. The physical hat was what it was; it was an object which could be worn on the head. There were no vagaries which could be inferred, apart from those that the wearer could impart to it.

The experience of designing through sketching was explored through a series of experiments which used an assortment of traditional and innovative tools and techniques, some of which were computer based, some related to established millinery practices and others were unconventional and were not computer or fashion / millinery practice based.

The hat is a 3D object designed to be worn on the head. In the context of this doctoral investigation, hat making and millinery are defined as such:

- Hat making: Mass produced everyday headwear, often made from flat patterns and woven or knit textiles, fabric, machine stitched, relating to the fashion term: prêt a porter / ready to wear.
- Model millinery or one off millinery, relates to the fashion term: couture or bespoke. This encompasses much headwear designed and made for women worn in a fashion context. Model millinery has been

designed and traditionally made in a 3D way, simultaneously on a hat block using handcraft techniques. This process is in contrast to many contemporary fashion practices which use flat patterns and to some extent, draping as a 3D practice and which often separate making from designing. Traditionally model millinery pieces are crafted through the process of blocking or manipulating, and stitching by machine and hand, using tools and processes from bygone days.

The millinery develops as a physical 3D sketch, materials such as fabric, felt, straw are used to design and make the final piece concurrently. When working directly with the materials creating ideas, mass production is difficult, in addition this process is time consuming and therefore the end product is often expensive if destined for sale. The process of designing model millinery through a 3D sketch was intuitive; this was where the tacit knowledge of materials, discipline and human factors were brought into play.

Like many so called working class crafts or trades, millinery has not had serious reviewing. Glossy coffee table publications are the primary vehicle for writings on millinery as fashion items. In addition, there are technical instruction manuals which ably show the novice how to make millinery. These books rightly celebrate the artistic merit of the milliner or millinery (Jones, 2009; Blow et al., 2002) or the history of millinery (McDowell, 1992; Wilcox, 1946), or a how to of millinery (Anlezark, 1990; Richter, 1961; Hill, 1909). All inspiring publications, but they do not add to the dialogue of the fate of millinery, or millinery as a signifier of change, or millinery making as an inspiration for other fields of fashion. Academic writings on millinery focus on millinery as women's work, millinery as a trade along with dressmaking (Gamber, 1997; Simonton, 2006), millinery and the obliteration of the bird population (Haynes, 1983).

The series of sketching in 3D designing experiments were experienced, reflected on and critiqued from the point of view of a designer/maker using the discipline of millinery as the lens, as the agent and tool. I acknowledge that other accessories or fashion items could have been used for this purpose; however, millinery (both practice and outcome) offered me a unique point of view.

Millinery as a fashion artefact is an intriguing subject, and could engage a researcher in a wealth of information, however, this investigation is centred around my experience as a millinery designer, therefore these issues are outside the scope of this doctoral investigation.

- the meaning of millinery;
- social functions of millinery;
- millinery history;
- millinery as protective apparel;
- millinery religious or cultural meanings; and,
- the decline of millinery.

In the early part of the 21<sup>st</sup> century, as I write this exegesis, although millinery wearing does cause the wearer to stand out in the crowd and could be seen as out of fashion, I have observed that millinery is set for resurgence. This revival of millinery is shown through the increase of media commentary on millinery wearing, the growing number of young millinery wearers, as well as millinery being sold in high street or chain stores.

The opportunity to move millinery designing and making to a new location, a nebulous space, is celebrated and explored in the experiments undertaken. The experiments that follow were mechanisms to explore methods of sketching and designing in three dimensions. Transformational understanding and a deepening of knowledge came with the multiple cycles of experiments and reflections.

While I worked through the different stages of the project, I did not anticipate some of the directions and methods that emerged, nor the discoveries which were made as a result. These experiments are discussed in the chapter to follow.

## **SECTION TWO: EXPERIMENTS**

To accomplish the research aim I planned to undertake a series of experiments to explore whether sketching in 3D might be possible. The experiments were, as Schön calls them (1987, p146), 'move-testing experiments'. Within these I actively experimented with techniques for sketching in 3D. I was uncertain where this may lead me; however I was confident that the plan of ongoing experiments would lead me to a deeper and perhaps different learning. The experiments may lead to the intended outcome of sketching in 3D, or conversely may not. Either result was acceptable, as what was shown through the experiments was that sometimes the unintended outcome could not be viewed as a failure. Both intended and unintended outcomes had the opportunity to be positive or negative. Undertaking reflection-in-action assisted me to uncover new discoveries which in turn informed the subsequent experiments and ongoing millinery practice.

Reflection-in-action and -practice (Schön, 1987) and reflection on action and practice (Scrivener, 2000) were both utilized within the experiments and the doctoral investigation as a whole, and this mirrored my design process, as it was cyclical, evolutionary and reflexive. Through the reflexive process I built knowledge from the unique situations, and I did as Schön suggested; I embraced the unfamiliar outcomes and occurrences that transpired within my designing. As Schön states (Schön, 1987, p.68-69) “...even in situations of uncertainty or uniqueness, because it is not bound by the dichotomies of Technical Rationality.”

Drawing in 3D was a difficult undertaking in itself; yet I did manage to draw in 3D using a computer. Through casting fresh light on the antiquated discipline of millinery I considered and reconsidered processes and practice of millinery designing, and what emerged was a redefined practice.

As discussed previously, millinery as a practice and as a fashion accessory was out of fashion. However, there were elements of the millinery-making process which were useful and productive, as well as satisfying designing needs, for example the sculptural nature of millinery designing was inherently 3D. Additionally, I believed that millinery had the potential to offer value to a wider audience.

As discussed within the introduction to this doctoral investigation, the experiments were classified into and themed by the discoveries that were made in the investigations, these themes are the titles of the four chapters to follow.

The four themes are:

- Practitioner at Work
- Practice Disrupted
- Practice Interrogated
- Practice Redefined

*Practitioner at Work* included experiments which principally drew on traditional fashion and millinery practices. Tradition was a place where I returned periodically throughout the study as it offered a quiet reflective place

to look back and critically evaluate the experiments in light of traditions, as well as a place to plan for future experiment undertaken within the series. While undertaking the experiments ruptures occurred, and although often frustrating, these were essential to the development of the investigation. These ruptures are outlined in the section *Practice Disrupted*. Knowledge emerged from both the traditional practice and the disrupted practice experiments and surrounding literature. A set of experiments called *Practice Interrogated* systematically challenged the knowledge which emerged in the previous two sections, as well as my assumptions of millinery designing. The final chapter *Practice Redefined*, marks where conclusions are made and further research opportunities discussed. Discoveries made within the investigations offered insights into sketching millinery in 3D as well as making a contribution to the process and practices of designers more widely.

The design experiments were structured in a manner that would enable a new understanding of sketching in 3D and would assist me to uncover design process opportunities through the use of digital technologies and an experience of embodied making. The experiments were designed to test and explore a selection of ways of developing fashion firstly, and later millinery ideas through making. These experiments consisted of designing projects and were formulated to test an assortment of design techniques, methods and tools, (utilizing both high and low end technology); which in turn could be used for the development of fashion and millinery ideas. Through the selection of particular experimental contexts, ideas were explored, evaluated, and then analysed, and insights were used to inform the further iterations of experiments that would follow.

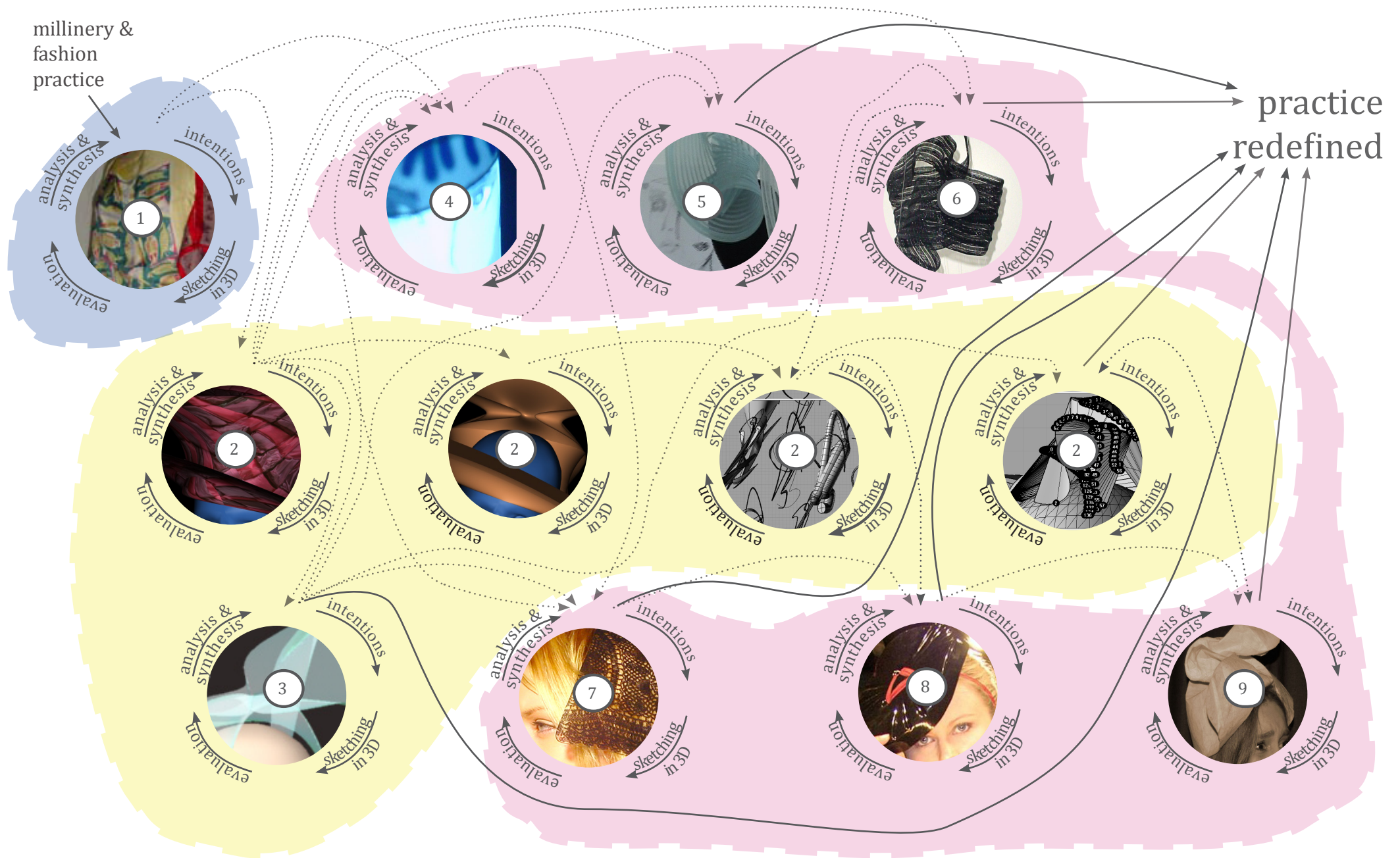
As discussed, digital technologies used in fashion at that time were primarily designed for, and used by, manufacturers to increase production capabilities. They were also used for the purposes of communicating the completed designs to the consumer, for example to encourage sales. Computers used in millinery were non-existent, with the exception of mass market headwear such as stitched caps. Within my research I proposed that software which focused solely on commercial endeavours missed an opportunity to enhance the designer's experience and my subsequent understanding of the experience and the design potentials.

Consequently, I initially focused on exploring the uses and potentials of digital technologies as creative designing tools for fashion, and then millinery. The analogy of the designer's sketchbook, a place that is used for the development of ideas rather than the development of fashion and millinery objects was the primary focus throughout, however at times I was distracted by the designed object, whether it was the fashion item or the hat. The investigation focused on the possibilities of working in a digital 3D manner, and although the use of digital technology was embedded in the work, it was not used exclusively. When I commenced the project I knew I wanted to make both digital 3D and physical 3D projects, using both traditional methods and digital methods to help me make sense of the possibilities that the digital technologies might offer. I was open to other methods that could arise along the way.

Reflection occurred in and on action and practice within the experiments. Often this was in the form of diagrams; and the knowledge gained through this process was used to inform the direction of the subsequent experiments. A phase of re-reflection occurred later on; sometimes the time between reflection and re-reflection was substantial with many experiments and years in-between the designing and making, reflection and the re-reflection. Effectively, the cooling down period between reflection and re-reflection offered me the occasion to find new and sometimes deep meaning from the experiments and experiences. The relationships between discrete experiments and themes that emerged were examined, and through this the intersections, connections and ruptures within my experience of designing practice were identified and analysed. The design process was the focus of the investigation, multiple experiments gave me the opportunity to explore and analyse a series of tools, contexts, studio spaces, environments, and processes: physical (or analogue), digital (or computer), 2D, 3D.

What follows is a discussion of the experiments organized into the four key phases of the research. Chronologically there were several loops of experiments and reflections within the *Practitioner at Work*, *Practice Defined* and *Practice Interrogated* before concluding with *Practice Redefined*. Please refer to the diagram to follow.





**Practitioner at Work**  
 1. Drape and Stop Animation

**Practice Disrupted**  
 2. 3D Digital Sketches (ongoing)  
 3. Artificial Elegance

**Practice Interrogated**  
 4. Making With Light  
 5. Cube Installation

6. Sketching Machine  
 7. Lucid  
 8. Buttoni  
 9. Hatistropic

Figure 4: Cyclical flow of experiments



## 5 PRACTITIONER AT WORK

*Practitioner at Work* is a grouping together of ideas where I focus on using the two techniques of sketching and modelling to develop fashion and millinery ideas critical to my existing and traditional fashion and millinery practices. I discuss one experiment – ‘Drape and Stop Animation’ - which fell within this chapter, practitioner at work. This experiment was undertaken to give me the opportunity to reflect on the process of designing fashion and millinery ideas through 3D physical sketching, a process that had become tacit. Although some of the experiments within the investigation did not utilize 3D digital technologies, the processes were analysed with the aim to discover how and later why, sketching in 3D was important to the practice. In addition, how the discoveries made within the experiments could inform sketching in 3D using digital technologies.

As indicated earlier, millinery is a part of my practice; however the first experiment examined was a fashion experiment, one which utilized drape as a model making technique. The experiment was structured to see if I could use traditional fashion draping processes to inform a way of sketching or modelling fashion ideas in a 3D digital environment. It was during these early experiments that I made the shift from fashion broadly to millinery specifically.

The discussion on these two processes critical to my practice follows; these processes informed the direction and structure of the series of experiments, and firstly informed the experiment within this chapter – *Drape and Stop Animation*.



## 5.1 DRAPE AND STOP ANIMATION EXPERIMENT

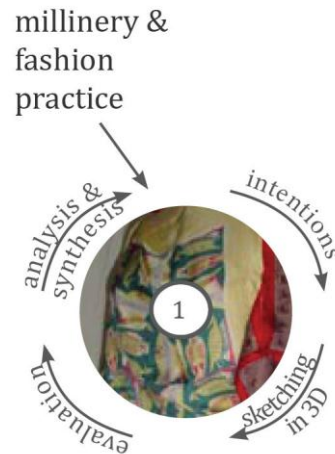


Figure 5: Influences on Drape and Stop Animation (1)

### 5.1.1 Part One: Drape

As I sketched the fashion item in 3D with cloth, my sketch became a design, I was designing and making the design concurrently; I had no expectations of the type of garment I would design. Please refer to Drape and Stop Animation within the DVD and catalogue. As I worked through this experiment I focused on how I felt when I sketched with fabrics on a tailor's mannequin; and the answer was that I was, blissfully in what Csikszentmihalyi (1997) would call a state of 'flow'.

### 5.1.2 Flow

Csikszentmihalyi discusses flow and the place of enjoyment in relation to creative endeavours in his publication *Creativity: flow and the psychology of discovery and invention* (1997). Csikszentmihalyi was interested in enjoyment, in particular enjoyment of activities to which people were devoting many hours, and which were not undertaken for financial or other gains; these were undertaken for enjoyment. He wanted to understand what motivated people to undertake these activities without the usual rewards, and to do this Csikszentmihalyi interviewed many people, from different age groups and activities and from a variety of areas such as the arts, performing arts, sport and science. From these interviews he compiled a list of nine elements, which were mentioned often, within the interviews from these diverse interviewees, people engaged in creative activities such as an artist, in physical activities such as a rock climber and what could be termed passive activities such as reading a novel. Below is the list of headings (nine elements) Csikszentmihalyi used in his discussion (Csikszentmihalyi, 1997, p111 - 113).

These were:

1. There are clear goals every step of the way.
2. There is immediate feedback to one's actions.
3. There is a balance between challenges and skills.
4. Action and awareness are merged.
5. Distractions are excluded from consciousness.
6. There is no worry of failure.
7. Self-consciousness disappears.
8. The sense of time becomes distorted.
9. The activity becomes autotelic.

I used Csikszentmihalyi's list of elements as a tool to analyse my designing experiences within this doctoral investigation. I was researching my experience of draping, and I wanted to understand how I felt, and to find meaning from the lived experience (Van Manen, 1997).

When I sketched through draping I was engulfed in the process. I draped, I pinned, I stood back and observed, I walked around the mannequin, I moved from draping, to photographing, to walking around the mannequin. I moved the camera and photographed, and again I draped, I added a scarf and secured it to the mannequin. I observed, walked around the mannequin, considered the design, photographed, again added another scarf, considered, photographed, and on this process went. I was in a meditative state; I was at one with the process, engrossed in the activity of draping, moving and photographing. I observed how the patterns and the textures of the scarves interacted with the mannequin beneath it, and I could imagine how this design would react on a body, it was an active bodily experience that engaged all of me, and at the end of it I had my garment and I had my images, so what was next?

Although the focus within this doctoral investigation was on using digital technologies to sketch in 3D, I used this draping experiment as a catalyst to help me analyse my physical 3D experience with the view that my physical world knowledge could inform my upcoming digital designing experiences.

At the time I believed that a draping experiment was not enough, and to have a deeper understanding with my aim of sketching digitally, I would also be well advised to use digital technologies in some form within this experiment. I elected to photograph my process with a single camera, from multiple viewpoints, to capture the evolution of the design along with the designing process, and to add a digital activity to the draping process. I did this to enable me to analyse the designing process at a later date; I believed that a reflection on the images would uncover knowledge that could be used to inform the development of a process for digital 3D sketching and design development. Furthermore, I wanted to see if I could make something 2D (the photographs) into an illusion of something 3D.



Figure 6: Drape and Stop Animation, stills of garment draping in progress



However, it soon became apparent that recording a 3D process through 2D photographs was not ideal. I could see the design develop before my eyes through the still photography, but something was missing. The images for 'drape and stop animation' were a 2D series, they captured the process from several viewpoints, and it worried me that although I could observe my process, the images offered no more information about my designing experience. I later understood what was missing from this element of the experiment, it was movement. It became evident that within my physical design process, movement was a key element in achieving a 3D designing experience. Movement included movement of me (the designer / viewer) and / or movement of the item I was designing.

Movement gave an illusion of 3D; this led me to plan the second part of this experiment, a stop animation experiment.

### **5.1.3 Part Two: Stop Animation**

Movement gave the viewer an opportunity to understand the piece, to see that the photos were not only a 2D image which illustrated the designed object, that the photos could also communicate the creation of the fashion object, along with the completed piece.

To achieve movement, the 2D still photographs were compiled as a stop animation of my 3D physical process; the photographs were imported into the computer software, Flash. These photographs were subsequently linked in a timeline to form a time based series of images as a stop animation. When played, these gave the effect of the designing occurring over a period of time, and of movement. The same effect was achieved in a low technology manner through the physical production of a flip book



Figure 7: Drape and Stop Animation, stills of completed garment for stop animation.

But what did this experience mean to me? There were two halves to this part of the experiment; it involved making the animation and viewing the animation. Firstly I will address making the animation.

At this time in the PhD I questioned whether digital technologies were quicker than physical methods. For example the flip book as opposed to the stop animation to achieve the same end point. Furthermore as I created the animation which I thought would be a simple process, I wondered if digital technology was useful in this context.

The analysis of making the animation confirmed for me that this stage was not successful from a maker's or designer's point of view, as it was not a designing experience, it was a viewing one, but was that important? I had made the animation and at the time I thought that making the animation was the critical element of this project, I didn't understand until I had completed several more experiments that the process of making the animation was not critical as an action in itself, as that activity could in no way be compared to that of sketching in 2D or 3D, the animation was not a designing process, it was a technical one.

However at the time I was enamoured with the technology, I wanted something I could show off, a finished thing if you like, I had not yet come to understand that my focus was to shift to the process rather than the product. I turned my attentions to the animation itself, and asked if this was a critical element in this experiment. Did I achieve a designing experience from watching the animation? I went about re analysing the animation from the point of view of an observer of the animation. Amongst Csikszentmihalyi's examples of activities is reading a book and being drawn into that reality, something that I often experience when viewing movies, and something that the makers of documentaries, for example about the fashion process, must assume or hope happens to their viewers. Did I feel as if I was part of the designing when observing the animation? Did I re-experience the invigoration I had when I physically sketched in 3D with cloth?

No, I did not. I wanted to use photography to track my 3D sketching with cloth on a tailor's mannequin, but what I had created was little more than a presentation of the process to myself, or to anyone who watched the animation. Perhaps it could be of use at a later date as a tracking device. For example if I wanted to intervene in the design process (prior to the resolution of the draped garment), with the aim of setting off down another design path, and therefore advancing the design lineage towards a different solution. I

wondered if I could reconstruct the garment to that point again if I followed the animation, and if I would ever want to. I acknowledge that this part of the experiment was something I could have also achieved via moving image. That is I could have filmed the process, from several angles, however I wanted to design and make, and I considered the film of the process as an inactive pursuit that would not serve a purpose in this project, I regarded the technique of making the animation as active, and therefore I believed making and viewing the animation would be useful.

As I reflected on the experiment, the computer screen or other flat surface that the animation played on also worried me. I was simulating a 3D experience in a 2D situation, and the 2D screen was getting in the way. I felt that although the experience of designing and making through draping was a successful 3D sketching experience, the recording of this experience was not. There were several reasons for this, notably, the animation had separated the action of designing from the communication of the designing, and I had in effect created a final fashion communication rather than a rough sketch.

As I worked through the experiment I repositioned myself from being the designer maker to the viewer; I was now an outsider when viewing the animation of the designing. I was no longer focused on designing, I was focused on the communication of the designing, and I was side-tracked by the object and the animation. This was not my objective; I aimed to record a designing experience in a way that I could experience the designing process again. I wanted to be part of the experience, during and after, merely observing the process after was a passive experience; this was not a success, and I wanted action.

What was lost in my experience between the doing and the observing? When I designed the garment through draping I was oblivious to all that was around me, as designing and making was a thoroughly satisfying occupation. The reward was not the final object, the garment; I didn't need the top at the end of the process. I mused on whether I would have enjoyed the designing experience as much if the work had resulted in an unsuccessful or un-wearable design. What was extremely rewarding was the designing experience, it was an enjoyable and completely engrossing experience, a full

bodily experience, and it was a meditative moment. I was as Csikszentmihalyi says, in the flow.

I had to ask myself, was I enamoured with the software to the point it had side tracked me? I was to answer that question more fully in later experiments, however within the context of the 'Drape and Stop Animation' experiment I discovered that I was so eager to use the technology that I had missed a key element. When I viewed the animation it was a passive situation, I had created an animation, but it did not replicate my experience as a designer in any way at all. I viewed the animation, I felt removed from the situation, and I was an observer. Anyone could have been the observer, a client, a colleague, a student, the animation had many commercial possibilities, but being an observer was not an experience that could be compared to being a designer.

Through movement the animation brought the static images to life, and movement was integral to creating an illusion of 3D within the digital (or non-physical) space. Coming to understand this was most useful for subsequent experiments into how my 3D physical process could inform a 3D digital design process.

What was most interesting in this discovery sat outside what I set out to do or to understand in a graphical or design sense. It was something that did not come to light until I re-reflected on this experiment several years after I completed it, and also after I had completed subsequent experiments. What I discovered several years after this experiment was the significance of the sketching experience to my happiness. I wondered if my happiness in this process was because I found engaging in the bodily experience of sketching as relaxing, or as Ursyn puts it, the experience of drawing "may alleviate cognitive overload" (2010, p8)

Fashion designers generally sketch developments of ideas in 2D, and then further develop the 2D images into 2D patterns ready to be constructed or alternatively create patterns in 3D through a process of modelling or draping. 3D modelling was the preferred method of working within my practice, because I like to see the design evolve before my eyes, that process enables me to expand and analyse the design, as it evolves, and from multiple angles. Viewing the designs from multiple perspectives, in 3D, helped me gain an

understanding of the object, to understand the form, proportions, and the potentials and problems of the object I was sketching.

Viewing the design from more than one angle as it develops can be achieved by other means than physically. For example I could draw multiple perspectives of the design, moving from one view to the next to enable me to perceive as many views as possible. When working in 3D in a fashion context, I prefer to develop front and back views at the very least, and the inclusion of a side or both sides is more preferable, and within millinery an aerial view is also desirable. However the action of sketching each of the views on paper, in 2D, and moving between these sketches could lessen the flow I achieved when I draped in 3D and when I sketched a singular view in 2D.

In the 'Drape and Stop Animation' experiment I used the concepts of sketching and modelling to compare my experience of sketching using physical and digital technologies, I undertook this with the view that the findings could be harnessed in a computer context. I acknowledge that undertaking this experiment did not enable me to find a method to sketch in 3D in a computer, however as mentioned earlier there were several outcomes which went on to inform later experiments, in particular it informed the Artificial Elegance experiment which is discussed in the next chapter.

At this stage in the investigation I was still grappling with a definition of digital 3D within this practice. Why did I so desperately want to work within it, and to understand what it could be for my future practice? Within this chapter I reflected upon my traditional fashion and millinery practice through draping and broadened that to include stop animation. I utilized Csikszentmihalyi's nine elements as a tool to critique my experience as a designer, while I sketched in 3D; and I reflected on my practice in action.

In the following chapter, Practice Disrupted, I use the knowledge I gained while draping and animating a garment to inform further experiments, including how I could develop a way of having an embodied experience while sketching in 3D in a computer environment.



