THE GRID REIMAGINED:
The grid as a representation of the urban landscape in small and wearable objects

A project submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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I acknowledge the support I have received for my
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Belinda Geraldine (Bin) Dixon-Ward

June 2017

Figure 1, Bin Dixon-Ward, 2017, Intersections, (detail), nylon, ink, photo: Giulia McGauran.
# Contents

**List of Figures** iii

**Acknowledgements** 1

**Abstract** 2

**Introduction** 3

- About the Research 4
- Background to the research 7

## 1 Context to the Research 10

- The City Grid as a Cultural Device 10
- Jewellery as a Cultural Artefact 13
- The Body of Contemporary Jewellery 14
- Jewellery, the city and the body 18
- More than a tool: Digital Manufacturing Technologies 20
- The crafted object: skills; technology, material and tools 23
- Tools and Affect 26
- CAD and 3D printing as transformative of existing practices 30
- The uses of CAD and 3D printing in the jewellery manufacturing industry 32
- CAD and 3D printing in art practice (including ‘hacking the tech’) 33
- Impacts on craft, the handmade and the creative process 37

## 2 The Grid on Topography 41

- The pre-grid landscape 42
- The Incising Grid #1, What Robert Hoddle Did (2013) 47
- Figure 17, Detail, Map of Melbourne & suburbs [cartographic material] / compiled and photolith. at the Melbourne Board of Works under the direction of G.R. McGowan, 1942. (Source State Library of Victoria) 49
- ‘Flow Along Surface’: Towards the organic grid 58

## 3 The protective, controlling (enframing) grid 63

- Material and tool 63
- Cuffs 70
- Three more cuffs (iterations of enframing) 72
- Containing Grid 1 74
- Containing Grid 2 76
- Grid chain mail 77
- Framing and Containing Neck Pieces 80

## 4 Experiencing the City Grid 85

- Bird’s-eye view 86
- Small City Rings 88
- Mega grids (Vertical Grids, 2014) 90
- High-Rise Towers 92
- GridSounds 104

## 5 The Grid 2.0 110

- Digital Grid 110
- Squares 111
- CrossBox (2013-17) 116
- Eroding and dematerialising grids 121

## 6 Conclusion 124
Bibliography 127
Maps and Artworks 133
Selected Exhibitions Viewed 134

Appendix 1 Bin Dixon-Ward CV 135
Appendix 2, List of abbreviations 138
Appendix 3, Presentation of the research 139
Appendix 4, Exhibitions 144
Appendix 5- Documentation of Examination Exhibition 163
Floorsheet 163
Photographic record of the exhibition installation 186
List of Figures
Unless otherwise noted all images are by the author, Bin Dixon-Ward