	Positive attributes	Negative attributes
Sketching, a 2D practice, on paper or similar item to create a 2D image.	Iterative  Imagination can be unrestricted, not curtailed by physical world restrictions  Can be ambiguous	2 D view and experience  Separates designing from making  Cannot save fleeting design moments without interrupting the flow
Modelling, a 3D practice, using materials to create a 3D form.	3D view and experience  Iterative  Designing and making occur concurrently	Imagination can be curtailed by physical laws of nature  Cannot save fleeting design moments without interrupting the flow  Difficult to be ambiguous

Table 1: comparing positive and negative attributes of a 2D and 3D physical world designing experiences.



## 6 PRACTICE DISRUPTED

I had considered sketching and draping in the previous chapter, and had undertaken a physical 3D drape experiment which was then expanded upon through stop animation. In this chapter I discuss how I stepped out from the traditional processes to disrupt my practice, and how I utilized the learnings that came out of chapter Practitioner at Work.

While I had productive embodied designing experiences whilst I engaged in the act of sketching (2D) and the act of modelling (3D), in both my practice and in the initial experiments, the actions of sketching and modelling occurred independently from each other, not simultaneously. Traditional 2D and 3D physical fashion and millinery designing processes had both positive and negative attributes, refer to the table 1 on the previous page.

I predicted that if I consolidated the key positive characteristics of both 2D and 3D in an inventive sketching and modelling process, I would achieve a most fulfilling designing experience, and therefore productive design developments. The positive qualities which I selected to highlight in this investigation were as follows:

- 2D paper sketching - lack of physical world restrictions; and,
- 3D modelling – 3D view and experience.

By amalgamating 2D paper sketching and 3D modelling I believed that I could circumvent physical world restrictions, and in addition be ambiguous with my sketching, and be able to view the entire design as it developed, much like the process in the mind's eye.

I was determined to sketch in 3D because I was designing 3D objects. They were objects which resided in the physical world and were often worn by humans, and because of this; I saw opportunities to link my 2D sketching and 3D modelling practices. I developed a designing process where both sketching

and modelling could become one, a concurrent hybrid practice, one which would occur by using computer technology, I called the integrated process tinkering<sup>17</sup>.

## 6.1 Tinkering

Tinkering within a 3D physical or digital space is a way to practice sketching and modelling simultaneously. It was a way to use my hands with purpose, to design fashion and millinery ideas. I am a tinkerer; I tinker in the physical and the digital environments, tinkering with lines and shapes to develop fashion and millinery ideas.

Tinkering is important in the design process, as although much designing actions can centre on problem solving, designing can also be a propositional process, this can be seen as a time to tinker. Tinkering while making is an important element in traditional fashion and millinery practices, where the designer or milliner designed directly onto the hat block, to tinker while designing, to let the material and tools talk (Schön, 1987, 1992). Through exploration and concurrent designing and making the designer proposes ideas which can be propositional and can also lead to the design solution. In a physical world practice, the milliner exposed many design opportunities while creating and draping models directly onto the millinery hat block, however, it was a problem to capture and save these fleeting ideas of design, and remain in a state of flow.

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<sup>17</sup> Tinkering is used in this PhD investigation as a verb, that is, to tinker, I am a tinkerer. Tinker is not used to indicate an Irish gypsy, a naughty child, or a travelling mender of pots and pans.

## 6.2 3D

My understanding of designing in 3D was defined by my experiences in the physical world, as a fashion designer using physical 3D processes, as demonstrated by the previous experiment, 'Drape and Stop Animation'. When I commenced this investigation I defined seeing in 3D as when I could perceive the object I was viewing had volume, and therefore occupied a physical space, there was a visual tactility.

3D is a fascination in popular culture today, and there are also early examples of imitations of a 3D viewing experience, notably in the cinema where in the early part of the 19<sup>th</sup> Century machines were invented that could replicate movement and in some cases provide an illusion of 3D.

Alex Huk stated in his Seeing in 3D online lecture notes that (1999, section 5)

Wheatstone's original (1838) stereoscope was the first example of this. It presented an image to each eye separately; while the images were of the same thing, they differed just as they would if you were really looking at a 3D object with actual depth (instead of a flat sheet of paper). By artificially including disparity in the pair of images, people looking through a stereoscope could see objects in depth.

The stereoscopic view gave the impression of depth. This technique is used to this day in greeting cards and quite delightfully in the Coronet 3D viewer from the middle of the 20<sup>th</sup> century.

As I pondered the seduction of 3D, I located a workshop, from the annual Siggraph<sup>18</sup> conference in 2001, titled 'Seeing in 3D', which was written and delivered by Bob Parslow and Geoff Wyvill. Professor Geoff Wyvill is from the Department of Computer Science, University of Otago and based in Dunedin, where I live. I contacted him to make a time to discuss the nature of seeing in

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<sup>18</sup> Siggraph is an annual computer graphics conference.

3D, and how 3D computer programmes could be utilised to assist with this quest.

My meeting with Professor Wyvill was a significant point in the study; it clarified my direction in several matters. Firstly, Wyvill informed me about the difficulty of designing clothes in 3D using a computer programme, he explained the problems of programming algorithms to enable them to display specifics of individual textiles, namely the drape of cloth, the stretch of cloth; and that complicated algorithms would have to be created for each textile. Creating algorithms was beyond me, I just wanted to sketch in 3D, using a computer.

Wyvill also explained the nature of seeing in 3D, and although I knew that without movement of me or the object I could not see around corners and therefore could not see in 3D, it was enlightening to get his eloquent explanation of what seeing in 3D was. Professor Wyvill stated that seeing in 3D was an illusion, and to see or understand the three dimensionality of a form, the viewer's eyes and brains cleverly and quickly meshed a series of images together. The single images were reconstructed as a form in the mind's eye, and thereby the viewer had the ability to perceive what they were viewing in 3D.

Wyvill had knowledge of 3D computer programmes used in communicating fashion. His knowledge was gained through the contact he had with a computer scientist from Switzerland, Nadia Magnenat-Thalmann, who was designing virtual catwalks, and creating fashion in 3D computer environments. Wyvill foresaw problems with my direction of investigation, as he believed that the drape<sup>19</sup> of the cloth was vitally important to the construction of a 3D entity, he informed me that the drape of cloth in a digital environment was problematic, the algorithms being notoriously complicated. Like the fabrics that the digital drape attempted to replicate, the digital cloth needed to possess the ability to vary in weight, texture, drape, stretch, and in addition it needed to show an interaction with the body and with itself through collision. Wyvill had informed me that the programming of 3D

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<sup>19</sup> The drape of a textile in this context refers to the way the textile falls due to its properties, that is, its drape-ability, the textiles reaction to gravity. Many factors affect this including textile composition, weight of the textile, cut, bias or grain direction, what the textile is falling from or secured to, and what it is falling on, undergarments and so forth. This is different to drape as discussed in the Drape and Stop Animation experiment which is the technique of draping a textile to achieve a fashion or millinery design idea.

software for textiles was very difficult and I can only assume that this was a significant reason why 3D fashion software did not become widely available until relatively recently<sup>20</sup>.

Wyvill was the first of many to misinterpret what I was doing. Like many others he connected the drape of a textile and fashion inextricably, he presumed that the fashion object designed needed to have drape-ability, however, in the context of this investigation, it did not.

Although I had determined that movement was important to my designing experience; I was not referring to drape-ability which would be demonstrated through the movement of the fashion or object achieving an illusion of 3D, of the piece hanging on a coat hanger or being worn on a model walking down a catwalk. What I desired was movement that would give a static sketch the illusion of 3D, through rotation of the model or of the view of the environment in a 3D digital space.

In addition, I had no desire or need to accurately represent or render the textile. I was creating sketches of hats, and my aim was to create interesting fashion and millinery ideas that centred on the form of the objects. At the time I viewed the colour, texture and print of the material as secondary, however, as I moved further into the investigation, the material became more important, and went on to inform and drive the designing.

Despite Wyvill's reservations with my quest, I believed I could find a way through this issue and that I would be able to design and sketch in 3D using computer software, I hadn't located the correct software yet. While I investigated the nature of 3D, and discussed with Wyvill, I commenced sketching in the digital environment using the programme 3D Studio MAX R3.

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<sup>20</sup> In recent years 3D capabilities for fashion purposes has become available as options or additions to standard commercial fashion CAD programmes.

## 6.3 SKETCHING USING COMPUTERS

Although the terminology for what I was doing in the computer was modelling, it seemed to me that the process was a lot like sketching. I had started to sketch in 3D, and to create a 3D visual diary.

I did not see that the use of computer technologies immediately negated the skill, thought or learning that could be achieved through the act of sketching physically. Admittedly the act of sketching with a mouse was entirely different to the act of sketching with a pen or pencil. The hand eye co-ordination when using a mouse rather than a traditional pencil tool or similar can be vastly different (Lawson, 1997, 2006; McCulloch, 1996; Pallasmaa, 2009). While sketching with a mouse, the eye was focused on the computer screen rather than on the hand holding the rather disembodied mouse. More recently the mouse has been subsumed by the pen tool and tablet and also by the tablet computer, and more recently still the touch screen. These developments of tools have brought the hand back into the field of vision in digital sketching.

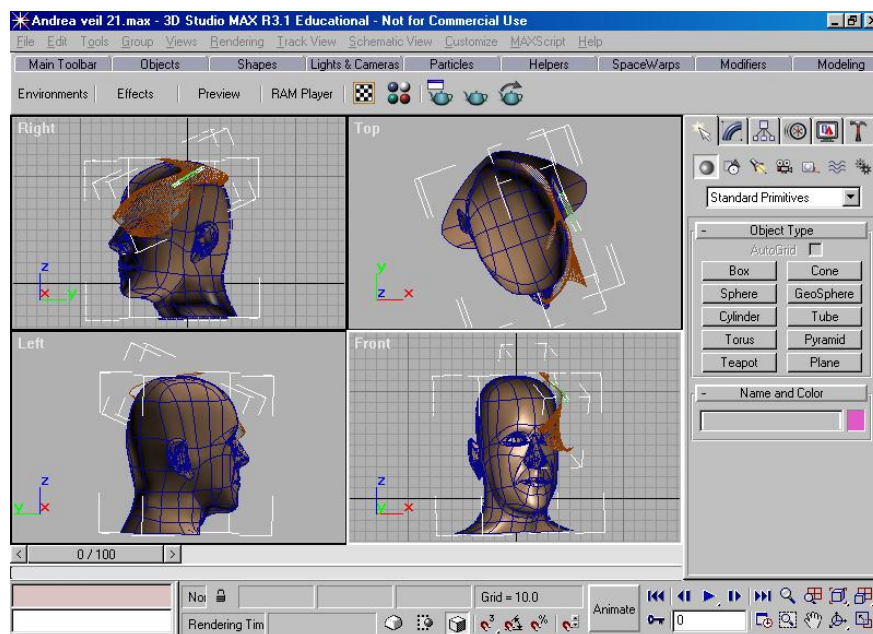


Figure 8: Andrea hat, digital sketch

When using a computer to undertake a task, many believe that the task will be sped up; this is sometimes the case and is also sometimes not the case. When using computers as a 'design tool' the production of the products is sped up for example undertaking grading or lay plans, however in my experience, the initial steps of creating designs in the sketching stage within a computer environment is slower not quicker.

*... when I think about it [CAD] more, most CAD is used for production, ie to speed up / streamline a way to an end product and more profit. This is interesting as we don't expect the pencil to do this when using it as a design tool, ie is it just our (human) expectations of the software? Do we expect too much? Often what is created in the CAD space is impossible to achieve in a physical realm, but that is ok, it (with a sketchbook in CAD or on paper), as a sketchbook is a place of imagining, a place to create ideas which may or may not ever come to reality.*

*reflection 2010*

Although in this case the hat did become a physical reality.



Figure 9: Andrea hat





## 6.4 3D DIGITAL SKETCHES EXPERIMENT

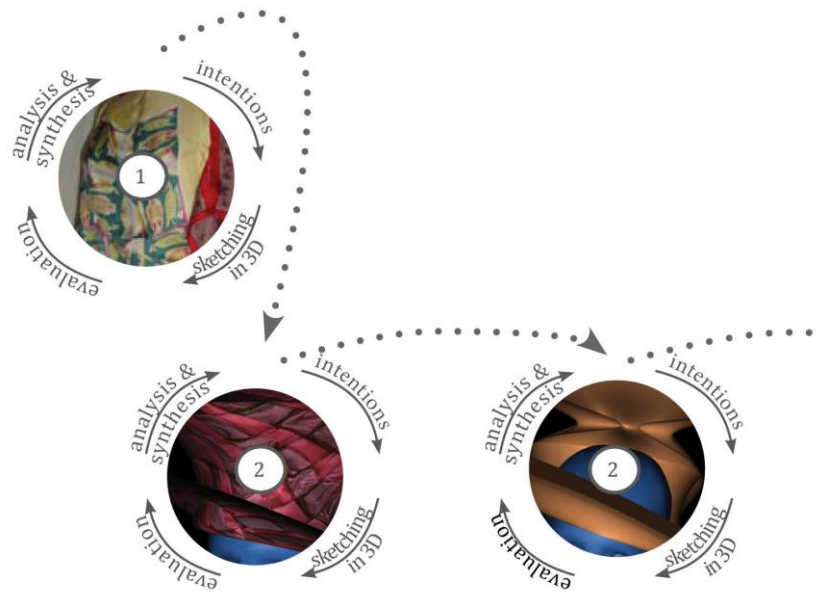


Figure 10: Influences on Digital Sketchbook part 1 (2)

This body of experiments explored sketching within a 3D computer environment, I will call it tinkering or sketching throughout the rest of this exegesis. As I reflected on my experiences in the drape and stop animation experiment, I acknowledged that tinkering also took place for me in 3D on the tailors mannequin using cloth. I had design conversations with the cloth, draping it onto the tailor's mannequin; it was a 3D physical designing conversation, I tinkered. However the materiality of the cloth meant that a truly prospective approach was unlikely due to cost of materials, space for storage and the like. Downton (2004) and Biggs (1997) both discuss models as a content of knowledge, and Schön (1992) goes one step further to suggest that a model or object can also be a designing conversation. I aimed to use this knowledge when sketching in a computer environment.

Firstly I sketched fashion garment ideas in the computer environment, and this was followed by sketching millinery, there was a period of overlap when I sketched both fashion and millinery, and therefore I have not separated these within this experiment discussion.

I selected the software 3D Studio MAX R3 as I had observed art colleagues creating impressive geographical animations and believed that this software could be manipulated to be useful in a fashion and millinery context, as the undulations of the hills developed equated to the form and shapes of garments and, especially hats. In addition, the software was freely available to me through my interactions with the Dunedin School of Art.

These 3D digital tinkering experiments were my first foray into utilizing 3D digital technologies to sketch in 3D. I used this group of experiments to test the water, to see where I could push the concept of tinkering and sketching in 3D using computer technology and to use this experience to inform ensuing experiments. I explored both the capabilities of the software and my capabilities to design with it.

I resolved to use the 3D digital tinkering process as I would a visual diary or sketchbook, however it could also be said what I did resembled designing in a studio. When I commenced, I had no expectation of finalizing designs, I was exploring where my designing thoughts might take me. I was having a design conversation with myself and with the shapes, lines and planes using sketching as my voice. When I tinkered in 3D, I doodled with ideas and techniques; I attempted to dress a figure in clothes, to drape bodies in textile, and to generally attempt to sketch traditional garments. As I moved between the physical and digital environments new challenges and opportunities presented themselves.

For a time I became ensconced in the use of a cloth drape plug-in for 3D Studio MAX R3 called ClothReyes<sup>21</sup>. This plug-in had simple instructions on how to input textile property information in order that it could develop an illusion of a textile which had adequate representation of stretch, weight of the fabric, with drape-ability. I created a textile, a sheet of digital cloth or as it is known in the digital environment, a plane of textile. I could produce a successful drape of a textile, build a two way stretch fabric and bounce a ball on it, much like a trampoline, and I wondered if I could I use this fabric to sketch or drape in 3D.

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<sup>21</sup> note: 2011 - ClothReyes plug-in became available again in 2011, as freeware.

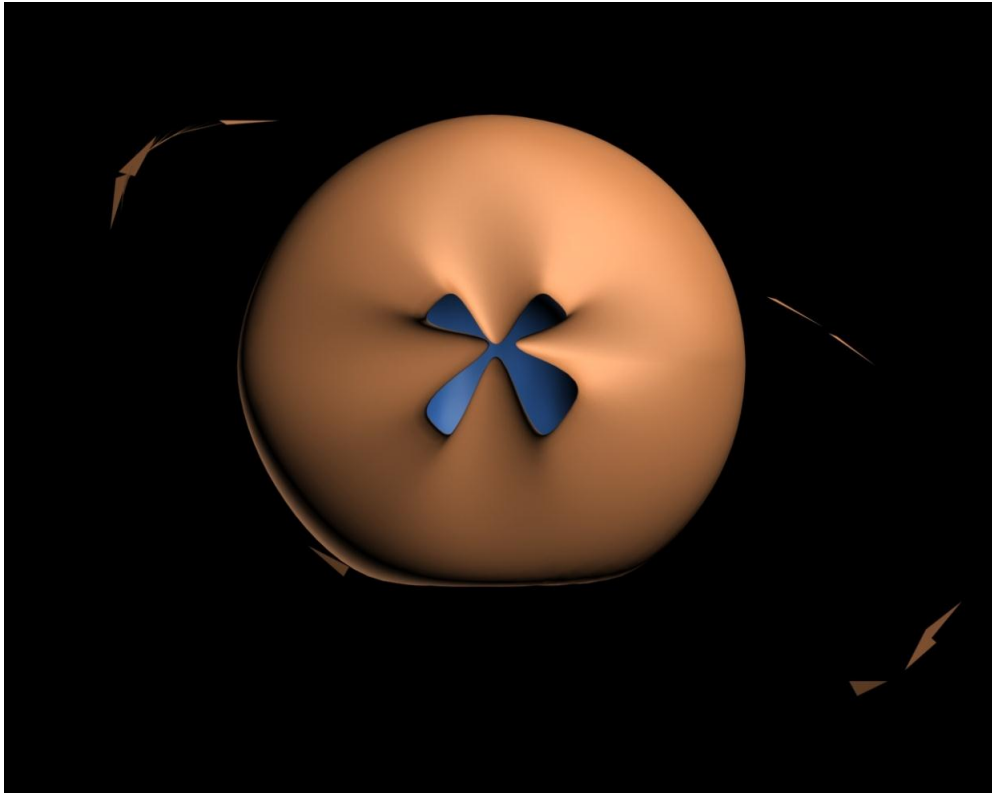


Figure 11: Top view, pumpkin hat

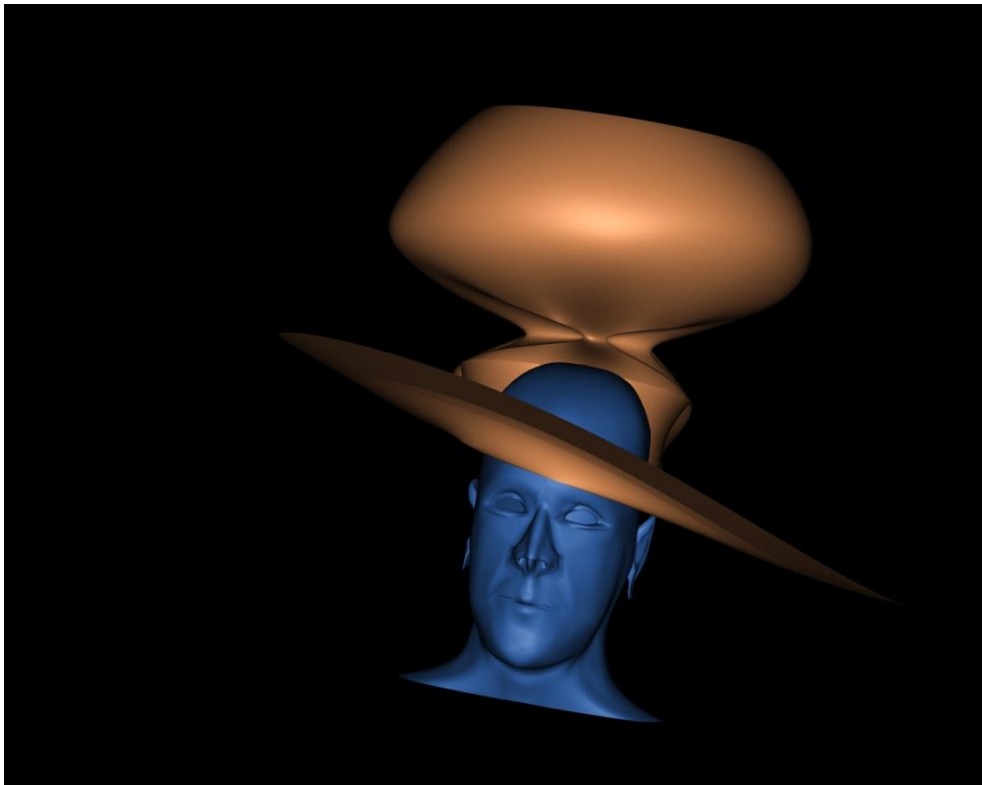


Figure 12: Front view, pumpkin hat

It was ironic that I pursued the draping of a textile after my admission previously that textiles were not important to my aesthetic, but I was trapped, I had the drape plug-in, therefore I could or should drape the textile. I used the virtual textile like a piece of two way stretch textile, I stretched and pulled it against the digital models I had made, some of these resembled the human form and some did not. I draped over a ball and made a draped hat of sorts. Learning how to use the plug-in was a challenge, and this additional aspect in the study was distracting I grappled with draping in a 3D digital environment, and in particular how transformed the computer environment was compared to a physical environment. I developed an understanding of how the objects that interacted with the textiles needed to be constructed so that the textile would collide and drape on or against the object, against each other, and not travel through each other, which was sometimes the case in my digital tinkering. In addition the environment lacked gravity which made the experience both exciting and terrifying, the 3D digital environment felt lawless.

3D Studio MAX R3 is a polygonal modelling programme, I created 3D models, which were not solid entities; these were surfaces or structures. Non solids or hollow structures were ideal for constructing fashion and millinery ideas, as I was constructing a hollow space; a space that was a covering of, or a space for a body or part of a body, such as a head.

I tried time and time again to wrap and unwrap the textile, to make a simple fashion item. I was bound to the materiality of fashion, and this propelled me down a frustrating path where I tried to make my digital ideas reflect a known physical reality. I was determined to find a way to sketch fashion (and later millinery) ideas in a 3D digital environment; this was not an easy task. I furiously draped singlets and skirts, but the results were disappointing.

Whilst undertaking this investigation, the ClothReyes plug-in disappeared from the computer, and from the department. I was distraught at first, but then reflected that the drape I was trying to achieve I had also espoused as being not important to me, to my aesthetic or to my process. I had to remind myself that I was not illustrating physical items; I was sketching ideas, I was tinkering with abstract sometimes ambiguous ideas, and the ability to drape in a computer environment was secondary. I was unable to continue draping,

and this was a blessing, as I was released from trying to replicate the physical attributes of a textile in the digital world, I moved on into an unknown space.

I reflected that my deep and as yet unspoken expectations of developing fashion that was recognizable as fashion was unknowingly affecting the direction of this doctoral investigation into millinery. It caused me to continue to attempt to design 3D digital millinery ideas that could be made in the physical world. I was unwittingly tied to the notion that designing a hat idea had to result in a physical reality, a wearable garment or hat, and because of this I was stopped from achieving that outcome at every step along the way.

I started to wonder if Professor Wyvill was correct, that the challenge of drape was too demanding for someone who was not a computer scientist. As time went on I fine-tuned my direction further, as the combination of the challenge of drape and the lure towards known material outcomes were overbearing.

During this experiment, the 3D digital sketches, the focus of the investigation shifted from fashion to millinery. The characteristics of millinery demanded a distinctive skill and knowledge set. These characteristics enabled me to focus on the abstract and physical forms through the act of tinkering in 3D, which in a physical practice could be compared to a process of model making. Millinery became the lens of the study at this juncture.

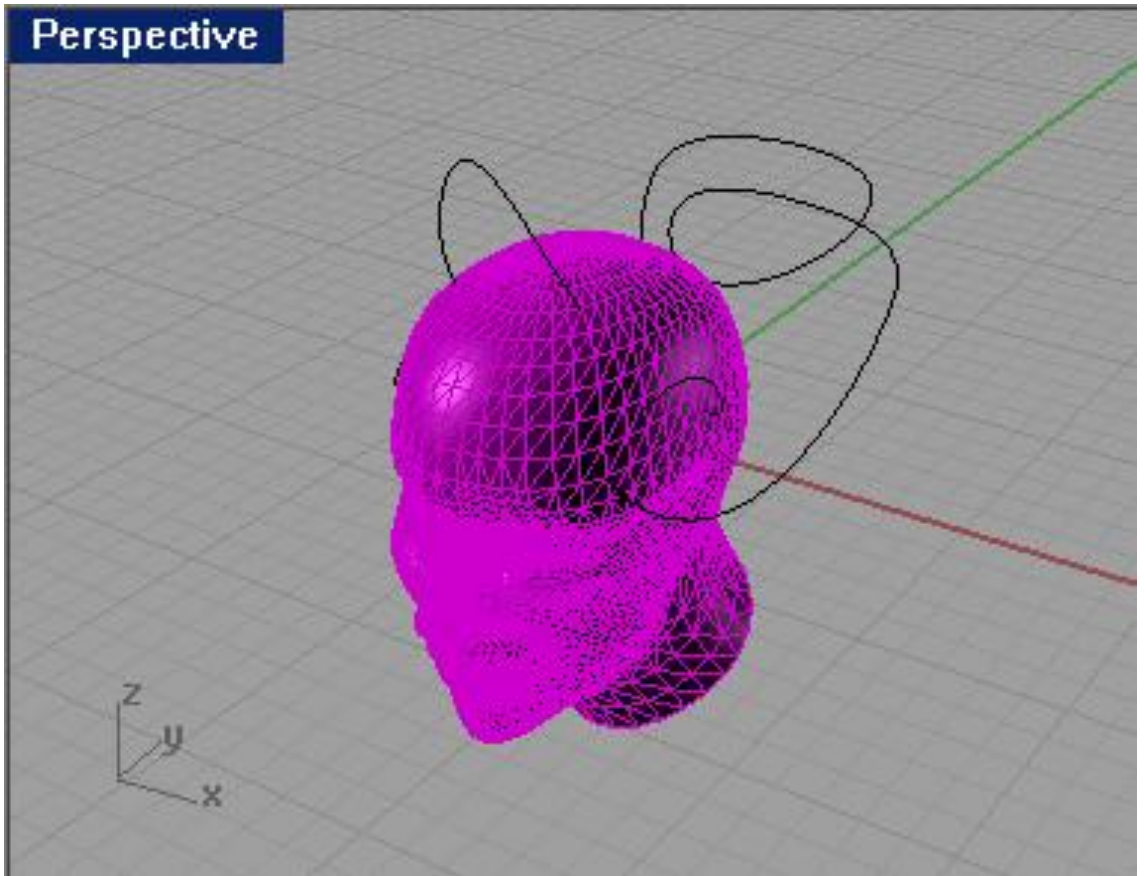


Figure 13: Sketch on head

## 6.5 DIGITAL MILLINERY MODELLING

Designing and making millinery in the digital sense was similar to and informed by traditional physical processes; yet it was a transformed process. The individual hand-made pieces were crafted through digital modelling processes, rather than hands-on toiling using cloth, felt, straw or other materials. In the digital world, the physical experience was changed through the digital tools, materials and environments. These tools included the software, a screen, a mouse, a tablet and pen and often four simultaneous viewpoints. The digital materials consisted of NURBs lines, planes, polygons and surfaces. The digital environment had no gravity, and like the digital materials, was mutable.

A disembodied head was used in the digital space; this digital head resembled a physical dolly<sup>22</sup> or hat block and yet was fundamentally dissimilar to it. When physically sketching in 3D, the dolly or hat block is an integral tool which was used as a firm base to sketch on, by securing the sketching materials to it. In the physical environment the dolly denoted scale, and also showed challenges that the designer may encounter if she chose to resolve the design. Within the discipline of millinery, difficulties often related to engineering issues of balancing an often large structure on the head, and these were addressed through the 3D physical sketching process. The dolly's very existence made it possible to sketch in 3D physically, as is common practice in the millinery field. The process of sketching physically in 3D offered an unambiguous view of the millinery and how the millinery may function. This could be viewed as a positive attribute, none the less, in the context of this investigation ambiguity is also an important element.

The practice of using 3D sketching as the predominant method to develop ideas in millinery is in contrast to fashion garments in western cultures, which are primarily created through the 2D sketch and the flat pattern. When

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<sup>22</sup> Dolly - This is effectively, a tailors dummy for a milliner; it includes the head and the neck only, there are no facial features.

working in a digital environment the computer generated head resembled the dolly, and yet it did not have the properties of a dolly, and it was not an integral tool in the process of sketching in 3D digitally. The digital head did not interact with the digital materials or the hat, it was a representation of the human head, it was a simulation of the future imagined wearer.



Figure 14: Physical dolly



Figure 15: Digital dolly



When I reflected on the millinery pieces I had created within this series, they were accurate digital simulations of physical millinery, and while this was pleasing to a point, there was an element of predictability. The hats represented the physical hat, there was nothing new. Over time I became dismissive of these images and designs, these pieces were replicants of millinery pieces I had already created or could easily create. Later on in a reflection on my investigation I realized what I had undertaken was a digital hat illustration and not a designing conversation, the 3D sketch was defined, it lacked ambiguity, which is the delightful nature of a sketch.

I wanted to tinker in 3D in a digital environment. I wanted to create a simulation of the dialectic process of sketching that I had in the physical environment, an embodied experience in a disembodied space, but I hadn't, instead I had created a simulation of the fashion and of the millinery. My conversation between the physical and digital world continued.



## 6.6 ARTIFICIAL ELEGANCE EXPERIMENT

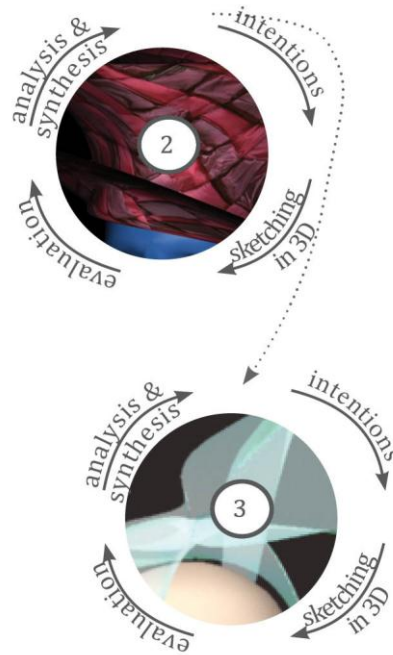


Figure 16: Influences on Artificial Elegance (3)

In the next experiment I abandoned replicating the physical properties of known millinery in a digital environment, and set about using computer generated entities to challenge traditional practices and to attempt to create previously unknown pieces of millinery. I drew lines and created planes which were then edited to form interesting organic shapes, the wire frames<sup>23</sup> and rendered millinery designs that were ambiguous, and poetic. I used the camera as both the eye of the viewer and sketcher; with the camera I could travel inside the hidden folds of millinery, something I had never been able to achieve in my physical millinery practice. I started to wonder if this millinery heralded a new way forward for a bygone object as coined by Baudrillard in 'Revenge of the Crystal' (1990).

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<sup>23</sup> Wireframes are the nature of the wire like structures formed by lines when creating 3D surface and solid models in CAD.

There were significant learnings to be had in the Artificial Elegance experiment. Firstly, there was the considerable frustration and technical challenges as a maker as I struggled to bring the immaterial digital millinery to a material reality; and secondly I was forced to reconsider the meaning of an object in the making process, and the fine line between the making and the made. I made many design ideas in the computer environment, and watched the millinery models develop from the privilege of multiple viewpoints.

My first foray into tinkering in 3D, creating wireframes, reminded me of a whale bone structure for a bonnet. I decided to expand on that idea, to use a truly bygone piece of millinery, the bonnet, as the starting point for these millinery ideas. I looked to the traditional "calash" bonnets from the mid-18<sup>th</sup> century and the drawn bonnets which followed these. These bonnet frames would have originally been constructed of wood, whale bone or wire, and I reinterpreted them using interpolated curves or splines in the digital studio.

I soon came to understand that the physical laws of nature did not exist in the digital space, and consequently understood that Baudrillard's 'Simulacra and Simulation' (1994) would offer a serious critical point of view to critique this investigation from. This knowledge was liberating.

Although I was engaging in a disembodied designing experience while sketching in a 3D computer environment, it was a thoroughly rewarding experience. I was able to sketch in 3D and employ my tacit knowledge of sketching, and relocate it into the digital space through my imagination. Because of this I was often in a state of flow when designing in the digital space. As I moved the camera (which acted as my eye or view) around in digital space I enjoyed viewing and capturing the different glimpses of ideas that were propositions for millinery.

### **Materiality**

I tried to give the digital ideas physicality. I could not accept that the digital sketch could be an authentic outcome, which was ironic, as I could accept the 2D sketchbook tinkering as authentic outcomes of sketching. When I

modelled in 3D in the physical environment the interaction between me, the designer, and the material was a dialogue. As Schön stated the materials talked back (1992), however interactions in the digital world posed problems and challenges with materials and environment which were not defined by the physical laws of nature. The lack of physical laws of nature in the digital space was eventually accepted and embraced as a valid way of working. However, a major issue was presented when I wanted to give the digital model life in the real world. The design was difficult to read or interpret in a traditional millinery making manner, I was moving into the second phase of the “precession of simulacra” (Baudrillard, 1994, p1), through my designing I had created millinery which “... masks and denatures a profound reality”.



Figure 17: Artificial Elegance bonnet: 3D digital bonnet

I found myself searching for a material output. This desire was related to the history of my design practice. I was tied to millinery that was destined to be worn, and I had an inability to let go of the materiality associated with this. The materiality of fashion was embedded so far within me it had become an integral part of my design practice without me even realising.

At this time I reflected:

*ok so having a problem here, I am getting confused between the communication of my ideas to others in the form of lovely rendered hats and what I actually set out to do, to create design concepts, rough and ready ideas...*

*Reflection 2007*

Although in a stage of re re-reflection I identified that I was tied to the materiality, and that that was a problem, at the time of carrying out these experiments I still did not realise what I was battling. I was trying to replicate a historical (or known) system of millinery practice, I was conforming to this and to an idea of what millinery objects were as material products. I halted this way of working.

At one point in time I asked myself the question, what is the point of all this designing? I wanted to push myself into making the real thing, that is, the physical objects.

*keep trying to figure out how to get the physical piece out of the computer, need to stop this*

*Reflection, 2007*

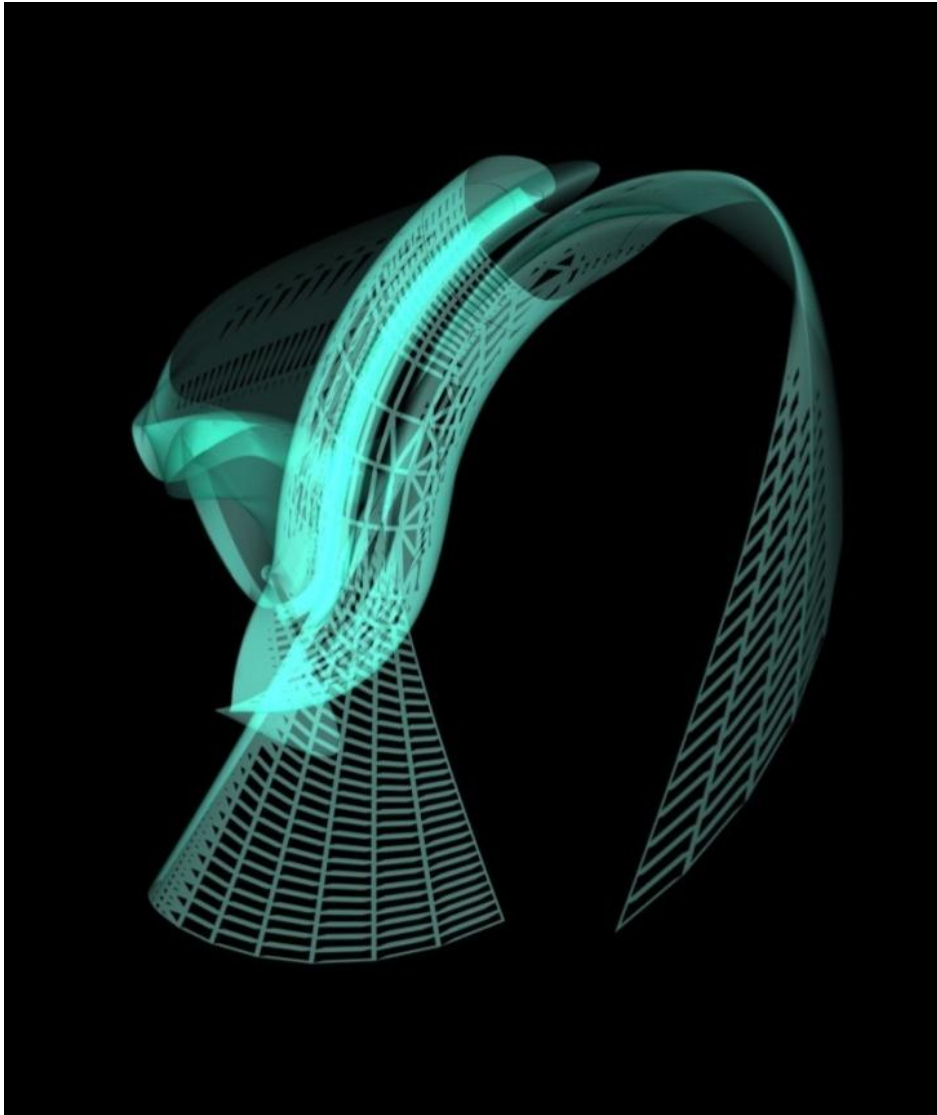


Figure 18: Wire frame of Artificial Elegance bonnet

The wire frame bonnets from 'Artificial Elegance' were beautiful structures, but I found it impossible to understand from a maker's point of view. I wanted to know how to make the piece physically. I understood that the software 3D Studio MAX R3 was animation software, and therefore did not have precise engineering measurements or a stable world. It was not a production driven software and therefore items created within it could sometimes be impossible to analyse for the purposes of constructing in the physical environment.

To gain an understanding of the millinery, I sketched the millinery in 2D in the physical environment using pencil and pastel extensively. I sketched Artificial Elegance on 2D paper, from five vantage points of front, back left side, right side and a perspective view from slightly above. I believed that sketching would help me understand how the millinery could be made physically, but the different vantage points did not link back together, they were almost like five different hats.

Through this investigation I moved into the next phase of Baudrillard's simulation, I had designed something that I could not analyse as I did my sketches or 3D physical models as its very being was in opposition to all the laws of nature. As Baudrillard states (1994, p6) "...it masks the absence of a profound reality", it consisted of zeros and ones. Through sketching in 3D, using 3D Studio MAX R3 I had as Baudrillard says made (1994, p6) "The transition from signs that dissimulate something to signs that dissimulate that there is nothing...". This realization led to two experiments in the following chapter, the Cube and the Sketching Machine (refer to 7.2 and 7.3).



Figure 19: Artificial Elegance bonnet: digital collage; and pastel sketch.



Within this chapter I discussed how I tinkered with sketching in 3D by working in a 3D sketchbook, the computer. I established that I was tied to a materiality of practice and I challenged myself to question that and my practice of designing known hats, and instead to push myself to the unknown. Most importantly, this experiment marked the point where Baudrillard's notion of Simulacra and Simulation became my prime critical tool.



Figure 20: Artificial Elegance bonnet: 3D Studio MAX R3 render.



# 7 PRACTICE INTERROGATED

This final group of experiments mark where discoveries and the influences of Baudrillard offered information and critical tools that could be used to develop a fresh way of tinkering in 3D and practicing millinery designing which could contribute to practitioners more widely.

## 7.1 MAKING WITH LIGHT EXPERIMENT

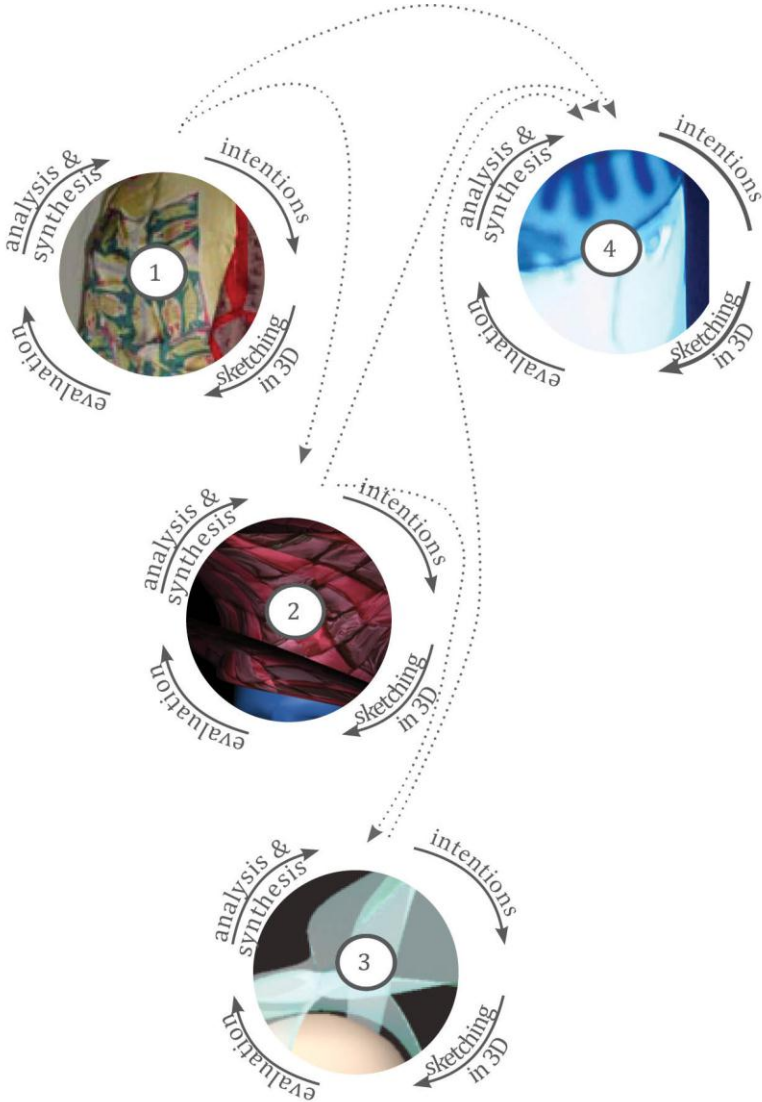


Figure 21: Influences on Making with Light (4)

Light is a substance which does not conform to gravity, an ethereal substance, one which has an illusion of materiality and yet doesn't have a material physicality, one which is not embodied and yet can offer an embodied experience, on reflection, after the fact, I understood that this experiment fell into Baudrillard phase in that (1994, p6) '...it masks the absence of a profound reality...'. This discussion focuses on light projections and how they were and could be used to sketch and design in 3D.

In the course of my investigations I came across the light projection work of Spanish multimedia artist Eulàlia Valldossera, in particular her installation titled Provisional Home (Provisional Living #1, 1999) shown at the 49th Venice Biennale, 2001. I noted, that paradoxically I had observed Valldossera's work as 2D images in the exhibition catalogue, second hand if you will, and not from a bodily experience at the exhibition. However, what I viewed excited me, it appeared to be alive with many possibilities of interactions with the imagery and significantly I believed it offered the possibility of an immaterial embodied experience.

As indicated in 'Stop Animation' and 'Artificial Elegance' experiments, I found the 2D nature of the computer screen to be an annoyance; it was a barrier to an embodied experience. I resolved to move away from the flat screen of the computer and thought carefully about what I could put in its place. The experiment overlapped 'Stop Animation' and 'Artificial Elegance', and therefore at times I was designing both fashion and millinery. The interaction between body or head and light was important; therefore I chose to use a cylindrical screen.

Projecting images using multiple projectors could result in an image which combined perspectives, and gave an illusion of a 3D object being made. Making, yes I was a maker, I could make without material as I made in my mind's eye and now I could make with light. I speculated if I had to touch something to have the experience I was searching for, a 3D embodied designing experience, or if an illusion of materiality was all that was needed.

I could draw on my memory of the performance and tactility of fabrics; I was in a privileged position as I had a material history, and therefore material memory. I knew how a duchess silk satin would hold its shape and rustle

when it is moved and how a viscose jersey would have a weight that was hard to replicate in another textile, how it would have a cool dry hand. I relished the embodied experience, I couldn't touch the materials, yet because of my material history, I had established that was not important. However, again, I wasn't sketching or designing in 3D, I was communicating finished ideas in 3D.

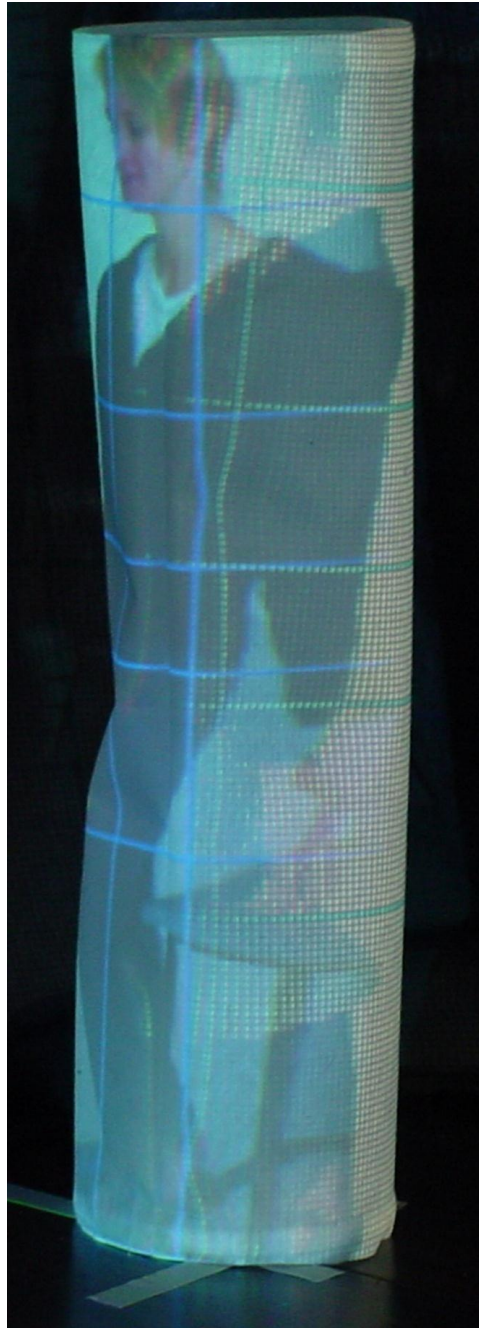


Figure 22: Projection of two photos onto cylinder

Using light was not an intuitive process; it required determination to get through the technical hitches of the computer and projector, to enable me to come to a satisfactory result. When I filmed the projections of still and moving

images for the purpose of communicating the effect to supervisor and others, it became clear that a 2D moving image of a 3D effect lost an essential element. At the time I said that element which I had lost was the illusion of 3D, however I realize now that the illusion of 3D was there. I can see it in the images to the left, and in the moving image, but what was missing in the second hand movie of the image was the experience, the embodied experience. Again I was merely observing, it was a passive experience. The saying 'you had to be there' rang true. Examples of the projections in still and moving images can be also viewed in the catalogue and on the DVD.

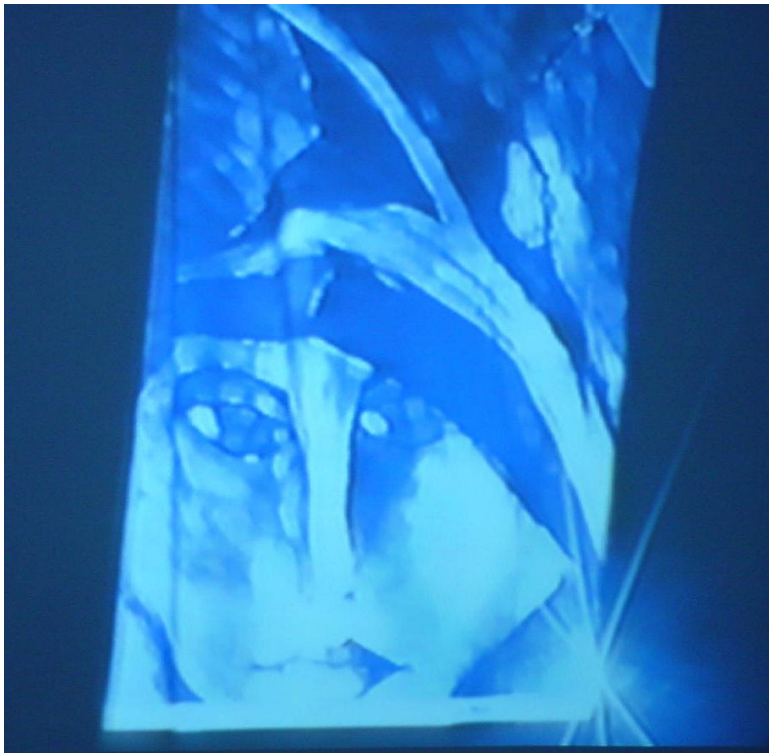


Figure 23: Projection of pastel drawing onto moving fabric



Figure 24: Sketches drawn live while projecting onto a curved surface

I projected a selection of images and formats onto a selection of surfaces:

- Drape and Stop Animation onto a cylinder
- Hand drawn sketches directly onto the cylinder - previously completed sketches which had been scanned, and real time sketches drawn directly onto the surface with light
- Artificial Elegance (3D digital sketch and animation) onto a cylinder

Sketching with light via projections was abandoned, but the concept of cylindrical screens continued in a different guise. I understood that the cylinder screen contributed to a richer sense of the 3D form. I reflected on my previous sketching practice and I asked myself why I sketched on flat paper, why was the sketch pad or drawing board flat? While continuing on with the projections, I also I decided to pick up pencil, pastel and paint and draw on a cylinder, this series was not analysed in detail as at the time I believed it was not relevant to the study.

I noticed later that in contrast to the projections of the sketches, the multiple projections of moving images from stop animations and 3D Studio MAX R3 animations looked more acceptable. One reason was that the movement in the animations meant that any inaccuracies of the images as well as the overlaps of the images were not as noticeable as they were in the static drawn image.

I asked myself questions about perception, and wondered if I needed to have a 3D experience of an artefact to believe that the artefact I was designing existed. I also wondered if a hint that something was there was enough to convince the viewer. On re-reflection I noted another problem, that yet again I was communicating an idea, that I was not designing many ideas, and was not using the process of light projections as a design tool, instead I was tangled up in finding a use for the technology, which may not have been all that useful anyway. Yet the issues of materiality I explored in 'Making With Light' later became an integral part of the investigation.





## 7.2 CUBE INSTALLATION EXPERIMENT

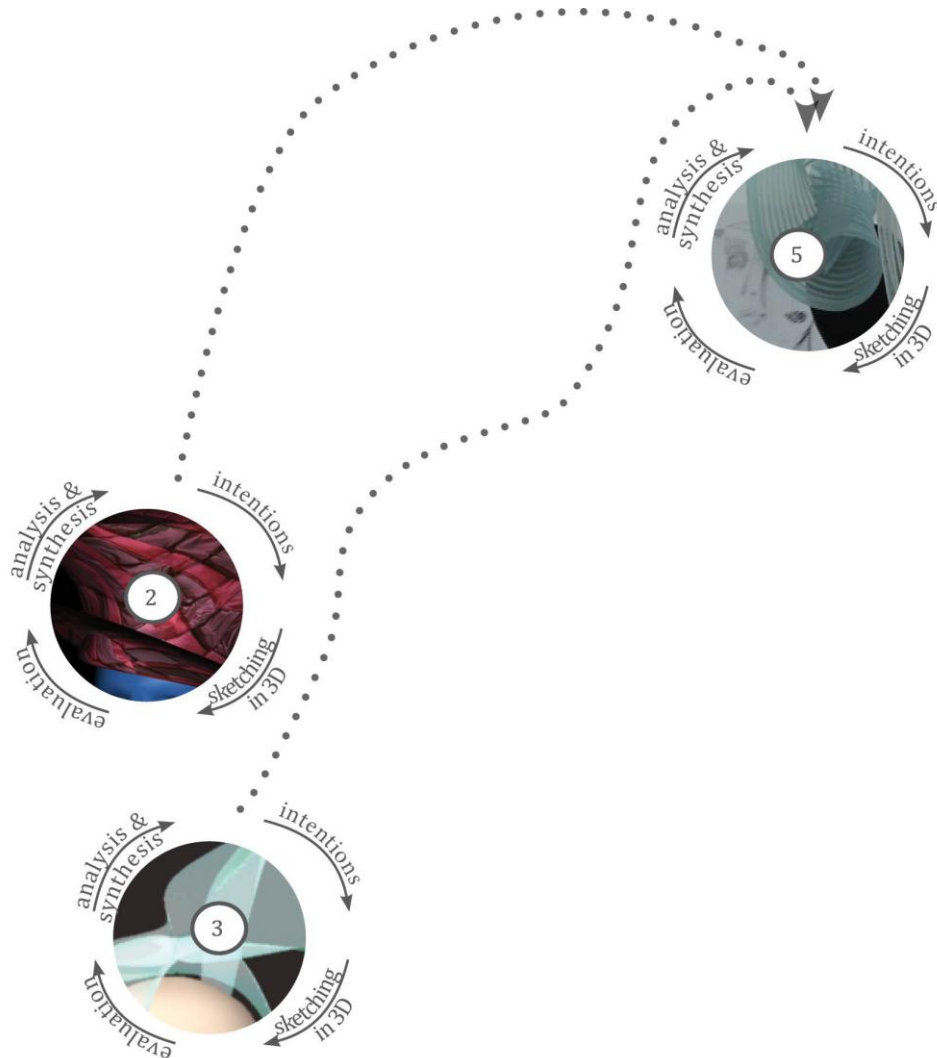


Figure 25: Influences on Cube Installation (5)

In the 'Artificial Elegance' project animated movie I observed that one of the hats was fractured, there were pieces of hat suspended within the computer environment, and the view of a whole hat was only available from one perspective. Again I looked to Baudrillard, and found that fractured hats in Artificial Elegance created a view which (1994, p6) "... masks the absence of a profound reality...". Additionally as the viewer's perspective changed, so did the placement of the hat on the head, and the pieces of the hat came apart. I understood that the 3D software created an illusion of millinery; I wasn't

concerned that I hadn't created a whole hat, as I was creating ideas, sketches. The millinery elements were suspended in the 3D computer environment. This serendipitous event illustrated my desire to seek glimpses of design ideas and not completed hats. The glimpse of a millinery idea is a concept that is paralleled to sketching, as it is an ambiguous and open ended idea, an important element within my practice and this investigation.

At the time the computer screen was a large cube, and I speculated if the computer space could be replicated in the physical world. This was the start of an experiment – *Cube Installation* - where the digital sketch was the original and the physical was the copy of the original. When I copied the digital original millinery as physical millinery, I asked myself, which was the authentic object? This physical millinery was not a truthful copy of the digital original, I resolved that these millinery pieces were in the final stages of simulacra, '... it has no relation to any reality whatsoever; it is its own pure simulacrum.' (Baudrillard, 1994) Furthermore the millinery pieces which existed within the physical space were hyperreal; a sign of millinery. It would be difficult to make these millinery pieces wearable, but not impossible as the hyperreal millinery of both Stephen Jones and Philip Treacy demonstrate. However, wearable millinery was not my aim, sketching in 3D was and if a sketch can be classified as unstructured and ambiguous as Purcell and Gero state below, then these pieces most definitely meet the requirements of a sketch.

The different types of drawings are associated with different stages of the process with one type, the relatively unstructured and ambiguous sketch, occurring early in the process. Designers place great emphasis on the sketch often because it is thought to be associated with innovation and creativity. (Purcell & Gero, 1998)



Figure 26: Crinoline bonnet stills from 3D Studio MAX R3 animation

The cube installation was situated in a square white room; this was chosen as I wanted to use the space as a metaphor for the shape of the computer screen, which at the time was a cube. The contents of the room were made up of elements of millinery practice including physical pieces of millinery, for example a hat brim and a whole crinoline hat. Drawings of millinery, tailors mannequins with heads and tear sheets from magazines, where present, all elements I might use in a designing experience. As I walked through the room, around and through the fragmented pieces of millinery, hat ideas surrounded me, I was having an embodied designing experience. I was interacting with all the elements I found delightful to engage with while in the designing process. I was interacting with sketching, with materials, with millinery, with playfulness and this occurred in a 3D physical environment.

I now understood that physically engaging with the designing in this physical environment, which was a lived illusion, a lived design process, demonstrated that 3D designing could be both physical and virtual at the same time. The cube offered me a design thinking space; it was a powerful embodied experience, pure simulation of millinery and of the sketch.

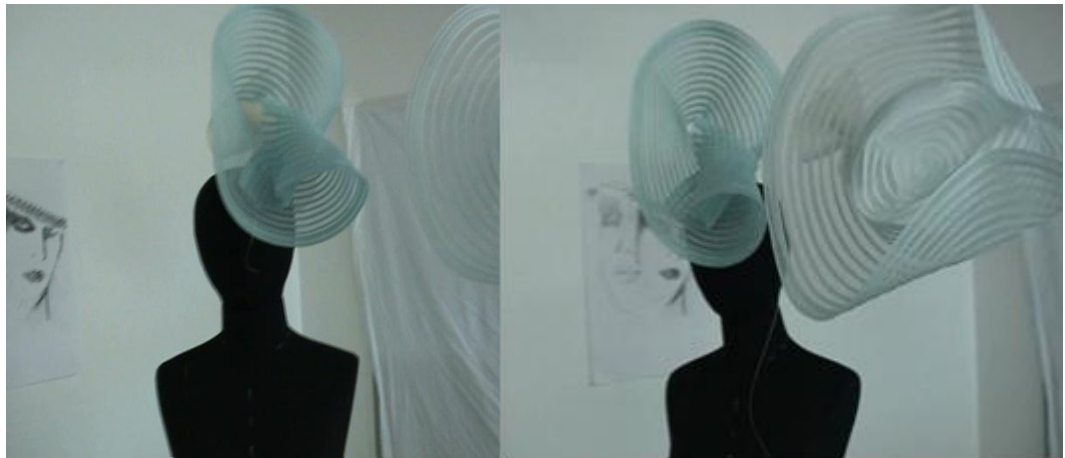
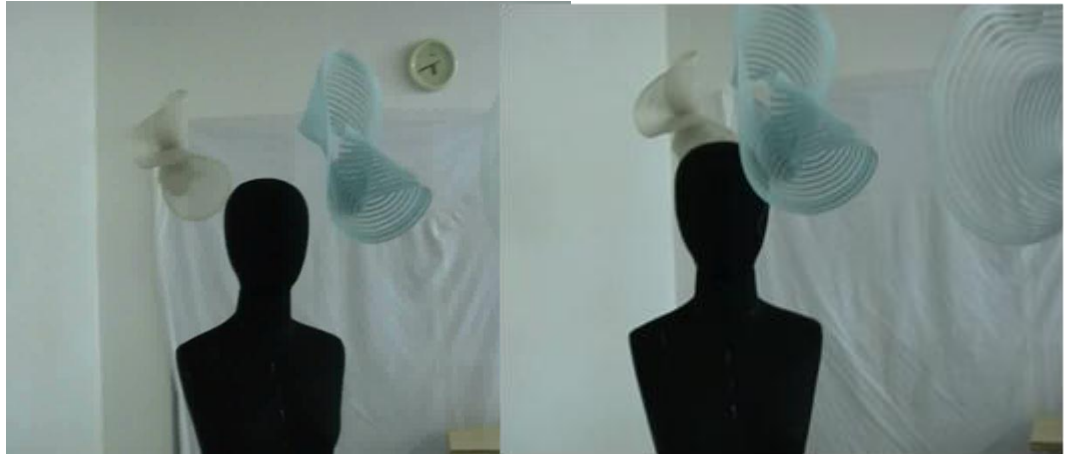


Figure 27: White cube installation: Still images from film footage, crinoline hats, mannequin, charcoal drawings.

### 7.3 SKETCHING MACHINE EXPERIMENT

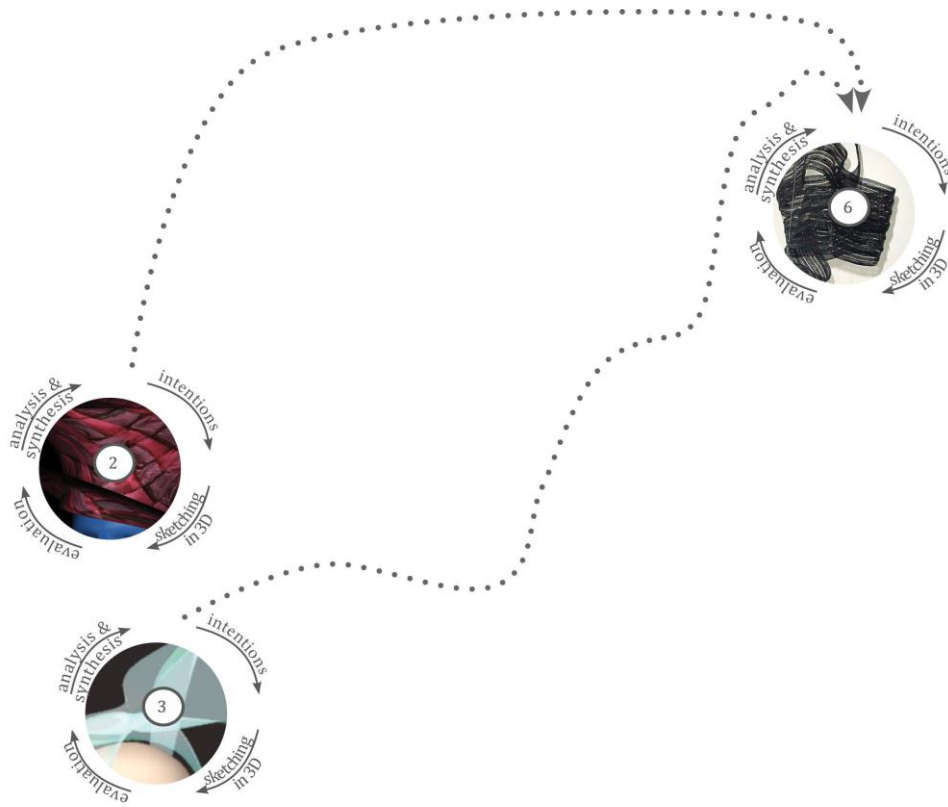


Figure 28: Influences on Sketching Machine (6)

The cube was a rewarding embodied designing experience; I was in the state of flow. The cube was a result of a reflection on ‘Artificial Elegance’, and this experiment, the ‘Sketching Machine’ also had its start there. The wire frame bonnets from ‘Artificial Elegance’ were beautiful structures, and I wanted to understand them from a maker’s point of view. They were impossible to deconstruct by the eye for the purposes of constructing in the physical environment. I had previously sketched the ideas from five view points and was still none the wiser, and this was a further experiment which explored Artificial Elegance millinery in a physical space.



Figure 29: Sketching Machine

I constructed a 3D physical 'Sketching Machine' made up of nylon thread for the Z axis and the crinoline became the X and Y axes, and this allowed me to explore ideas in the physical 3D space, the way I would in the digital space. Sketching in 3D digitally had challenged me. I desired to simulate the digital in the physical environment to help me both understand what I had designed and to push the ideas further. As with the cube, this was also a complete

turnaround from my previous views on digital images, which focused on the digital image copying the authentic physical image or artefact.

I had a hunch I was onto something, like the Cube experiment, the Sketching Machine demonstrated that it was the complexity of the experience of 3D views that made a successful designing experience that projected me into a state of flow. When I re-reflected on the experience of imitating the 3D computer environment in the 3D physical environment, I realized the significance of these experiments, flow continued to be important, and gaining more significance was Baudrillard's notion of simulacra.

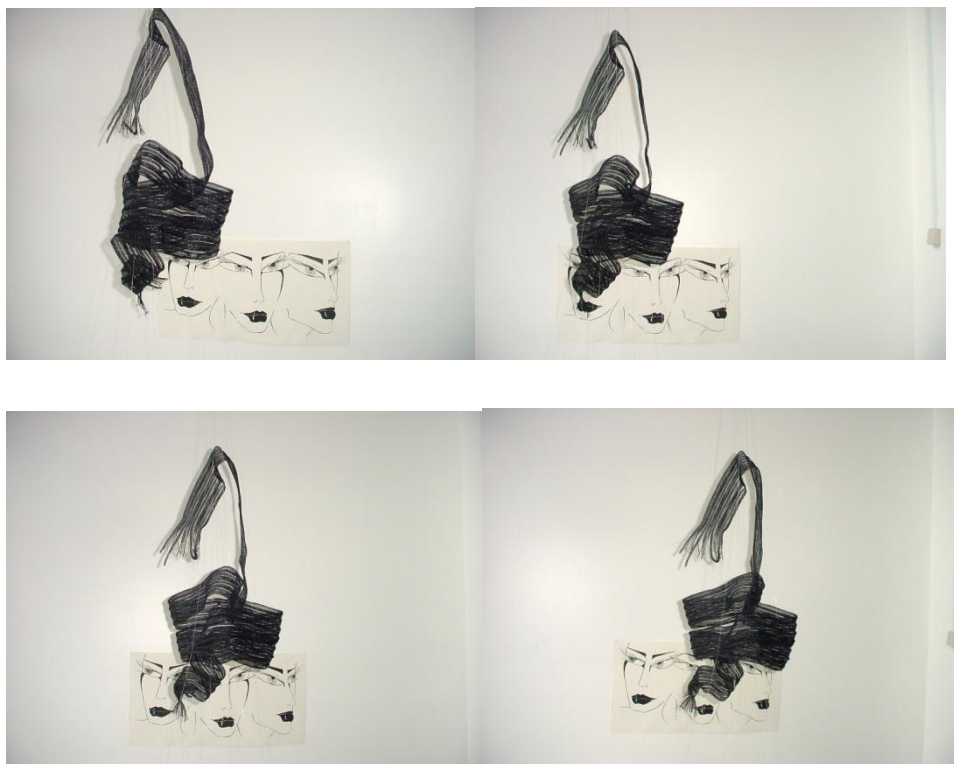


Figure 30: Sketching Machine with ink drawing

There were challenging concepts here. I had created a physical copy of a digital original in the physical environment. Replicating the digital environment in a physical world was challenging the notion of the original and the copy. Baudrillard was becoming more and more important to this study I was enchanted by the hyper reality of the new millinery, I wanted this millinery to be wearable, I desired to show it off, to send down the catwalk as hyperreal millinery pieces, and I commenced the next experiment in order to do just that.





## 7.4 LUCID EXPERIMENT

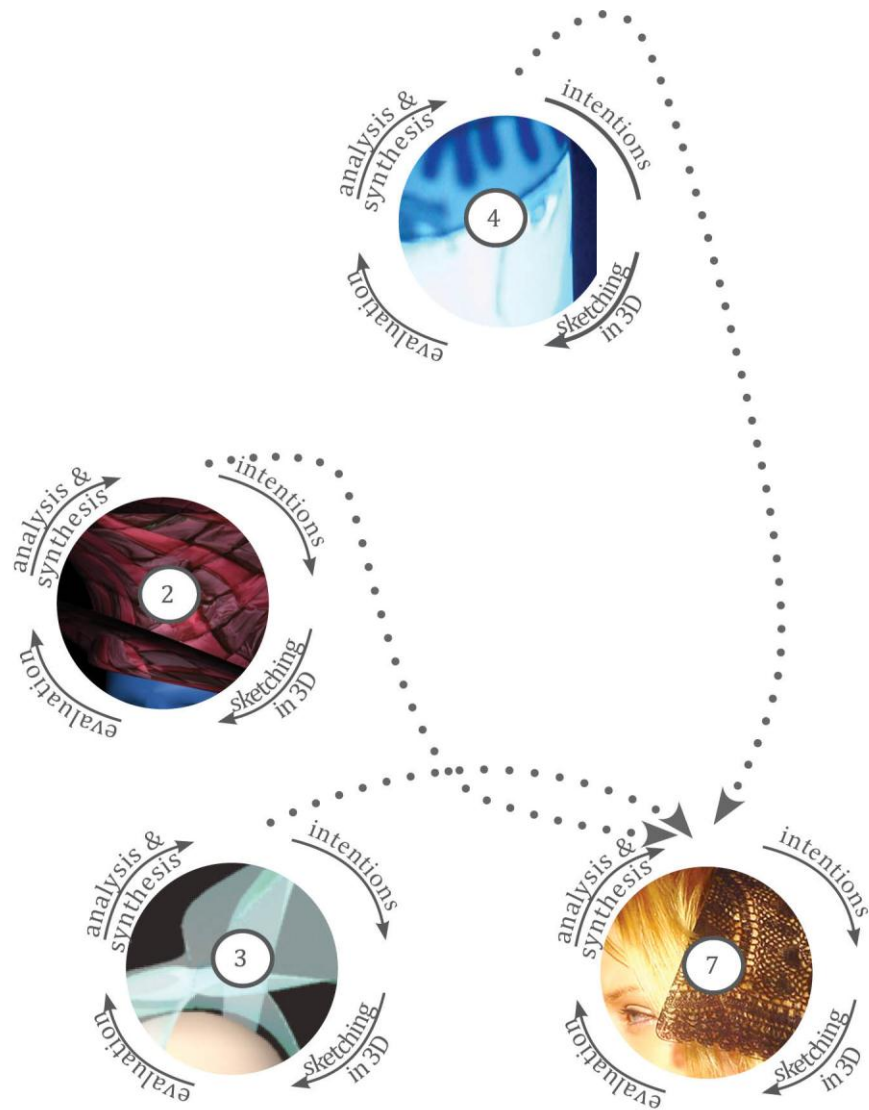


Figure 31: Influences on Lucid (7)

The lure of the materiality of the hat was too much to bear. New Zealand fashion designer Doris de Pont, long-time collaborator, made a comment to me when she discovered that I was using computers to design my hats; by saying that computer generated pieces often have that ‘processed cheese look’ which she did not like. de Pont was referring to computer generated images, as at that stage she had never seen a computer generated object, or a computer generated sketch, and I believe that she was worried that there was no mark of the hand; that all outputs from anything computer-related would look the same.

Like de Pont I also had concerns about the trap of using digital processes to effect an unattractive plastic outcome, I reflected on the millinery designed in 'Artificial Elegance' as well as my sketches undertaken. Eames (2002) stated that computer designed elements can show 'too much polish and not enough spit' meaning that there was no mark of the hand or of the designer. Of course the hand was involved, as was the designer, the hand and eye were an integral part of the design process in this doctoral investigation, as the machine cannot create a sketch or piece without considerable input from the designer, a human. The hand responds to the directions of the designer, and given the appropriate skills, the designer and therefore the designers hand is in control of the computer's performance and subsequent outputs.

David Hockney discussed the belief that computers would spawn images that would look similar (in Glazebrook, 2006, paragraph 13)

Most people thought they knew what 'computer art' looked like, but of course that is saying they know what 'brush art' looks like. It is daft. What did Leonardo use to paint the Mona Lisa? Well, he used brushes; so if I get a brush I can do that, can't I? No! A brush, like a computer, is merely a tool.

In the past I have used 3D software to make representations of physical objects and their traditional materials for example straw and crinoline in 3D digital tinkering's and sketches. In the lucid experiment the acrylic hats produced were a physical response to the notion of the hyperreal (Baudrillard). I simulated the digital, and this time instead of a sketch I resolved to also output a wearable hat in the physical world. Additionally inspired by the notion of the hyperreal, the computer sketches, I decided to move away from traditional materials associated with millinery like felt or straw or even textiles, and to embrace the plastic sheen I had tried to reject within the digital realm of 3D Studio MAX R3, to make the digital fantasy a reality.



Figure 32: Printed acrylic millinery

Although the acrylic millinery pieces exist in the real world, they represent or replicate the digital world with, as Paul Klee, says a 'transparent polyphony'. This is a state when the boundaries were blurred between the physical object and the wearer. The acrylic millinery re-presents the ephemeral dimensionality of the 'Making with Light' projections with a re-presentation of this liminality through a tangible, material artefact.

As I attempted to make a closer connection between the 3D physical and the 3D computer generated pieces, acrylic became the physical world representation of the digital millinery, a material product. These millinery pieces reflected my new found digital aesthetic, as well as their hyperreality.

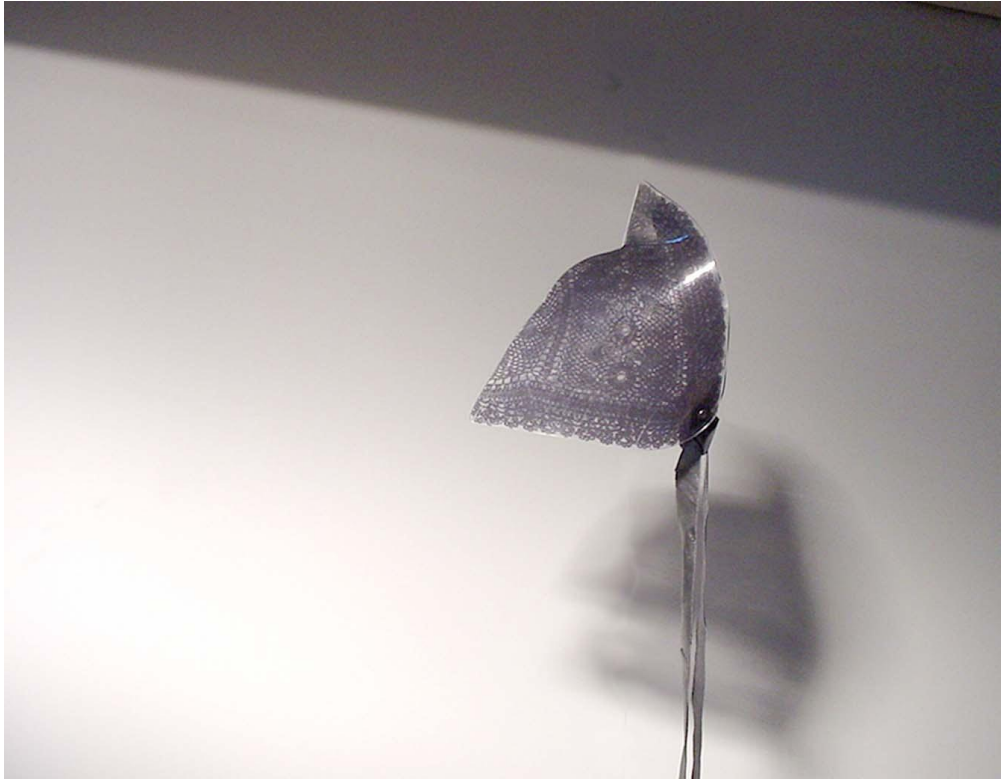


Figure 33: Printed acrylic millinery

The decision to simulate the digital was reached after a journey through the series of experiments. I consciously reflected on my process and considered Csikszentmihalyi's notion of flow, as the experiments progressed I also identified connections with Baudrillard's orders of simulation. My design process had been reconfigured to allow the use of both digital and analogue processes and technologies. I had embraced both the process of designing using the computer as well as the physical output. Designing and making acrylic hats took my tinkering process from sketching and designing purely computer generated millinery projects and firmly planted my practice back in the physical world. Ironically de Pont also found my first iterations of this experiment attractive and commissioned me to design a collection specifically to accessorize her collection of garments, which I undertook gladly.



Figure 34: Lets Gather Here, Printed acrylic millinery, Margo Barton for Doris de Pont

In this investigation I created digital head wear which existed in both the digital and physical worlds. I no longer found the plastic unattractive, I liked it, and I was entranced with the resultant millinery. I had stopped trying to make the digital millinery something it was not, the millinery no longer had to copy and reflect traditional physical millinery expectations; it could now display its intrinsic digital aesthetics proudly, physical hyperreal manifestations of the digital millinery.

In this experiment, the digital had become the original, the physical acrylic hats were copies of the digital, and replicated the former replicants, object representing a non-object.

## 7.5 MODELLING AND THE DIGITAL SKETCHBOOK

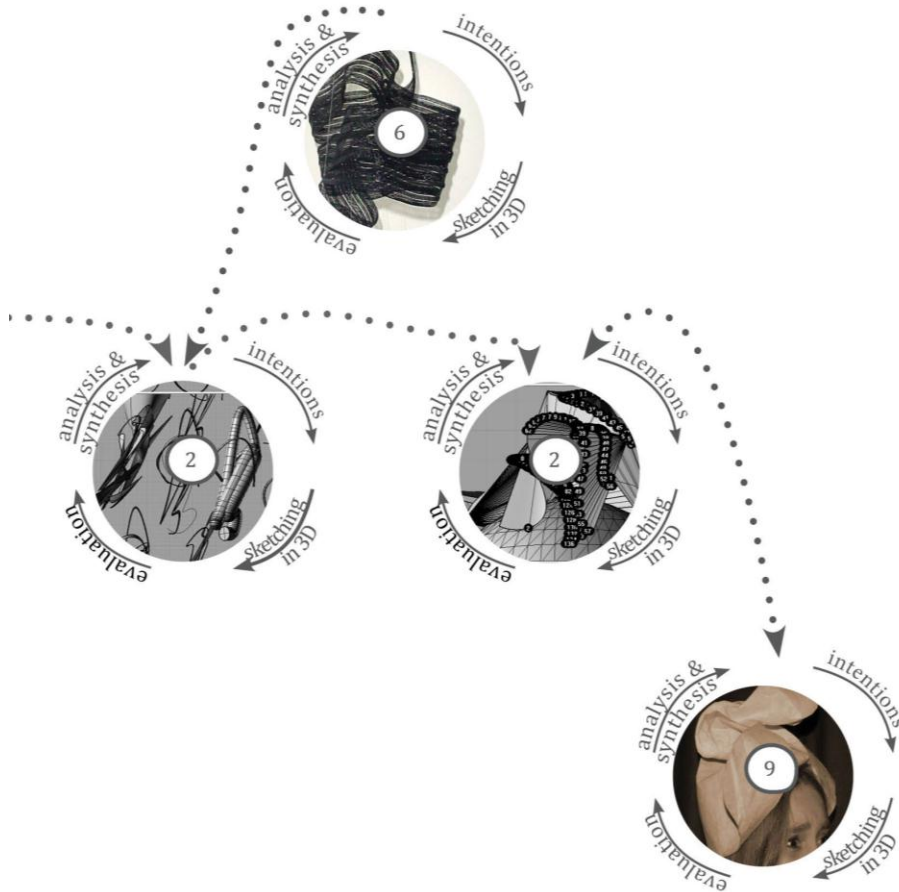


Figure 35: Influences on Digital Sketchbook part 2 (2)

'Artificial Elegance' was created using the programme 3D Studio MAX R3, it was the programme I used the most up until 2005, and was ideal for the earlier work undertaken that relied on the representation of millinery ideas. Unfortunately when I attempted to transfer the digital representations to a physical object it was nigh on impossible to achieve. The objects that I had developed in Artificial Elegance showed little promise of having potential as millinery which was made and worn in a physical world. I believed that this problem had to be solved, and I therefore searched for a different type of technology, one which had the ability to be precise and which was specifically created to enable a digital to physical object conversation, and therefore could output a hat.

Since 2005, Rhinoceros was the software I employed most often for sketching in a digital environment; this was because it was a free-form non-uniform rational B-spline (NURBS) modelling programme. It was precise, and the outcomes have more promise within the physical world. I resolved to do an experiment utilizing Rhinoceros to track my design process only, and not to be concerned with the final product.

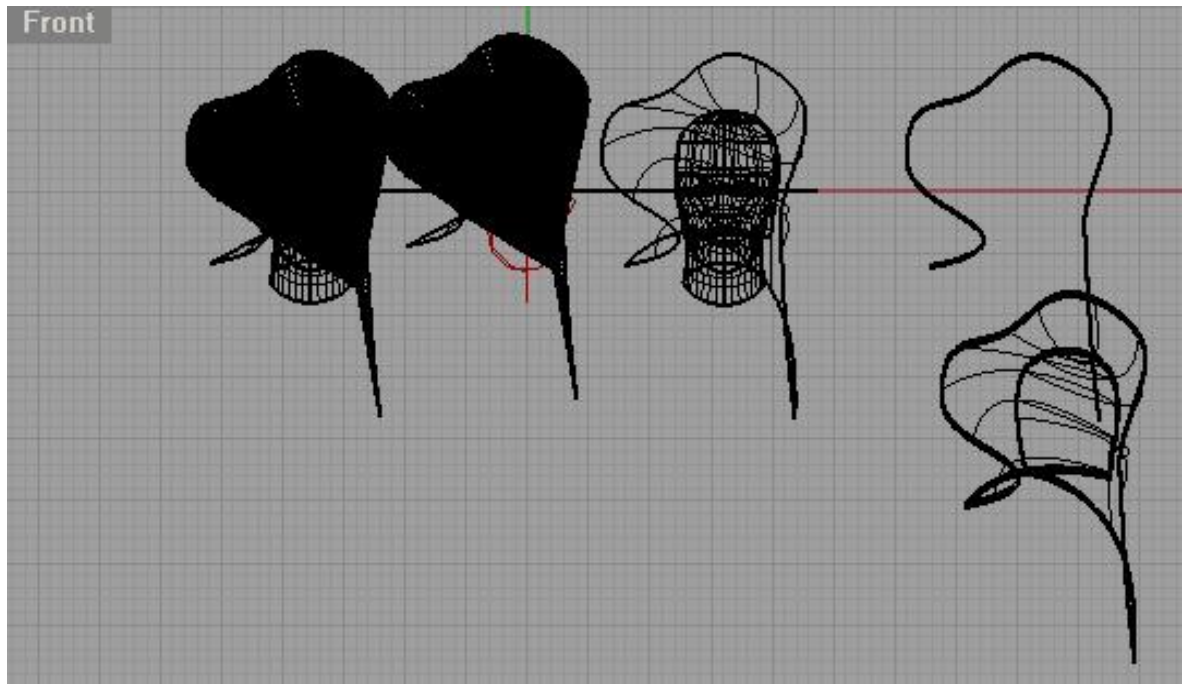


Figure 36: Sketches in Rhinoceros

Rhinoceros models were not solids; they did not have volume that could be used in the rapid prototyping process. The curves could be unwrapped and output as lines for flat patterns, and subsequently used as a guide for production of millinery through a cut and sew process. It was possible to make a solid model from scratch by using a solid modelling technique within the Rhinoceros programme but the outputs were limited, the process was not as intuitive or flexible as sketching with the NURB curve was, as shown by the image of the piped solid below.

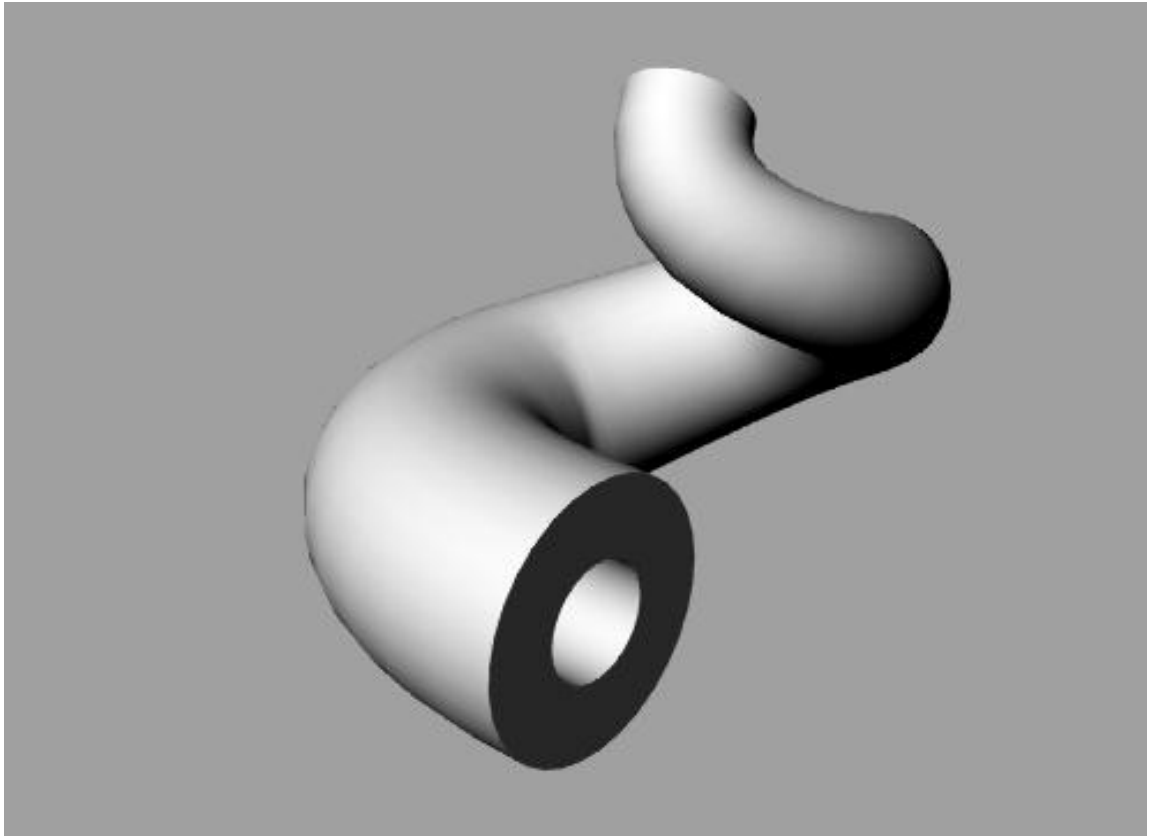


Figure 37: Rendered pipe, in Rhinoceros

However when sketching in 3D in Rhinoceros, the design development trajectory of my artefacts shown within this experiment exposed many more off-spring than would be able to be recorded within a physical 2D paper based or 3D toiling or modelling practice. The incremental saves, gave me the ability to back track and re start a new design path from any stage down the design process, and to harness the intuitive iterative 3D designing process. This allowed me to have an unhindered and embodied designing experience with the designing process and at the same time, I was able to capture the essential elements, which were held for me to call upon when needed at a later date.

The 3D computer software was utilized to assist my mind's eye, to help ideas grow and to subsequently be saved and to sometimes find a reality as a material outcome, however, I was aware that trying to replicate the mind's eye was not desirable, as Ehrenzweig said 'I have mentioned how architectural design is hampered by the tendency to visualize too precisely and by the abuse of diagrammatic aids (ground plan, elevation etc.).' Ehrenzweig's book was published in 1967, the year following his death and this made me wonder



what he would have made of digital technologies used for developing design ideas in many disciplines today. Pallasmaa also refers to Ehrenzweig's concerns and makes the link to digital technologies. Pallasmaa is also concerned with computer aided designs when he states (Pallasmaa, 2009, p97).

The computer is usually enthusiastically presented as a solely beneficial invention that liberates human fantasy. In my view however, computer imaging tends to flatten our magnificent multi-sensory and synchronistic capacity of imagination by turning the design process into a passive visual manipulation, a retinal survey. The computer creates distance between the maker and the object, whereas drawing by hand or building a model puts the designer in skin-contact with the object or space from the inside outwards, as it were. More precisely, in imagination the object is simultaneously held in the palm of the hand and inside the brain: we are inside and outside the object at the same time. Ultimately the object becomes an extension and part of the designer's body.

I wondered why Pallasmaa does not see the link between the process of sketching on paper and sketching in the computer as I do. However, I agree with him that building a model is entirely different in the digital space to the physical spaces, and assume he believes this has much to do with the embodied experience. However I discovered that once I came to understand the software and sketch with ease, I could easily project myself into the situation using my imagination, as I would in my physical practice.

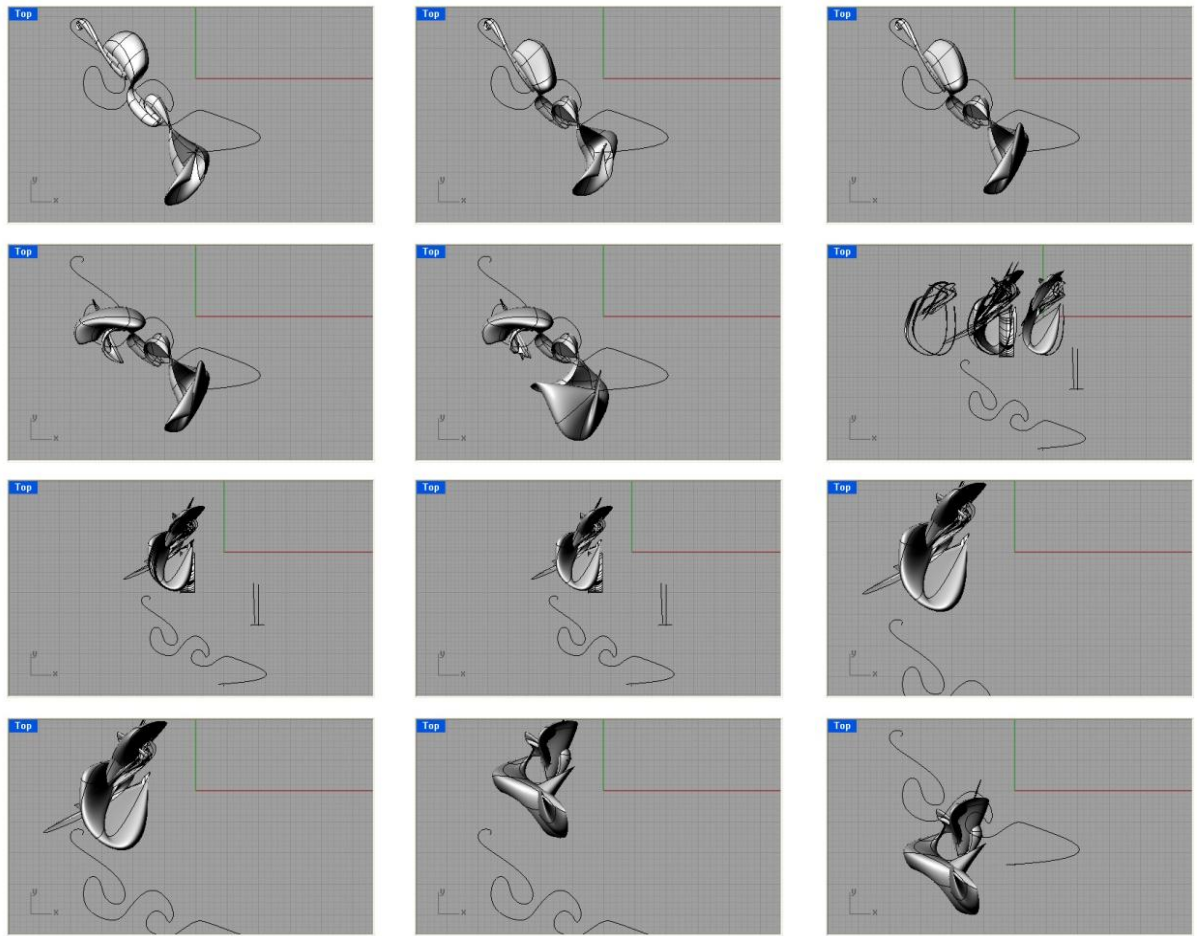


Figure 38: Digital sketchbook, tracking in progress, top viewpoint in Rhinoceros

## 7.6 BUTTONI EXPERIMENT

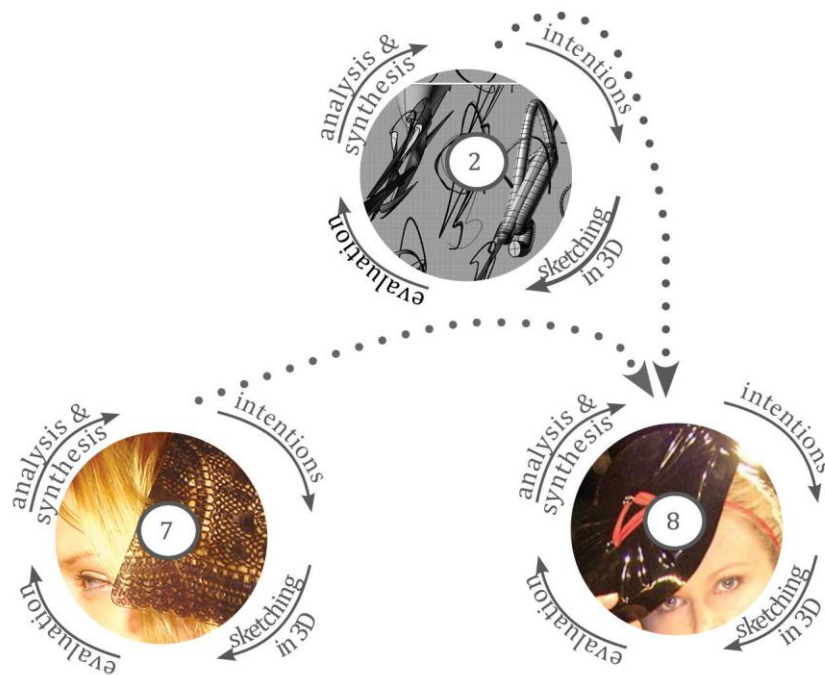


Figure 39: Influences on Buttoni (8)

Lured by the materiality of a wearable piece of millinery, I sought to make more material millinery from the virtual.

I decided to work towards outputting a millinery object from a computer without touching the physical material or object at all until it was finished and ready to be worn. This necessitated collaboration with a technician to undertake the making process in the actual material stages. If I wanted to pass on my sketches to a collaborator, an ambiguous sketch was not desirable. I would need to produce production quality sketches instead, as this would enable the sketches to be used as a guide for production.

I had some concerns from past experiences of handing over the making to someone else; I was worried that I would not be able to maintain the quality and integrity of the design. I accomplished this through two different experiments using Rhinoceros sketches as a starting point. Unfortunately my models were not able to be rapid prototyped as the difficulty of converting my sketches into water tight models made it impossible. The first of these

experiments, Buttoni, a vacuum forming experiment, and the second, Hatistropic, a reversed engineered experiment both had their beginnings in the software Rhinoceros, and the discussion follows.

Although my aim was to sketch millinery ideas and not to create final hats per se, the lure of the material object was too much. Buttoni was an experiment which tested my ability to transmit design information about a hat which I had sketched in 3D using digital technology. This was a hands-off experiment which centred on the use of Rhinoceros software to design millinery.

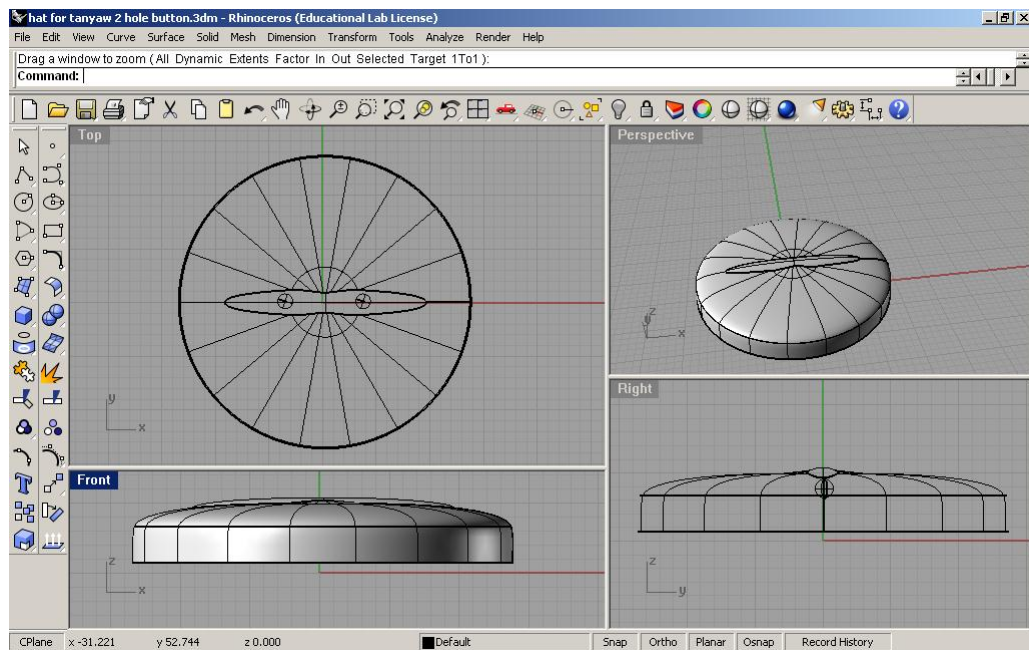


Figure 40: Buttoni initial rendering

Within this experiment I explored the concept of designer versus workman. I did this because within the discipline of millinery the designer and workman, or craftsperson as I will call it, are often the same person, and this is not always the case within other disciplines. I use the word craftsperson as I am indicating a skill that is underpinned by knowledge of the discipline rather than a skill, which could be said to be a production line or manual skills not requiring knowledge or indeed insight.

My sketching and designing process was informed and enriched by my knowledge of the craft of making millinery, and I wondered if I could instil enough information into the sketch or model that a person who was not the designer and acted only as the workman could become the craftsperson. In

publication, *The Nature and Art of Workmanship*, David Pye defined the design and the making as such Pye states, (1995, Page 17)

Design is what, for practical purposes, can be conveyed in words and by drawing: workmanship is what, for practical purposes, can not.

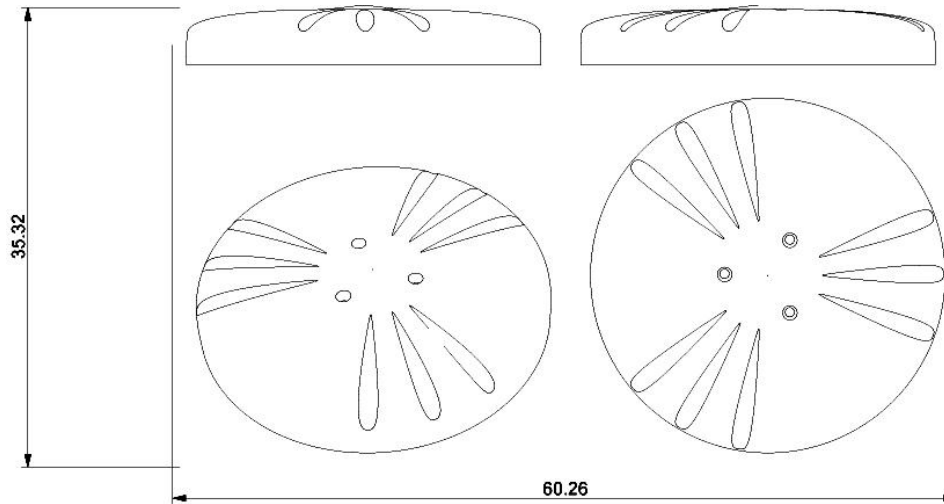


Figure 41: Profile images of Buttoni

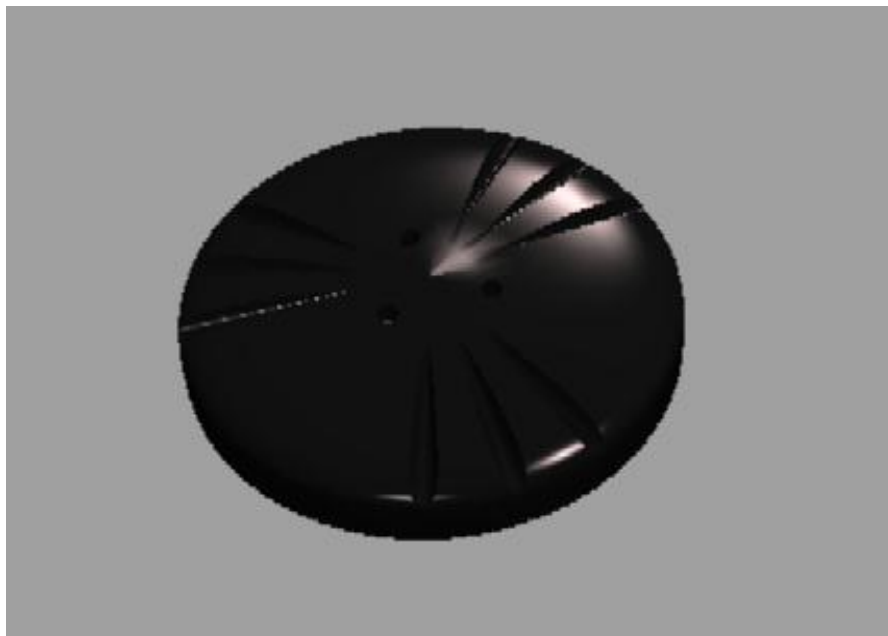


Figure 42: Rendered image of Buttoni

Sketching by modelling an idea, whether it was physical or digital helped me, the designer to understand the idea more fully, and expanded the notion of the mind's eye. Pye stated that what was seen in the mind's eye is "ideally perfect and therefore unattainable embodiment of his intention" (1995, p49).

I tried to refute Pye's statement within this experiment, believing that what I viewed in my mind's eye was attainable. Firstly I communicated my mind's eye vision of Buttoni, a large beret that resembled a button, to myself through the action of making a 3D model using 3D software. When I sketched within Rhino I was acting as the craftsperson, making the model in a digital environment, but I was making exactly what I saw in my mind's eye, and furthermore, I was negating Pye's claim with a digital model in this instance, but this was at the expense of progressing the idea further, and not engaging in the rich dialectic process. Secondly what I saw in the mind's eye was now able to be viewed by others, and there was another opportunity to make what was in my mind's eye physically attainable.

The 3D model and profiles were communicated to Ian Barker, he had no knowledge of millinery processes, he was however a skilled product designer and design technician. I gave Barker the rendered images showing that the button beret was to be black and shiny, and although had hoped not to discuss the project any further until completion I found it difficult not to enter into conversations about the millinery.

Barker showed me the material chosen, which met my aesthetic, being black and shiny. He determined the millinery would be made using high impact polystyrene (HIPS) as this could be vacuum formed which was the process Barker said would be most suited to my design, and I left him to it. I emailed Barker the files, I knew he could use Rhinoceros and any other desired software and machinery in the Product Development Centre at Otago Polytechnic if need be, and I expected him to do so. Although I did not communicate that to him, after all he was to decide how to get to the end point of a vacuum formed button beret, not me.



Figure 43: Hand carved hat block for vacuum forming

The process that Barker chose to use surprised me. He carefully hand carved a hat block from wood, and that met the specifications of the Rhinoceros models I had sent to him by email. I was shocked when he came to see me holding the printed out elevations in one hand and a hand carved hat block in the other. I had imagined Barker would send the information I had given him directly to a machine, for example a five axis CNC machine or lathe and I had made the model with this in mind. My digital model and elevations of the hat had become both a positive (the hat) and a negative (the hat block).

Had I used my workmanship in the digital realm to ensure all options were communicated correctly? I would argue yes, that workmanship did occur in the digital designing process, when I made the models. In addition, my long history of the physical experience of making gave me the visual language I needed to describe what the design should look like when complete.



Figure 44: Ian Barker, technician at Otago Polytechnic finishing the vacuum formed Buttonis



Figure 45: Vacuum forming, and Buttoni

I had, as Pye states created a model of an object that would result in workmanship of certainty. My exacting images and models given to the technician ensured that there would be no mistakes. I had done as Pye states (1995, p20) "... the quality of the result is predetermined and beyond the control of the operative". But was this a successful project within the context of this doctoral investigation, in this I would argue yes and no.

I was torn between the action of sketching prospectively for the sake of sketching and the action of sketching to create a final design. In this case, and on reflection I had unwittingly focused on the final artefact, the millinery, possibly because Tanya Carlson a fashion designer, had communicated that



she wished to use these hats on the catwalk. On the other hand, could it have been because the years of prospective sketching had started to become humdrum and that I was ready to bring some ideas to an end point. However, I believe it was a combination of both of these issues.



Figure 46: Buttoni vacuum formed millinery worn with Carlson fashions, iD Dunedin

I wanted to see my millinery on the catwalk, and I wanted other people to see my millinery. I was a milliner after all, and people were asking where were the hats that I was designing as a part of my doctoral investigation. It was difficult to explain that my millinery making practice consisted of sketches, and not only that, that these sketches were not physical, that they resided within the computer, as zeros and ones. Furthermore, the use of the millinery was not as a hat to be worn, to make someone look exotic or fashionable or to provide shade from the sun or any of the many other uses of millinery, but that my millinery had become a thinking tool, a reflective tool.

My designing experience was productive and rewarding in both the physical and digital environments, I could sketch in 3D, and for me that was a successful millinery experiment. However the focus on a final product worried me, as in sketching that way I had removed the element of risk. I decided to reintroduce the element of risk in the next experiment. Within the Buttoni experiment digital technologies were embraced as a process of designing and developing the millinery, a means to communicate an end, as well as well as an aesthetic signifier of millinery to come.

What I needed was a propositional sketching and tinkering space, and Hatistrophic offered such a space.

## 7.7 HATISTROPHIC UNWRAP EXPERIMENT

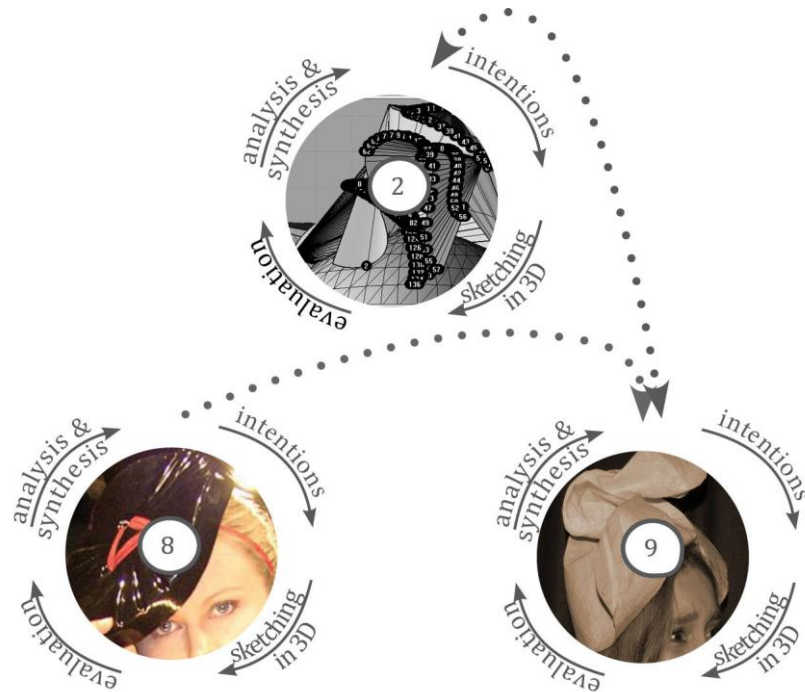


Figure 47 Influences on Hatistropic (9)

Hatistropic was named due to the unfortunate results, which could have been considered to be catastrophic if wearable millinery was the aim. At several points in this doctoral investigation, and as can be noted from the previous experiment, I was periodically drawn to the hat, rather than to millinery as a process, including this amusing unwrap hat.

I continued to sketch in 3D, and I also undertook making projects which had the aim of converting the sketches into physical designs, I reflected on my millinery practice draping designs in the physical environment. I reflected on the practice of taking the draped design off the hat block or mannequin and flattening it to result in a 2D pattern. The process of producing a 2D pattern from a 3D form could be compared to the process that engineers go through when using reverse engineering, for example 2D patterns made from shaped forms ready to be cut from metal to achieve a hull for a boat building, or other sheet metal processes. In my case I wished to create a pattern that could be cut from fabric, and then stitched on a sewing machine.

In the physical world, the draped millinery idea can be finalized at the 3D sketching stage to the point that it could be worn, and in fashion practice there is a long tradition of draping, when both designing and making occurs concurrently. In the digital realm, draping occurs in a different manner, the surfaces or planes constructed within must conform to a process which can be unwrapped, and they must be developable surfaces. The designs are created with this restriction in mind; there are limited commercial developments in the use of reverse engineering for fashion using digital technologies<sup>24</sup>.

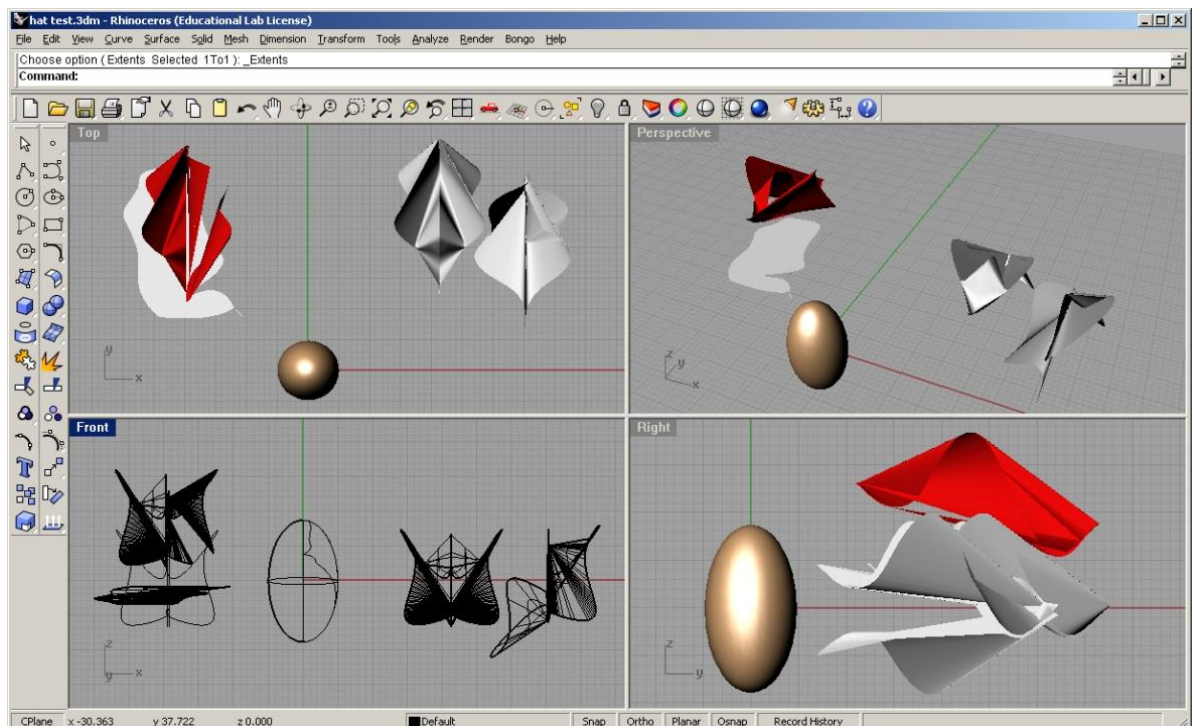


Figure 48: Development of Hatistropic screen shot

Sketching and unwrapping millinery was a rewarding experience, I was in the flow as I systematically sketched, unwrapped, sketched and unwrapped. There was no doubt about it, these were rough sketches, and most of the time there were several hats in the digital environment. Sometimes the digital environment became cluttered and I had to hide hats to enable me to carry on sketching. Using this software I was able to save incremental development sketches and return to a certain point on the designing trajectory, and then undertake further developments.

<sup>24</sup> Since undertaking this experiment several fashion industry CAD companies have developed this option in their software. However, I believe that the inbuilt rules of the software, which are designed to prevent costly mistakes, could also inhibit creativity.

This experiment occurred twice, firstly prior to Buttoni, when I used a craftsperson to make the physical millinery, and secondly after a period of years. I undertook the making, and this time I was the craftsperson. Each undertaking resulted in different outcomes, and in both cases I undertook the sketching in the 3D environment.

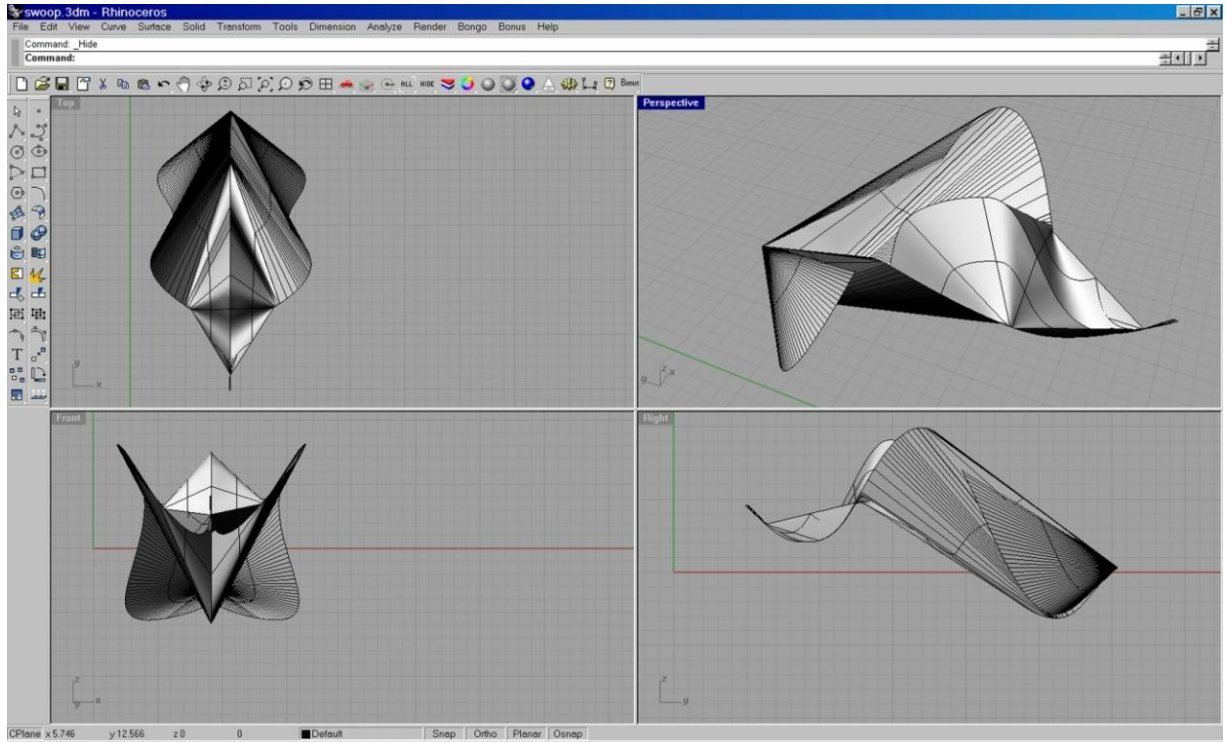


Figure 49: Hatistrophic, screen save of digital millinery pre unwrap.

Teaching and Research assistant at the School of Design, Jeong Hee Shin was to undertake this assignment, and like Barker, was a technician; however she was familiar with the area of sewing, which was to be the process of making this hat. Like Barker she was also a very creative designer as well as a clever patternmaker, however this particular job required her to act as the workman and I requested that she merely cut out fabric from the pattern which I supplied, and then sew it.

Unfortunately Shin decided that the hat looked too unusual and she would help me out by fixing it. The resultant millinery piece could have been considered to be a failure as it did not truly represent the digital original; however I considered it to be a success as it taught me that creative solutions can be overridden by the workman's expectations of a design or process. In

addition, I learned not to presume that what I asked for was what I would get. Shin did not act as the workman; she returned to being the designer.

After a period of time I decided to undertake a second iteration of this experiment. I wanted to make the hat and not alter the pattern in any way. Although the hat was not likely to be worn, it was a physical copy of a 3D digital sketch, an embodiment of my digital sketches.

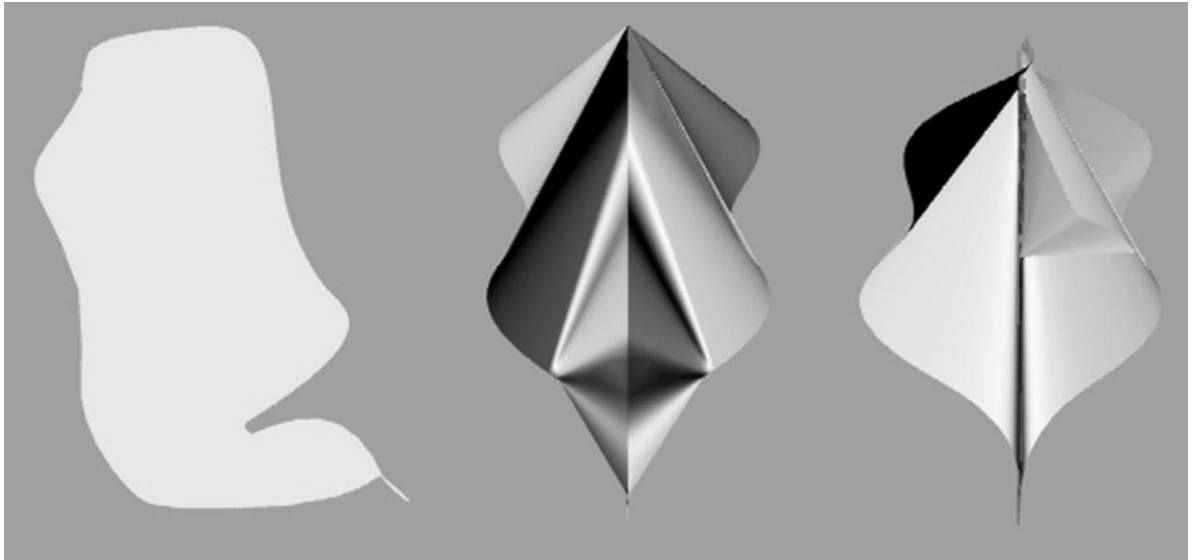


Figure 50: Hatistropic, screen-save of rendered digital millinery and the unwrapped pattern.

When I viewed the physical copy of the digital sketch I was spurred to ask this question – Was I a victim of fashion or was I a victim of the computer?



Figure 51: Still images from the Hatistropic movie





## 8 PRACTICE REDEFINED – THE CONCLUSION

In this concluding chapter I restate my discoveries, and link these to the broader understandings of the entire investigation. I conclude the exegesis with a question which came out of the research, and which is my direction for future practice and research.

Within this doctoral investigation I sought to find a way to sketch millinery in 3D when using computer technologies. In order to understand if this was possible I planned a series of experiments which would enable me through a process of designing, making and reflecting, to explore my practices of sketching, modelling and tinkering in both computer and physical spaces.

Although I stated at the beginning that I only wanted to explore what it was to sketch in 3D, and to create ideas and not products, as the study evolved I was constantly drawn back to the object, the hat. Through this process the questions that I posed at the beginning of the investigation were explored and answered, and subsequently further questions were posed.

During the timespan of this investigation the range of digital technologies available for designers developed considerably, as did the breadth of researchers investigating these technologies. As indicated in the Research Context, one such researcher is Rebecca Leah Miller.

Like Miller I had also inadvertently used the software to create a hat block in one of the projects 'Buttoni'. However, unlike Miller, my investigation primarily focused on using the technology as a sketching space, a designing space, and as a making space. I also used the investigation to reflect on and critique the millinery designing experience through the concept of 'flow' and I came to know that through my changed practice, the millinery had become a hyperreal simulacra of traditional millinery. My practice and millinery

practice was transformed and in many respects it did not reflect previous millinery traditions.

As the investigation progressed my focus went from being subsumed in making, where I concentrated on asking myself the questions - what am I doing, how does it feel (Csikszentmihalyi), and repositioned my questioning to also include what have I done, what is the result (Baudrillard). This repositioning my focus was also linked to the development of my confidence when using the software during the investigation and to the reversal of the order of the questions when my focus moved from 'How', to 'Why'. Refer to table 2: Transformation of Practice, on the following page.

The following research questions formed the framework of the enquiry, and were reordered for this conclusion to demonstrate the shift in the investigation.

1. Why would I use CAD for designing fashion and millinery?
2. How can I use physical and digital methods to explore a selection of designing experiences?
3. How could I use 3D CAD for designing fashion and millinery?

PRACTICE			PRACTICE REDEFINED		
Representation	millinery studio location, process and hat are recognisable and reflect traditional millinery praxis			millinery studio location, process and hat are redefined and do not reflect traditional millinery praxis	Simulacrum
Aim – sketch millinery ideas in 3D using CAD	draw a sketch or make a model	the process and the product of the sketch and model become one when making in the digital environ. The definition of what I am making is undermined through the process and by the resultant hats.		attentions turn to what is the result  the redefined hat supplants the understanding of millinery, it becomes the hyperreal hat	
Object defined	aim to use CAD to design a physical object to be worn	physical object unimportant		aim to integrate CAD into the designing process, unimportant if physical object is output.	object, process and space redefined - hyperreal
HOW could I use 3D CAD in my practice?	physical objects developed, some 3D CAD interaction	physical objects and 3D CAD representations of physical objects	physical objects, 3D CAD representations and outputs to give the ability to design and make ideas and objects	physical / 3D CAD objects; integration starting between environments and tools	WHY would I use 3D CAD in my practice?
Reflections in and on practice focus on Schön for the duration plus	Csikszentmihalyi how does designing feel?				
	Baudrillard what is the result of my actions?				
Experiments	1. Drape and Stop Animation 2. 3D Digital Sketches (on-going) → 3. Artificial Elegance 4. Making With Light 5. Cube Installation 6. Sketching Machine 7. Lucid 8. Buttoni 9. Hatistropic				

Table 2: Transformation of Practice

My physical or embodied experiences during the course of the research influenced how I operated when using a computer, and these computer experiences then went on to influence my physical world practice. Within my practice, technical or making and conceptual or designing issues were most successful when considered together.

The technologies that I used in this study could be considered to be both mechanisms and materials, and these continue to inform the process of designing and making through constant flow of knowledge and understanding that emerges from them. In the Context section of this exegesis I positioned my practice based investigation, and surveyed the literature on sketching; 3D; millinery and fashion; and, of computer technologies.

Within the Experiments section I explored a selection of techniques and environments involving both computer and analogue methods to sketch millinery in 3D. These experiments were positioned to answer my research questions. Downton stated that he 'was interested to know where form comes from...' (2004, p13), I now know I am interested in how and why the form exists, and what it can add to future sketching. In particular the inclusion of Baudrillard's notion of the copy and the original became significant. I was not consciously designing in the mode of Baudrillard, I did not consciously harness the stages of simulation to be imposed on a designing process, and yet Baudrillard's orders of simulation frequently emerged as the key theoretical tool for reflections through the knowing I had gained along the way.

## 8.1 FINDINGS FROM THE EXPERIMENTS

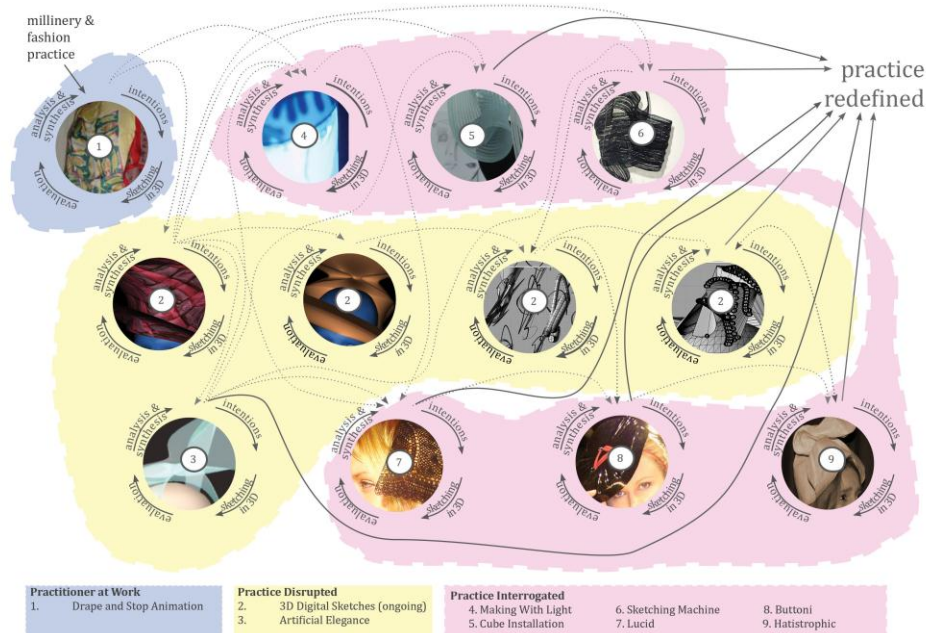


Figure 52: Flow of experiments

Millinery is a field of design practice that has its roots firmly planted in the realm of the handmade. Through this doctoral investigation I engaged in a sketching and designing conversation within a millinery context, utilising and contrasting physical and digital spaces. The conversation existed when I sketched millinery, as well as when I designed the experiments and in the investigation as a whole.



Figure 53: Drape and Stop Animation still



Figure 54: 3D Sketch screen shot

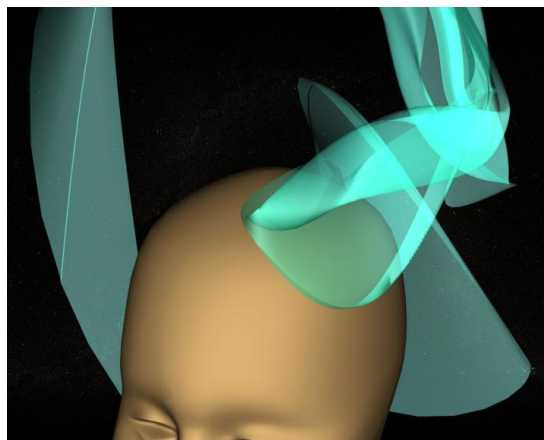


Figure 55: Artificial Elegance rendered image

Within the 'Drape and Stop Animation' experiment, I experienced two distinct forms of lived experiences. Firstly there was the embodied process of designing with fabric, draping on the mannequin in a physical environment. As I undertook this experiment, draping the mannequin with fabric, I moved to what can be called a 'state of flow'; a state of active, meditative engagement with the practice of making. However, this state was starkly contrasted by one of non-flow. This was what I experienced to be a passive process of making during the development of the stop animation. The drape element of the Drape and Stop animation experiment identified for me, that an embodied experience was essential to this doctoral investigation and furthermore the stop animation element taught me that movement was a key to giving an illusion of 3D to a 2D image.

The elements of embodiment and movement were subsequently considered in the first digital experiment discussed in '3D Digital Sketches' experiment. This was comprised of a series of sketches undertaken over a period of time. When I undertook the 3D digital sketches within this experiment I attempted to replicate my physical world materials and millinery, the results were not pleasing. A rupture in practice occurred when I came to understand that digital millinery models did not need to replicate previous physical practices.

I understood that the digital sketches and therefore the digital millinery were distinct from my physical sketches and millinery; therefore the digital had particular characteristics that could be exploited as design and aesthetic features. I subsequently embarked on 'Artificial Elegance', a series of digital millinery and within this started to embrace the digital aesthetic. I also came to understand that, although there was no gravity to affect my designing, unexpected results can and did occur. I analysed the forms I had created, and the three ruptures that occurred within this experiment were explored as concepts in the following three experiments. These included the lack of gravity in the digital environment; illusions of completed millinery in a 3D digital environment; and the 3D digital axis of X Y and Z.

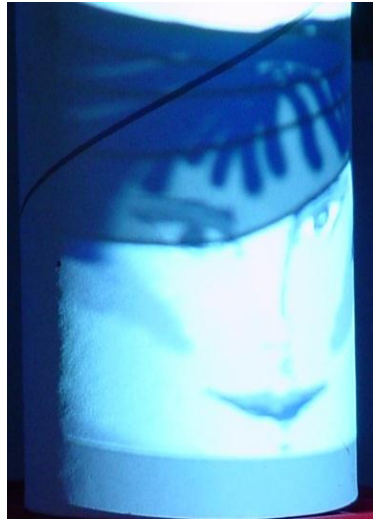


Figure 56: Making With Light, single projection of drawing onto cylinder



Figure 57: The Cube installation hat piece and drawing



Figure 58: Sketching Machine



The 'Making With Light' experiment followed. Here I explored the notion of ethereality of form and material, this is where I sought to defy gravity and question notions of materiality, which were successfully achieved. However the technology was cumbersome and I began to understand that sometimes I was enamoured by the technology and that this could be a problem and get in the way of achieving what I wanted - to explore what it means to sketch in 3D using the computer.

In 'Artificial Elegance' I discovered that the five views of front, back, left and right sides and aerial did not always correlate to make one hat. While this meant that I could not make a physical hat from my sketches, the discovery motivated me to attempt to create a physical representation of the digital workspace. 'The Cube' was that representation; it brought the digital sketches into the physical environment, and allowed me to explore point of view in a playful way. I constructed a physical space that I could enter and again had an embodied designing experience, a 3D sketching experience while I moved through the room. The physical lived experience was overwhelmingly captivating, I was in the 'state of flow' and at that time this caused the digital experience to pale beside it.

As I explored the XYZ axes and the lack of gravity in the digital environment, I again replicated the digital space in the physical environment, this time through the construction of a 3D 'Sketching Machine'. While not entirely successful as a process that I could undertake where I would arrive at a 'state of flow' as I had in the hand draping, I could utilize this as a method of creating the millinery in the digital environment. In this experiment the physical model was a response to the digital sketches, which in turn influenced the development of further digital sketches.



Figure 59: Lucid acrylic millinery



Figure 60: Buttoni millinery



Figure 61: Hatistropic moving image still

I had touched on digital aesthetics in the 'Making with Light' experiment and set about replicating the digital and the light sketches in a material guise. This resulted in the experiment 'Lucid'. This was the first time that the physical represented the digital; the physical millinery became copies of the digital sketches. This was a significant shift in the investigation, as it was at this point when I resolved to allow the digital millinery to be itself, to embrace the affordances and aesthetics, and no longer attempt to make it conform to the expectations of the physical world. The digital became the original, not the documentation or realisation of an earlier entity – the paper sketch.

If the digital sketches could be copied in the physical world I was going to require suitable software, and it was at this stage when I started using software that would allow me to transfer my digital sketches to the physical environment as millinery objects. In 'Buttoni' I embarked on a production line of millinery with a distinctly digital aesthetic, as they were copies of a digital sketch.

Making a series of physical copies of the digital sketch occurred in two experiments, in Lucid and particularly in 'Buttoni'. I revolted against making physical millinery and sought to make sketches of millinery in the digital space and to use the software as a digital sketchbook. In 'Hatistrophic', the technology had become invisible, and when I sketched I was in a state of flow. If I desired, I could stop my designing trajectory anywhere within the process, save the incremental digital sketch, and then keep designing. I could access any part of a process at a later date. Using the technology in this way I was able to create a web of design possibilities, and to have easy access to these 3D digital sketches in the future.

In an unexpected turn of events I took the Hatistrophic experiment one step further when I reverse engineered a Hatistrophic millinery sketch to unwrap it. I made a pattern, cut and sewed it and gave the sketches a physical form. In doing so my practice rotated in a full circle as I returned to my patternmaking roots, with a transformed understanding. I reflected on the misguided information I had received that computer technology would replace pattern graders in the fashion industry. I had come to understand that without a human, in this case me, and my thinking, my designing, my sketching, that

none of this investigation and fluctuation between the digital and physical processes; and the millinery or findings would have transpired.

The experiments were not without challenges and incongruities.

## **8.2 DIGITAL SKETCHING POSTSCRIPT**

In this section I discuss selected research which added particular value to the findings within this investigation.

Coyne, Park, & Wiszniewski, 2002 examined the use of an 'electronic drawing board', which they referred to as the device in their paper 'Design devices: digital drawing and the pursuit of difference'. The electronic drawing board' was developed to facilitate the process of manual drawing techniques within a computer environment. They noted that other devices had been developed to meet specific needs, (Coyne, Park, & Wiszniewski, 2002, p263) of '...speed ... accuracy ... succinctness...'. At the time of writing their paper there were many such devices in prototype form which had not been sent to market, and that they aimed to investigate and present '...useful insights into the relationship between manual and digital media'.

The discussion of the relationship between manual and digital media is useful to this investigation, albeit the technical developments discussed within the paper have long since been superseded by more advanced technologies. Their device mirrored the manual drawing board, and in many respects resembled a tablet, a now commonplace device. It received a varied reception from the designers who trialled it, some embraced it, some did not. The relevant point to my investigation is noted in the conclusion, when the usefulness of the device is defined by its ability to highlight the differences between manual and digital drawing. Additionally Coyne, Park, & Wiszniewski (2002, p286) these differences are seen as possible 'catalysts to disclose and provoke new practices, terms, definitions, metaphors, narratives, structures and significations in design'.

Indeed, it wasn't until I contrasted the physical experiments with digital experiments within my practice and attempted to transpose the methods and understanding from one setting to another that the ruptures and learning's occurred. At the beginning of the investigation my objective was to sketch in 3D, and indeed I met that objective, going on many successful sketching in 3D adventures. However reflecting on my practice, and the shifts that occurred, demonstrated to me that there were firstly links with other digital practices which had a rich academic dialogue around it and that secondly the experiments offered knowledge building occurrences that were not identified at the start of the investigation. These transformed my practice, and furthermore will continue to do so.

Millinery is the context of the investigation; the 3D sketches are designs which potentially could be worn on the head. They are not sculptural pieces; they are not idle sketches for no purpose, the sketches are hats which may or may not ever come to fruition as a completed product. I acknowledge however, that I am drawn to the work of sculptors as although I am designing a hat, not creating art, millinery and the combination of its three dimensionality, its often playful nature and the importance of aesthetics over function lend itself to an affinity with sculptural practices. The area of digital sculpture influenced the investigation.

Keith Brown<sup>25</sup> (a well-known digital sculptor) has been investigating this area for some time; and in his 2001 paper 'Atoms in the Net' he outlined a history of sculptures interactions with the medium. Brown noted that in the 1990's there were limited sculptors utilizing digital technologies, this was due to the fact that engaging with the technology at that time was through entering data, and was not a visual process as it is now, additionally it was very expensive. Brown also noted it (p29) "was far from an intuitive process", thus not an attractive option.

Although his article was written in 2001, Brown stated that then that the uptake of digital technologies had grown, and had infiltrated "...into almost every aspect of our lives..." (P29). He attributed that in part to the development of better faster and cheaper hardware and software. Since the

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<sup>25</sup> Director of Art & Computing Technologies for the Manchester Institute for Research and Innovation in Art & Design (MIRIAD).

writing of his paper, digital technologies have been up taken by many in an exponential manner. Like me, Brown suggested a link between drawing and using a computer to draw / sketch or model, and that many sculptors distrusted the digital medium as it was not real. A drawing (or sketch) is also not real, but was accepted by sculptors as a valid way to develop and idea (Brown).

Brown suggested that digital technology would become a commonplace addition to the "... tool chest of the contemporary practitioner..." (p35), however I believe that in spite of eleven years since the writing of Browns paper that digital tools as commonplace for the designing process is not yet the case. Brown continues to practice as a sculptor and works between digital and physical spaces. In an outline of Brown and his work on the Digital Aesthetics website<sup>26</sup> (Brown, 2012) the last paragraph of Browns artist statement mirrored my sentiments on my digital practices.

My work is born out of the direct exploration of a multi-dimensional cyber world where material, as we understand it, does not exist. In the cyber environment 3D entities may be encouraged to behave in ways not achievable through physical means, being located in an area that exists beyond the imagination and everyday experience. This work, now manifest in true space, acts as a vehicle which transports us to this strange and wonderful "other place" where unpredictable and surprisingly beautiful events may occur. It is as if modeling with light in an environment where matter and energy, materiality and gravity, play no part, miraculously freeing form from traditional material constraints and our usual understanding of how objects work in the world.

Brown speaks in a playful way about his process and his motivation for undertaking his work, he uses the technology as a tool, as a means to transport the viewer, and the artist to an other worldly place.

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<sup>26</sup>Available at – <http://digitalaesthetic.org.uk/participant/keith-brown>

I am from the world of design, and as a millinery designer my main directive is to design hats. I sought flow, through the experience of designing, to transport me to an area of flow and as time progressed I also struggled with the notion of how to amalgamate a non-material practice with a very material area of the design discipline. I will discuss flow firstly.

Flow, the all-consuming time when the designer in this case, was happily submerged in the creative process, and interestingly when I was actively engaged in the process, I moved into a state of flow with equal ease in both physical and digital spaces. Csikszentmihalyi discussed the problem when a creative type was unable to be creative, and the pain it brought and he contrasted this with this statement, which I concur with. (1996, p75) “Yet when a person is working in the area of his or her expertise, worries and cares fall away, replaced by a sense of bliss.” My practice is my area of expertise; being engaged in sketching millinery in 3D was and is the apex within my practice.

When I grew to understand that not only was creativity useful as a means to an end, that is, to a possible design solution of a wearable hat, and therefore potentially saleable, that also the un-wearable and un-saleable millinery sketches (which could be considered useless if analysed from purely economic terms), had a use, to me. This was in the form of a location or opportunity for self-expression, happiness, and fun. Furthermore it was encouraging to locate academic research on the subject matter. Runco (2004, p 677) suggests that creativity can also be linked to these uneconomic issues as well as health, and equally notes that it can be linked to various disorders, which I chose not to focus on in this investigation. Runco acknowledges that there is much room for further research on the subject of creativity, and I look forward to contributing to that discussion in future years.

My creativity in this investigation centred on sketching millinery design developments in 3D, using computer technologies. Downton (2004, 2006) suggested that most early design developments in architectural practice occurred through two dimensional means with some basic digital input. Downton discusses how creating the detailed sketch of the design, another person can construct it, which is similar to the Buttoni process I undertook. Downton also talks of the more sketchy sketch, a type of sketch which would

need the hands of the designer to complete the task. Although he undertakes some pre modelling sketching himself with his models examined within 'Studies in Design Research: Ten Epistemological Pavilions' (2004), much of his design developments occur in the physical model making stage. Following an initial sketch on paper, Downton advanced his pavilion experiments, and much like my experiments, he generally launched into the modelling stage, thereby sketching in 3D in the physical environment.

In the publication *Homo Faber: modelling architecture* (2006) besides essays from eminent model makers such as the Chief Investigators of the exhibition and subsequent catalogue Burry, Downton, Mina and Ostwald, a selection of Participating Firms answered questions on their model making practices. As noted earlier, within this investigation modelling is seen as a form of sketching in 3D, a common practice in the area of millinery. Most participants within the *Homo Faber* publication utilised digital tools in some form or other, like the investigation undertaken by Coyne, Park, & Wiszniewski (2002) four years earlier, some practitioner's embraced digital tools and others disliked it.

Allan Powell (in Burry, Downton, Mina and Ostwald, 2006, p42) noted that the digital models were "unsympathetic and clinical" and felt that the "for the cost, time and the result fall short of giving a true sense poetically of the spaces and their connection to the exterior space." Powell suggests he prefers manually made models, although doesn't specifically note this.

Lyons (in Burry, Downton, Mina and Ostwald, 2006, p73) appeared to be one of the most advanced in the uptake of computer technologies. They discussed how they use digital models in a functional space to help them "understand site conditions and the spatial relationships" and went on to discuss how models were also used as quick visualisation tools. I found it interesting that Lyons utilised Rhinoceros, the same software that I do, one which was not specifically designed for architects, and one which they, and also I, find easy to use. I speculated whether this ease of use was because the software did not come with rules imposed by a specific discipline, as was a problem I identified in commercial fashion computer technologies. I speculated whether a software like Rhinoceros could be deemed as discipline neutral.



Some were tied to the 3D print, a physical version of the computer model and I wondered why they had to print it at all. An image of discarded models in the corner of the Terroir studio concerned me, I reflected on my studio which was mounting up and up with discarded millinery prior to my digital studio, and I analysed the topic in my 2009 paper titled 'More more more - can digital practice be an antidote for affluenza?' Terroir stated (in Burry, Downton, Mina and Ostwald, 2006, p86 - 87)

A model has one of two possible fates in our office: many models are discarded, well, not quite discarded, rather put to one side, not quite thrown out but piled up in 'graveyards' collections of embodied ideas now dead but retained out of respect. Others escape burial and (through an informal process of deliberate placement within the office), hang around longer on the ends of desks or empty spots on shelves.

Like me, they often picked up old models (in my case digital models and sketches) and reworked them, as further iterations of the same or as pieces reformed into something entirely new. I identified a method of saving incremental stages of the digital models, in order that the catalogue of possibilities is manifestly greater than could be achieved in a physical 2D or 3D sketching process, and that would not impose on physical space or use materials unnecessarily.

As I worked through the study I also identified that in many cases there were problems with sketching in a 3D digital environment. Principally, the problem was due to the fact that the 3D sketches are invisible, hidden within the workings of the computer, on a disc, pen drive or in the digital networks, somewhere, but not present. Terroir also worried that the digital models would be forgotten as they were no longer visible. I believe invisibility of digital models and sketches is a real issue, and was one which was noticeable within this investigation; within my designing and within other areas of the study. This was because unless the digital sketch or writing was printed (2D or 3D), projected or on a screen, the digital was invisible, it was illusive, and therefore it was forgettable and it was a simulacrum.

Within my practice the sketchy sketch and the working model are the same thing, I do not differentiate between the 2D and 3D or the physical or digital spaces, and now at the conclusion of this investigation, understand that I can confidently travel between physical and digital, and sketch in 3D, within the context of millinery, albeit a transformed millinery practice.

### **8.3 MATERIALITY**

As the research evolved a new millinery reality developed, this was one which was determined by form and environment and not by material, and often it was immaterial. However, at the same time that this was occurring, an overriding theme that kept emerging took me by surprise was that I was drawn to giving the digital millinery life in the physical world. I was enticed by the materiality of the discipline of millinery which has its roots in fashion.

Fashion by its very nature was, and is, a material practice; therefore materiality and making could be viewed to be at fashion's very heart. I had an on-going battle with myself; as my research and design practice were in a constant state of flux between two standpoints - to be made or not to be made. This occurred throughout the duration of the investigation. I reflected on the fact that I didn't demand that the design ideas I had drawn with pencil in my physical sketchbook became physical objects; it was acceptable for these drawings to remain as concepts.

My ambition to investigate the practices of millinery in a non-physical way challenged not only me, but also the various people I engaged with in the course of the study. I found it unsettling that observers of the project also expected that the sketches produced using technology were resolved design ideas, and were destined to be physically made. Even though making physical millinery was not an objective that I had identified at the start of the project, I was concerned that the lack of a physical object could make the project worthless or irrelevant to my peers. This was because I had a deep underlying ingrained tie to materiality in fashion; it was at fashion's very core. Materiality

and embodiment in fashion was a theme that went through the entire study, the lack of materiality both worried me and excited me.

Associated to the materiality of making and the object, was my quest to explore and critique these as embodied experiences. This commitment came out of my reading of the writings of Maurice Merleau-Ponty (1962) and Max Van Manen (1997). It was reinforced by the experience I had when I first analysed my draping process in light of Csikszentmihalyi's nine elements (1997). I aimed to not only sketch or draw in 3D, but to achieve a state of flow whilst doing it.

Through the process of undertaking the investigation I identified that I did not like to be separated from the practices of making by hand; the computer screen was getting in the way of an embodied experience. I continued to feel uncomfortable about my physical separation from the design process as well as from the designed. I investigated ways to overcome this; many of these were discussed in the experiments. I examined ways I could overcome my separation from the physical process and product, and reconsider materiality and embodiment. I wanted to achieve an embodied sketching experience that could be both or either material or immaterial.

The computer was utilized to assist the mind's eye, to help the glimmer of an idea grow brighter; enabling the imaginings develop and sometimes find a digital or material reality. My millinery designing experiences were firmly based in the memory of bodily practices of the hand made. I used that knowledge and understanding to drive the perceptive and making opportunities through the use of digital technologies.

When I used a pencil on paper, my eye followed the hand; my hand and eye were linked, whereas when drawing using a mouse or a pen tool, my eye followed the cursor on the computer screen, my hand was often not in the field of vision. The link between my hand and eye was redefined in 3D computer spaces; the gap in the gaze and in materiality was addressed through my remembered bodily experiences. Within my millinery practice the digital object was real to me. I could imagine it. I could reside there. I knew the form. I knew the material. I thought that I did not need to touch it or have it

worn. However, I was wrong, I did desire to touch it, and therefore underwent several physical making projects.

I moved across domains to help me make sense of my own, I did this for two main reasons; firstly that the area of millinery practice is under theorised, and secondly as disciplines outside millinery and fashion were displaying advanced interactions with technology within their practices.

In the course of this doctoral investigation I found myself in a 'state of flow' and experiencing this, which Flügel describes in an art context as (Flügel, 1933, p 237):

Art itself (and with it sartorial art) is a compromise between imagination and reality; it deals with real media but implies an inability to find complete satisfaction with reality and creates a new world 'nearer to the heart's desire'.

Within this practice based doctoral investigation I acknowledge that my experience was unique, it was created through the specific aspects and contexts of my practice. What I brought to the investigation within my practice is what makes it so. The assemblage of my physical world practice as a milliner, a very specific craft with a strong focus on the handmade was an interesting space to view digital practices from and through. Additionally my experience is unique; to this time in history, as it is a time when digital technologies are developing, along with the skills and knowledge of the design practitioners who work with them, such as me. In years to come practitioners may come to an investigation with a wealth of digital experiences, and this would alter their experiences and the outcome of the investigation.

I brought extensive experience and knowledge of the hand made to this investigation, and I transplanted this into the digital space. I travelled between the two spaces of the hand made and the digital in order to understand the process of sketching and designing in 3D, using computer technology, from a milliner's perspective.

After undertaking this investigation I now know that the dialogue between the digital and the physical enriched the experience of designing and the design

possibilities in both areas, and furthermore I have discovered that there is a space between the digital and the physical that offers even more possibilities for embodied designing experiences, and for alternative millinery outcomes.

Through this doctoral investigation I used the hand made and the digital to rethink millinery practice in light of the hats peripheral position in the fashion scene. I wanted to sketch in 3D by using digital technologies, and I wanted to be transported to a new place in my designing, to develop a method or tool like no other. My practice was transformed when I went from two separate processes of the handmade or the digital to one which was not defined by materiality or environment.

I acknowledge the invisible stored digital sketches were often forgotten, nonetheless, as a result of undertaking this research I have come to know that whether sketching in 3D within a physical or digital space the most important element for me is that the technology or tool I am using for this process becomes 'invisible' within the designing process. It is at that point in time when I not only achieve a state of flow, but I also redefine my millinery practice, a practice which can now comfortably remain immaterial and reside in the digital realm, until I surrender to the lure of materiality yet again, the hyperreal hat.

Within my redefined practice the millinery, the studio location, the process and the hat have moved and have become as Baudrillard states (1994, p6) "its own pure simulacrum", redefining my millinery traditions.

## 8.4 FUTURE DIRECTIONS

Through practice based research and an iterative process of doing and thinking about the doing, I was able develop several approaches to sketching in 3D using the technology or not as discussed in the preceding chapters. In doing so I created digital models of the millinery which challenged traditional millinery practices, and which led to new approaches to sketching in 3D. I discovered that the computer had not jettisoned the pattern grader or any similar position, the computer had become another tool in the millinery tool box, however, I also identified significant problems of working within the digital space, notably that of invisibility of the digital models when stored.

Even so, the digital tool is one that I intend to continue to explore in the context of millinery sketching, the hyperreal, and to explore further the area of sketching directly to patternmaking. I will investigate other potential applications of non-fashion specific technologies and devices, by using a wide breadth of non-fashion specific technologies, as has been the focus in this investigation. This will advance prospects of subsequent chapters of my 3D digital sketching and designing trajectory.

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# 10 APPENDIX

## 10.1 Glossary of terms

<b>2D</b>	Two dimensional
<b>3D</b>	Three dimensional
<b>Bespoke</b>	Made specifically for a client to the clients measurements
<b>Block</b> <i>(or blocking)</i>	<p>In this project the word block is used to indicate both a tool and the process; that is noun and verb.</p> <ul style="list-style-type: none"><li>• The hat block, a form which is shaped to create a millinery shape (n)</li><li>• The process of draping and moulding material over a hat block, that is, to block (v)</li></ul>
<b>CAD</b>	Computer Aided Design
<b>CAM</b>	Computer Aided Manufacturing
<b>Couture</b>	Exclusive fashions custom designed and often associated to the French fashion organisation <i>Chambre syndicale de la haute couture</i> where the name <i>couture</i> is defined by specific conditions.
<b>Digital Millinery</b>	Millinery residing within the computer or digital realm, constructed by data of zeros and ones
<b>Draping</b>	A 3D method of creating fashion and millinery designs by draping fabric onto a mannequin or hat block / dolly respectively.
<b>Hat</b>	The physical artefact which is the results of making millinery, which is usually worn on the head.



<b>Hat Block</b>	Generally a wooden or metal shape used by the milliner as a foundation to drape, mould or block the millinery material over during the design process.
<b>Hat making</b>	Hat making refers to mass produced everyday headwear, often made from fashion / garment textiles and machine stitched.
<b>Hat making</b>	Hat making refers to mass produced everyday headwear, often made from fashion / garment textiles and machine stitched.
<b>Ideation</b>	Creating design ideas
<b>Mannequin</b> <i>(and tailors mannequin)</i>	Form which represents the human body, used as a foundation to drape fabrics thereby creating a garment design or to fit garments on.
<b>Milliner</b>	The designer maker of product which is worn on the head. ie the act of millinery to create millinery
<b>Millinery</b>	In this project the word millinery is used to indicate both process and product, that is verb and noun. <ul style="list-style-type: none"> <li>• The discipline or craft of making artefacts which are worn on the head</li> <li>• Any accessory which can be worn upon the head.</li> </ul>
<b>Millinery materials</b>	Straw, felt, textiles, crinoline, feathers,
<b>Model millinery</b>	Any accessory which can be worn upon the head which is usually a one off piece and destined for high fashion situations. These pieces are usually hand blocked or manipulated, often stitched by hand, crafted using tools and processes from bygone days. Mass production of such an item is difficult.

<b>NURBs</b>	Non-Uniform Rational B-Spline (NURBS) are curves used in 3D programme.
<b>Pattern grading</b> <i>(or patterngrader)</i>	A process of developing a size range of garment or accessory patterns from a single pattern. This is an activity undertaken by a patterngrader.
<b>Plug-in</b>	A computer application which has been designed as an add on to existing software to cause the software to perform a specific task which is in addition to its main function.
<b>Ragrade</b>	Colloquial name for the fashion industry.
<b>Rapid prototyping</b>	The broad name for the method of creating a prototype directly from a machine. Software such as Rhinoceros or SolidWorks is used to drive the machinery.
<b>Stylus</b>	A computer tool which acts like a pencil or pen. The user draws or manipulates the images on the tablet using the stylus. (see Tablet)
<b>Tablet</b> <i>(and tablet computer)</i>	A computer device which acts like a drawing board or paper, and which is connected to the software in the same manner as a mouse. A stylus is used instead of a pen or pencil. (see Stylus)
<b>Toile</b> <i>(or toileing)</i>	Three dimensional prototype the garment of part thereof, often made in fabric created for the purpose of testing the pattern.
<b>Virtual millinery</b>	Millinery which exists within the physical world and which does not have any 'hard' material presence. It is a symbol for millinery ideas, which is for millinery concepts.

# 10.2 Critical Evaluation Matrix

Classification for exegesis	not analysed in exegesis	Practitioner at Work			Practice Disrupted	Practice Interrogated	not analysed in exegesis	Practice Disrupted	not analysed in exegesis	Practice Interrogated	Practice Interrogated	Practice Interrogated	Practice Interrogated	Practice Interrogated	Practice Interrogated	Practice Interrogated	Practice Interrogated	Practice Interrogated	Practice Interrogated	Practice Interrogated	Classification for exegesis
Experiment name and year	questionnaire on 2D / 3D methods of working (2001)	1. Drape and Stop Animation (2001)			2. 3D Digital Sketches (2001 - 2005)	4. Making With Light (2002)	not analysed	1. Artificial Elegance (2003 - 4)	not analysed	5. Cube Installation (2004)	6. Sketching Machine (2004)	7. Lucid (2003 - 4)	(2005)	2. 3D Digital Sketches (2005 - on going) primary software - Rhinoceros	8. Buttons (2006)	9. Hatstrophic (2007 and 2009)					Experiment name and year
Intensions of experiment	Was this occurred concurrently with the beginning of experiment 1, Drape and Stop Animation	Part one: Drape and Stop Animation Part two: Stop Animation (making the animation) Part two: Stop Animation (viewing the animation)			Part one: 3D Digital Sketches (2001 - 2005) primary software - 3D Studio MAX R3	Project 1 - Clothes Photos, hand drawings and studio mannequins onto a tubular screen, and onto a dressmakers mannequin Project 2 - millinery Photos, hand drawings and computer generated ideas onto a tubular screen, and onto a dressmakers mannequin	Mini experiment - drawing onto a tubular paper / card, drawing around the body	3D sketching and animation	mini experiment - sketching in pastels	Cube installation	Sketching machine	Prepops - eCRH and Lerts Garber Here	Casting	Part two: 3D Digital Sketches (2005 - on going) primary software - Rhinoceros	Vacuum forming - Buttons hats	Bioscreens unwrap - 1 (2007)	Bioscreens unwrap - 2 and Hatstrophic movie (2009)				Intensions of experiment
Key words	draps, sketch, CAD, computer, practitioners, reflective practice	3D; drape; embodied; experience; flow; modelling; movement; physical; sketching with cloth			animation, digital, disembodied; movement; passive	3D digital technology; digital aesthetic; enmeshed by technology; ebrawl; experience; flow; gravity; illusion, materiality; millinery; sketching; tinkering; projection	sketch, 3D, 3D > 2D, round, physical	3D digital technology; digital aesthetic; experience; flow; gravity; illusion, materiality; millinery; modelling; point of view; sketching; tinkering	sketch, multiple views, analysis of form	3D; embodied; flow; fragments; gravity; illusion, low technology; physical; virtual; interaction	3D; embodied; flow; fragments; gravity; illusion, low technology; physical; virtual; XYZ; axes	3D digital technology; digital aesthetic; physical; millinery; acrylic	3D physical modelling, cross disciplinary, ad-hoc	3D digital technology; digital aesthetic; experience; flow; materiality; millinery; modelling; sketching; tinkering; reverse engineering	3D digital technology; digital aesthetic; experience; flow; materiality; millinery; modelling; sketching; tinkering; reverse engineering	3D digital technology; digital aesthetic; experience; flow; materiality; millinery; modelling; sketching; tinkering; reverse engineering	3D digital technology; communication; digital aesthetic; hands of making; incremental; social; physical; millinery; serendipity-				Key words
Technology, software, materials and tools	questionnaire participants	3D Studio MAX R3 Pencil, pen, paper Photoshop Modelling Cardboard Fabric Data projector			Digital photography Macromedia Flash	3D Studio MAX R3 Photoshop Photography Modelling Cardboard Fabric Data projector	traditional drawing media - pastel, pencil, paint acetate, paper, board	3D Studio MAX R3 Photoshop Modelling Cardboard Fabric Data projector	traditional drawing media - pastel, pencil paper, board	Crimo-line ribbon Nylon Thread White plath	3D Studio MAX R3 Printer Fabric Patternmaking Sewing	wire plaster silicon mould wax silicon mould	Rhinoceros Modelling Reverse engineering Patternmaking Sewing	Rhinoceros High impact polystyrene (HIPS) Vacuum forming	Rhinoceros Printer Fabric Photography Moving Image					Technology, software, materials and tools	
Process	These questions were developed as a preliminary scoping document to anonymously survey colleagues, professionals and students about their experiences of in 2D (on paper traditionally) and in 3D (by drawing / building models in reality or by using a 3D modelling computer programme). This was undertaken in attempts to discover if fashion designers had a preference to working in 2D or 3D when developing ideas. The questionnaire was abandoned prior to due to distributing to students as although permission had been received to undertake the questionnaire from the then Head of School, I deemed that the data collected could be of little use, due to the low number of potential participants.	Drape the textiles on the dummy Construct a stop animation using Macromedia Flash Plan next iteration - 3D Digital sketch			Photograph the process of draping Construct a stop animation using Macromedia Flash Plan next iteration - 3D Digital sketch	Sketch using mouse Create digital models from polygons, and NURBS objects Define objects via the transform options Render objects to achieve the desired aesthetic (physical or digital) Animate a selection of sketches	unwraps the head - drawing - informed the Rhino unwrap hats sketch in the round, on a tubular drawing board	Sketch using mouse Create digital models from polygons, and NURBS objects Define objects via the transform options Render objects to achieve the desired aesthetic (physical or digital) Animate the millinery to display many angles of the hats	sketch multiple views in 2D to try to gain a better understanding of the designed piece	Hang pieces of millinery and images (drawings, tear sheets) in a room with nylon thread Reflect the arrangement within a computer environment, sketch in the round, as if sketching in air Secure images to the wall, to get an individual point of view, to present the full of the potential of the millinery Walk through the room Capture on camera and video	Hang a vertically gridded series of nylon threads from the ceiling attached to a plinth Attach the crinoline to the pieces of nylon, as if sketching in air Secure images to the wall, to get an individual point of view, to present the full of the potential of the millinery Walk through the room Capture on camera and video	Create millinery ideas using 3D Studio MAX Used Rhinoceros as inspiration for first iteration Used Photoshop as inspiration for second iteration Created digital models from polygons, and NURBS objects Print out patterns for millinery Create a deformable object in millinery Have acrylic printed Cut acrylic with hand saw Finish edges	create physical models and take moulds, in turn use the moulds to make pieces of millinery	Sketch using mouse, pen tool and tablet, tablet computer Scan in 3D (object and freedom scanning) Create digital models from polygons, and NURBS objects Render objects to achieve the desired aesthetic (physical or digital) Print out patterns Hand printed patterns to technician Hand digital files to technician (2007) Produce profile images for construction Construct millinery in fabric or other material	Create millinery ideas using Rhinoceros Save incremental developments Render objects via the transform options Hand digital files to technician (2007) Construct millinery in fabric or other material	Sketch many millinery ideas using Rhinoceros Save incremental developments Save incremental developments Unwrap those suitable using Rhinoceros Print out patterns Hand printed patterns to technician Designer sees (2009) Create a digital story of the millinery (2009) Hands of production (2007)	Sketch many millinery ideas using Rhinoceros Save incremental developments Save incremental developments Unwrap those suitable using Rhinoceros Print out patterns Hand printed patterns to technician Designer sees (2009) Create a digital story of the millinery (2009) Hands of production (2007)			Process	
Key theories	Schön and reflective practice-referred to for the entire project	Colkzentzimbaly: notion of 'Flow'			Colkzentzimbaly: notion of 'Flow'	Baudrillard: Simulacra and Simulation	Colkzentzimbaly: notion of 'Flow'	Baudrillard: Simulacra and Simulation	Colkzentzimbaly: notion of 'Flow'	Colkzentzimbaly: notion of 'Flow'	Baudrillard: Simulacra and Simulation	Colkzentzimbaly: notion of 'Flow'	Colkzentzimbaly: notion of 'Flow'	Colkzentzimbaly: notion of 'Flow'	Colkzentzimbaly: notion of 'Flow'	Colkzentzimbaly: notion of 'Flow'	Colkzentzimbaly: notion of 'Flow'	Colkzentzimbaly: notion of 'Flow'	Colkzentzimbaly: notion of 'Flow'	Acquisition of theory and knowledge influences and theories	
Influential practitioners and researchers	Cray, Hadden, Kang and Kim, Magenat-Thalman, Stylian	Vionnet, Barthes, Crang and Thrift, Merleau-Ponty, Wylie				Haraway, Lovoy, Michael Rees	Bayer, Hockney	Baudrillard - Revenge of the Crystal, Jones, McCulloch, Tracy		Berger, Cray, Klee	Bacon, Wolheim	Dorner	Stelarc	all, plus downtown	Pye	Gehry, Homo Faber, Semetti					Influential practitioners and researchers
Reality > Representation > Hyperreal	n/a	reality representation of reality - a photograph and movie				the millinery created swings between these two phases - 1. representation of reality - 'is a reflection of a profound reality' Baudrillard (1982, p6), and 2. 'it makes and denatures a profound reality' Baudrillard (1982, p6)	representation of reality	masks and denatures a profound reality Baudrillard (1982, p6)	representation	third order / fourth stage simulacra - pure simulation and the hyperreal	third order / fourth stage simulacra - pure simulation and the hyperreal	third order / third stage simulacra - pure simulation	n/a	exploration and skill building	pretends to be a reality - 'it masks the absence of a profound reality' Baudrillard (1982, p6)	third order / fourth stage simulacra - pure simulation and the hyperreal				Reality > Representation > Hyperreal	
most influential element	development of questions I could use to reflect on my investigation	being in the flow, analysing the experience, how did I feel?			coming to terms with the digital space, and working in new ways, especially as the software was designed as an animation tool to visualise ideas, not as a making tool	Use the immaterial to represent the material	physicality and movement	physical action of sketching moves me into a state of flow very easily	the experience of moving through the installation, experiencing sketches all around me	the physical experience of making the installation was extremely satisfying and from a Colkzentzimbaly point of view, I was completely in the flow	the physical experience of making the installation was extremely satisfying and from a Colkzentzimbaly point of view, I was completely in the flow	the physical experience of making the installation was extremely satisfying and from a Colkzentzimbaly point of view, I was completely in the flow	the physical experience of making the installation was extremely satisfying and from a Colkzentzimbaly point of view, I was completely in the flow	using software which was designed to create items that could be made physically	working with the technician who chose to 'help' me by offering my pattern, a lack of communication of intention	creating the millinery myself, being both designer and workman				most influential element	
met the intentions?	No. The intention was to ask colleagues, students and practitioners about design practice in 2D and / or 3D.	blissfully in the flow; draping in 3D physically was a meditative experience			making the animation I was suggest, it was an active experience	viewing the animation I was bored, it was a passive experience	yes, exceeded expectations, however as was a small project the decision was made not to analyse within the exegesis	yes, exceeded expectations, however as was a small project the decision was made not to analyse within the exegesis	yes, a totally immersive experience	yes, a totally immersive experience	yes, a totally immersive experience	yes, a totally immersive experience	yes, a totally immersive experience	yes, but was not successful in terms of Colkzentzimbaly and flow	yes, due to the quality technical support. If that had not been the case, the process of vacuum forming would have been an frustration as the key into casting.	in part, however although intentions not met fully, other anticipated learning around communication with workman developed	very much so and more			met the intentions?	
what emerged from the experiment?	The questions developed were referred to in every subsequent experiment within the investigation, these questions were instrumental in my own subsequent reflective process. (refer to appendix 10.5)	The goal was to design something, I did not have any design of fashion expectations other than the materials, the curves. My only goal was to design a fashion object that could be worn.			The aim of animating the still images of the draping process was to achieve an illusion of 3D, this was achieved.	Viewing the animation was a passive situation, the goal was to re-experience a designing activity. Viewing the animation did not meet that expectation.	that the digital space was a somewhat surely space which would take me time to understand fully, the pieces I sketched were representations of fashion and millinery which although looked like traditional millinery, in many cases could not be made in the physical world	the physics of moving around the 3D drawing was successful, again, movement was important, one, of the object	most important was the embodied experience of being located in the physical sketching space in addition, millinery sketches, still photographs, and moving image of glimpses of film, and that the experience was open ended	like the Cube installation it was an embodied designing experience, however, it was not open ended, it was to achieve one piece at a time	I am attracted to the physical nature of the digital - and so are others. I feel an intense pull to creating millinery which can be worn, albeit in a fashion parade	I did I fail to achieve flow as the process was forced, and time consuming, additionally the 3D millinery was not aesthetically pleasing, it was clumsy and unattractive	that although the digital space had been somewhat blurry earlier when using other software, the pieces I made within Rhinoceros could in most cases be made in the physical world. Additionally there was a very exciting element of being able to save incremental developments of the design as I designed, solving the problem of losing glimpses ideas when sketching on paper and sketching in 3D physically	Although I thought I had created a hands off process, I had instead found the hand had interactions to someone else, and they then used a process that was much like traditional millinery processes. However they did not know he was utilizing a millinery process, it was coincidental.	the physical manifestations of the digital sketches did not represent anything millinery like and therefore confused the viewer	an exciting practice which not only resulted in wearable millinery, (albeit initially was extremely unconventional millinery) but also when the millinery was printed and made physically, the results could be viewed as millinery or interpreted as 3D physical sketches, copy of the 3D digital sketches.				what emerged from the experiment?	
benefits from working this way	N/A	able to design / draw / make in 3D			even though not designing / drawing / draping in 3D, the action made this activity a satisfying one	understood that viewing was not the same as doing	becoming competent in using the technology	easy to get into be flow - was this because it was a physical experience? useful to inform reverse engineered patterns a subsequent experiment.	hand to paper, the physical contact was extremely satisfying	in the flow, met these intentions very well, also brought the project to a new level of Simulacra	artificial elegance which I had tried to understand through 'sketching in pastels' could be better (but not completely) analysed for the purpose of making as a final hat, if desired.	I had attained an objective - I had created a sketch or model in 3D using a computer, and I knew that 3D digital sketches as the basis of the physical millinery.	been understanding developed that not all processes can be successfully transferred to a different context	thinking sketching, designing and making in a very seamless manner, the discovery that I could capture incremental saves of the design development, thereby expanding the boundaries of a digital visual diary immensely.	this was not beneficial to the process, only in that it taught me to communicate more clearly with technicians - that is to state that my work was not done and I do not have the skills, it was beneficial to draw the experience of another person	benefits from working this way				benefits from working this way	
limitations from working this way	N/A	not able to save the drawing as it occurred, limited by materials at hand, gravity and the like restricted options			not designing in 3D	no challenge, no activity	am falling back on physical practices, which are often not applicable within this space	self doubt - is an immaterial practice authentic? distortions when projected onto shapes; missed physical contact with the material	it was an installation that was not experienced, that is you had to be there, considerable time was taken to take a move, which is not communicated the experience; time and space needed to create this work was what I made useful as a fashion designer or sketching tool?	Although this was to assist me in analysing the digital, it felt like I had moved too far from the digital, and although this was a process to help me understand the digital, I abandoned the digital, I abandoned the digital, I abandoned the digital.	however I was concerned that the two stages of sketching and making the final were divorced. This need not be the case in 2012, although in 2003/04 when this was undertaken I did not have access to laser cutters and the like, so I went through a process much like a traditional sketch - final pieces, although some sketches were able to be re-used. I had somewhat moved my attention from reflecting on process of how to create designs, to reflecting on the outcome product	organisation of all of the files was / is problematic. Easy to file in a folder of the name of the project, but would be better if I could see all images / stages at once. I can visualise what this would look like and aim to develop a solution to this problem when this doctoral investigation concludes.	the file given to the technician was final, there was no opportunity for design development in the making process.	many, all around communication issues	none		limitations from working this way				
discoveries	N/A	designing and making occurring as one were important; movement and 3D were important to my practice; both of the above are linked			movement gives the illusion of 3D	bored, distanced from the process	start to utilise Baudrillard's Simulacra and Simulation to think about both the process and the product.	by the end of this project I was in the second stage of Baudrillard's Simulacra and Simulation and the image (1982, p6) 'masks and denatures a profound reality.'	the sketches were physical representations of the digital models; physical action of sketching usually assists in me having a better understanding, a form of visual analysis, but in this case I was not able to 'unwind' this puzzle	I could analyse the structure of a 3D piece more successfully via 3D methods than via 2D methods for example traditional sketching on paper	I find the digital very beautiful, both when purely digital as a digital sketch / model to the physical manifestation of the digital and when the Project starts to blend with the wearer, in this case a model.	I was not skilled enough to utilise these processes in a manner that would afford me a model or hat lived up to my design expectations	during this experiment I had moved away from representing a known designed object or process, I was designing and making digital millinery simultaneously	was amused that a hat block was effectively made, by hand from the file / digital model supplied. I was not expecting that				discoveries			
actual or potential impact on millinery practice and its investigation	shdoun asking questions of others, not enough potential participants, instead ask myself.	aim to translate this into a digital environment			aim to use movement in future experiments	looking and doing are separate things, needs more wrapping	at the time I dismissed this experiment as I believed it was not useful as it was an immaterial process, however time would show me that being tied to a material process was a hurdle I would overcome when my focus moved from the clearly defined and responsible object to the redefined object and practice	utilised the process of unwrapping within the final experiment	utilised the process of unwrapping within the final experiment	utilised the process of unwrapping within the final experiment	utilised the process of unwrapping within the final experiment	utilised the process of unwrapping within the final experiment	utilised the process of unwrapping within the final experiment	utilised the process of unwrapping within the final experiment	utilised the process of unwrapping within the final experiment	utilised the process of unwrapping within the final experiment	utilised the process of unwrapping within the final experiment	utilised the process of unwrapping within the final experiment	utilised the process of unwrapping within the final experiment	actual or potential impact on millinery practice and its investigation	

### 10.3 Reflection using Csikszentmihalyi's notion of 'flow' matrix

Csikszentmihalyi's 'Nine main elements were mentioned over and over again to describe how it feels when an experience is enjoyable.'

EXPERIMENTS	Practitioner at work		
	Drape and Stop Animation (2001)		
Csikszentmihalyi's nine main elements.	Part one: Drape and Stop Animation	Part two: Stop Animation (making the animation)	Part two: Stop Animation (viewing the animation)
How did I feel overall?	blissfully in the flow, it was meditative	Engaged, it was a new experience	bored
1. There are clear goals to every step of the way.	The goal was to design something, I did not have any design or fashion expectations other than the materials, the scarves. My only goal was to design a fashion object that could be worn.	The aim of animating the still images of the draping process was to achieve an illusion of 3D, and this was achieved.	This was a passive situation; the goal was to re-experience a designing activity.
2. There is immediate feedback to one's actions.	I understand the process of draping, I am well versed in this area, and therefore I was able to ascertain if my sketching in 3D with fabric was progressing favourably. As I draped the item by pinning the scarves onto the dummy, I observed that the top was developing in a successful manner. I did not care or want the end product, but I did want to see that the idea was a successful one, whether or not the idea was ever going to be a designed object that had a use by a consumer.	Yes, I could see as I worked on the animation the top would appear to be three dimensional.	There were no actions, only observations
3. There is a balance between challenges and skills.	I had skills from many years as a fashion and millinery practitioner, and I had limitations of materials imposed on the situation by myself, and the tailors mannequin. I had the challenge of making an idea that had potential as a fashion object, and I could push this as far as I wanted, as long as what I did could be termed fashion. The combination of limitations and freedoms gave me a structure to work within; later I speculated that the project may not have been so enjoyable without the particular mix of limitations and freedoms.	Using a new software and animating was a challenging experience, but no so challenging as to make it difficult. Again, I had skills from many years as a fashion practitioner to help me gauge whether I had captured the process adequately.	Viewing the animation was not challenging in any way.
4. Action and awareness are merged.	This element was the opposite of multi-tasking that I do in my everyday life, as I was completely absorbed in the action of designing.	Full attention was required as I was not operating as an expert with the software.	It was mildly absorbing, in that I could be easily distracted. (see below)
5. Distractions are excluded from consciousness.	This element relates to point 4, all I was aware of was what I was doing, I was in the moment, being in the here and now.	As above, due to the challenges, I had to be completely aware of what I was doing.	I was easily distracted from watching the animation.
6. There is no worry of failure.	This could be seen as contradictory to point 1, as without an expectation how could I fail, although on reflection, if my piece wasn't a fashion object then it could be considered to be a failure. However, at the time I was not concerned about failure, I was too tied up in the moment to give that a thought, and I had the expertise to avoid failure.	Although I did have confidence in my skills, there was an element of worry of failure here, this was due to my lack of experience with the software, plus I was unsure that animation would achieve what I desired. But of course, the process could be repeated with corrections, so ultimate failure was not possible.	What could I fail from? I was an observer.
7. Self-consciousness disappears.	The self-consciousness I began with did reduce as I became engrossed in the process. I was all alone, and did not care about anybody else or what anyone else thought, I was doing this for me.	I was doing this for me, and although I did not care about anybody else or what anyone else thought, I was aware that my efforts may not work as I expected them to.	Self-consciousness was not applicable in this passive situation.
8. The sense of time becomes distorted.	I was not aware of time distortion, but I was not aware of the time passing, I had no time restraints on me; I did this in my own time, and took as long as needed.	While again I was not aware of a time distortion, the activity did demand my concentration. Making an animation was a different sort of experience to being engrossed in draping, I was concentrating on learning a new skill rather than operating tacitly.	No, sense of time was not distorted; this could have been influenced by the brevity of the animation and or the content of the animation.
9. The activity becomes autotelic.'	Autotelic is the key, my designing was autotelic, I designed because I enjoyed designing, for the experience of designing's sake, not for any other reason.	Autotelic was not the case here; the activity had altered to be an exotelic one. It was exotelic as I was undertaking the animation to achieve another end, and that was to recreate the situation of sketching in 3D physically, by draping. Making the animation was not particularly enjoyable.	Autotelic was most definitely not the case here; it was not exotelic either, it seemed to be a futile experience from the point of view of the maker. It may not have been futile if I was viewing another designer's work, I could learn from their experiences.

## **10.4 Conferences, journal, exhibitions and public seminars associated with this investigation**

### **Conferences (including full proceedings)**

- THOMPSON, K and BARTON, M. 2004. A conversation: virtual and actual spaces - textile practices in an era of new technologies. the space between, Faculty of Built Environment, Art and Design (BEAD) Doropoulos, M; Farren A; Worden S [eds] ISBN 0-9752106-2-9 Conference Proceedings November 2004, Volume 2 Curtin University of Technology, Perth, Australia 9 pages
- BARTON, M. 2005. Cross Pollination = Engineered Accessories Southern Threads: Connecting dress, cloth, and culture, The New Zealand Costume and Textile Section of the Auckland Museum Institute 4th annual Symposium, Otago Museum, Dunedin 5 March
- BARTON, M. 2008. Tinker tailor: the disembodied practice of a milliner using CAD technologies to think through designing and making. The Body: Connections with Fashion IFFTI 2008 - 10th Annual Conference of International Foundation of Fashion Technology Institutes. RMIT University, Melbourne, Australia ISBN 978-1-921426-18-6 ; 13 - 14 March 2008 pp655-669.
- BARTON, M. 2008. Marginal practice - a space for creativity Addressing the Margins Conference, The New Zealand Costume and Textile Section of the Auckland Museum Institute Seventh Annual Symposium. Otago Museum, Dunedin. 29 March 2008
- BARTON, M. 2009. More more more - can digital practice be an antidote for affluenza? Fashion and Well-Being. 11th Annual Conference of International Foundation of Fashion Technology Institutes. London College of Fashion, London, UK. ISBN 978-0-9560382-2-7 2nd - 3rd April 2009 pp 494-504
- BARTON, M. 2011. Get ahead, get a hat: model millinery in the 21st Century. IFFTI 13th Annual conference - Fashion and Luxury: Between Heritage and Innovation. Institut Francais De La Mode, Paris, France. ISBN: 978-2-914863-23-0 Conference dates: 13 and 14 April 2011; pp201-209.

### **Journal article**

- THOMPSON, K and BARTON, M. 2004. A conversation: virtual and actual spaces - textile practices in an era of new technologies *Junctures the Journal for Thematic Dialogue* 2: system, June pages 61 - 71 <http://www.junctures.org.nz>

## Exhibitions

- BARTON, M (2000) Invited to create millinery for Andrea Bentley at New Zealand Fashion Week, October 2000. Location - The Edge, Auckland Town Hall. *Net millinery created in CAD for the 2001 winter collection*
- BARTON, M (2001) Invited to create millinery for Tanya Carlson at New Zealand Fashion Week, October 2001. Location - The Edge, Auckland Town Hall. *Velvet millinery created for the 2002 winter collection - The Fall of the Winter Palace.*
- BARTON, M. 2002. Invited to create millinery for Tanya Carlson at New Zealand Fashion Week, October 2002. Location - The Edge, Auckland Town Hall. *Felt millinery created for the 2003 winter collection - Sweet Child*
- BARTON, M. 2002. Where the Wild Things Are. Millinery designs accessorized the clothes of DNA in L'Oreal NZ Fashion Week Auckland Art Gallery, Auckland October 2002 *12 millinery feather head pieces*
- BARTON, M. 2003. Artificial Elegance L'Oreal Melbourne Fashion Festival First Site RMIT Union Gallery, Melbourne, Australia March 19 – 29, 2003 10 days. *Video presentation of virtual millinery and still images from the video*
- Barton, M. 2003. Artificial Elegance Design Gallery, A Block, Otago Polytechnic May 20 – June 2, 2003. *Melbourne Fashion Festival exhibit was expanded to produce a larger installation for Otago Polytechnics Design Gallery.*
- BARTON, M. 2003. eCHO - Hatch, Match and Dispatch Curated by Queensland University of Technology, Brisbane July 2003 - Old Government House, Brisbane 3 printed perspex bonnets for this exhibition *The eCHO project was undertaken by invited researchers including British, Australian and New Zealand fashion and textile designers, artists, academics and postgraduate students.*
- BARTON, M. 2003. Let's Gather Here. Millinery designs accessorized the clothes of Doris de Pont Doris De Pont in L'Oreal NZ Fashion Week St Kevins Arcade, Auckland, October 22, 2003 10 perspex headpieces. *In 2005 six of these pieces were acquired for the permanent collection at Museum of New Zealand Te Papa Tongarewa Pacific Collection, Wellington, New Zealand. In 2008 two of these pieces were acquired for the permanent collection of National Gallery of Victoria, Australia.*
- BARTON, M. 2004. eCHO - Hatch Match and Dispatch Curated by Queensland University of Technology, Brisbane; exhibited at London College of Fashion 'Fashion Space' Gallery, Central London November 29 to December 10 3 printed perspex bonnets for this exhibition. *This second*

*exhibition showed a selection of 27 key pieces from the first exhibition, including my work titled 'Hatch, Match and Dispatch'*

BARTON, M. 2005. Invited to create millinery for Mild Red at New Zealand Fashion Week, October 2005. Location - The Viaduct, Auckland. *These sewn felt hats were based on the works of Hunderwasser. Patterns developed in CAD and sample supplied to fashion designer - Donna Tulloch.*

BARTON, M. 2006. Buttoni Designer and lead researcher - Margo Barton. Technical assistance from Ian Barker, Technician at Otago Polytechnic. Millinery shown at iD Dunedin fashion parade accessorized the clothes of Tanya Carlson, March 2006. 8 pieces.

BARTON, M. 2008. Hatricks, group show. Artworks at the Hilton, Hilton Hotel, Auckland. 25 - 30 August. One work.

BARTON, M. 2009. Desire / n, Otago Polytechnic Design Staff Exhibition, eCHO - A piece of perspex millinery. Foyer Gallery, Otago Polytechnic School of Art. 17 April - 1st May.

BARTON, M. 2009. Together Alone. Myer Fashion & Textiles Gallery at The Ian Potter Centre: NGV Australia, Federation Square, Melbourne, and National Gallery of Victoria, Melbourne, Australia. Exhibition catalogue ISBN:9780724103126. Exhibition 1st October 2009 until 18 April, 2010. pp 14, 15 & 28 in Together Alone exhibition catalogue. Also exhibited in New Zealand Fashion Week 2003. *The exhibition was the first major Australian and New Zealand fashion exhibition & I was the only milliner showing pieces to compliment the fashion designs of Doris de Pont. Two designs acquired by the National Gallery of Victoria, Melbourne, July 2008 for their permanent collection.*

BARTON, M. 2010. ECHO Material Memories: restaging the eCHO project. Collection of three printed acrylic millinery pieces – Hatch Match and Dispatch QUT Art Museum, Brisbane exhibited as part of the Mercedes-Benz Fashion Festival Brisbane 13 July to 22 August 2010. *Invited to re-present works that had previously been exhibited in 2003 for the eCHO exhibition in Brisbane, Australia.*

BARTON, M. 2010. Nom\*D millinery for New Zealand Fashion Week, September, 2010. *Invited to create the millinery for Nom\*D at NZFW 2010. These hats formed an integral part of their Winter 2011 collection, also shown at iD Dunedin Fashion Week, April 2011.*

### **Public seminars**

- BARTON, M. (2008) The Disembodied Practice of a Milliner Using CAD technologies to Think Through Designing and Making. Dunedin School of Art Seminar series, Otago Art School Seminar series, Dunedin School of Art Public Seminar Research Programme, Otago Polytechnic. 20th March 2008
- BARTON, M (2010) Object Representing Non Object-Millinery in the Digital Age. Dunedin School of Art Seminar series, Otago Polytechnic. September 2, 2010.
- BARTON, M. (2011) Get ahead, get a hat: model millinery in the 20th Century. Designers Talk Design, Otago Polytechnic, 30 March, 2011. Invited Seminar series
- BARTON, M (various) Graduate research Conference, School of Architecture and Design, RMIT University, Melbourne. Attended and presented – October 2008, October 2007, October 2006, October 2005, October 2004, June 2006, June 2010, June 2008, June 2007