Figure 1, Bin Dixon-Ward, 2017, Intersections, (detail), nylon, ink, photo: Giulia McGauran..........................ii
Figure 2, LAB and Bates Smart Architects, 2002, Federation Square Atrium, Melbourne. .........................8
Figure 3, Gijs Bakker, 1973, Schaduwsierraad (Shadow Jewellery), photo: Ton Baddenhuizen....................16
Figure 4, Tiffany Parbs, 2005, blister-ring, blister, skin, digital print, 330 x 470 x 35 mm, photo: Terence Bogue..................................................................................................................17
Figure 5, Emmy van Leersum, 1967, Stovepipe (collar and bracelet), prefabricated stovepipe ...............17
Figure 6, Roseanne Bartley, 2005, Human Necklace, passers-by, ball, town plaza, Barcelona. Photo: Roseanne Bartley ........................................................................................................................................19
Figure 7, Ron Arad, 2002, Not Made By Hand, Made in China, polyamide. Approximately 90 x 90 x 60, photo: chp...? jewelry................................................................................................................26
Figure 8, Gijs Bakker, 2002, Porsche, resin. Approximately 90 x 75 x 20, photo: chp...? jewelry..............27
Figure 9, Michael Eden, 2008, Wedgewouldn’t Tureen, plaster/gypsum with ceramic coating, 220 x 240 x 15. Photo by Michael Eden.....................................................................................................................................36
Figure 10, Map shewing the site of Melbourne and the position of the huts & buildings previous to the foundation of the township by Sir Richard Bourke in 1837 [cartographic material] / surveyed & drawn by Robert Russell (detail) ...............................................................................................44
Figure 11, Bin Dixon-Ward, 2013, Russell’s Grid Version 1, Rhino 3D screenshot ................................44
Figure 12, Bin Dixon-Ward, 2013, Russell’s Grid Version 2, Rhino 3D screenshot (work in progress) ....45
Figure 13, An early view of Melbourne from the south of the Yarra, probably reconstructed after 1836. R. Hofmann, after 1838. .........................................................................................................................46
Figure 14, Bin Dixon-Ward, 2014, Forever Altered, digitally altered version of An early view of Melbourne (Figure 13) ........................................................................................................................................46
Figure 15, Bin Dixon-Ward, 2013, Russell’s Landscape, digitally altered image of Robert Russell’s Melbourne Map 1837 (Figure 10) overlaid onto R. Hofmann’s Melbourne 1836 (after 1838) ......46
Figure 16, Bin Dixon-Ward, 2013, What Robert Hoddle Did, nylon, ink, stainless steel pin, 95 x 95 x 40 mm ........................................................................................................................................48
Figure 17, Detail, Map of Melbourne & suburbs [cartographic material] / compiled and photo-lith. at the Melbourne Board of Works under the direction of G.R. McGowan, 1942. (Source State Library of Victoria)...............................................................................................................................................49
Figure 18, Detail of my tracing of Figure 14 ........................................................................................................49
Figure 19, Detail of 3D print of Russell’s grid on the contours of the Melbourne site, 130 x110 65 mm ...................................................................................................................................................50
Figure 20, Bin Dixon-Ward, 2014, test print for Rhino ‘drape’ command on the 3D model of the Melbourne site, nylon, acrylic paint, 80 x 285 x 40 mm........................................................................51
Figure 21, Bin Dixon-Ward, 2013, Study with Skyline, nylon, ink, 70 x 50 x 35 mm..................................52
Figure 22, Bin Dixon-Ward, 2013, Study with Skyline, internal ..................................................................52
Figure 23, Bin Dixon-Ward, 2013, 3D model of Melbourne’s streets, nylon, 200 x 120 x 12 mm ...........52
Figure 24, Bin Dixon-Ward, 2013, study for What Robert Hoddle Did, nylon, ink, 80 x 80 x20 mm .......53
Figure 25, Bin Dixon-Ward, 2013, Working sketches for What Robert Hoddle Did .............................54
Figure 26, Bin Dixon-Ward, 2013, Rhino drawing for prototype of What Robert Hoddle Did ..................54
Figure 27, Johannes Vingboons, 1639, Manatus gelegen op de Noot Rivier, Manuscript map on vellum in pen and ink and watercolor wash. .......................................................... 56
Figure 28, Map of Manhattan Island showing elevation contours (Source: Sanderson 2009) ............. 57
Figure 29, Bin Dixon-Ward, 2015, Randall Grid Cuff, ABS plastic, 80 x 80 x 55 mm. ............................. 57
Figure 30, Bin Dixon-Ward, 2012, 3 Rings, nylon, ink, each approximately 70 x 40 x 40, photo: Jeremy Dillon .......................................................... 58
Figure 31, Bin Dixon-Ward, 2014, Test sample of interlinked cubes, nylon, ink, 80 x 285 x 40 mm ....... 59
Figure 32, Bin Dixon-Ward, 2014, Rhino screen capture showing cubes flowed on a surface ............. 60
Figure 33, Bin Dixon-Ward, 2014, Rhino screen capture showing applying distortion tools to a form ... 61
Figure 34, Bin Dixon-Ward, 2014, test print ‘flow along surface’, nylon, 200 x 120 x 40 mm .............. 61
Figure 35, (L) Bin Dixon-Ward, 2016, microscopic grains of nylon on a fingertip (the diagonal lines are finger print whorls). .......................................................... 64
Figure 36, (R) Bin Dixon-Ward, 2016, contour lines formed by layering in the 3D printing process (the squares are approx. 6-8 mm across) .......................................................... 64
Figure 37, Anish Kapoor and Factum-Arte, 2009, Greyman Cries, Billowing Smoke Beauty Evoked Work in progress (Source: Factum Arte) .......................................................... 67
Figure 38, Gilbert Riedelbauch, 2000, CHS Brooch, 925 silver, 11.5 x 66.4 x 52.9 mm ..................... 68
Figure 39, Clarence Woodhouse, 1888, Melbourne in 1838, From The Yarra Yarra, colour lithograph, 16.0 x 32.4 cm .................................................................................. 69
Figure 40, W. Knight, 1839, Wurundjeri near Collins Street, Melbourne, watercolour, 49.2 x 39.3 cm (Source: National Library of Australia). .......................................................... 70
Figure 41, Bin Dixon-Ward, 2013, Experimental versions for City Walls cuff, nylon, ink, fabric dye, ink, each approximately 120 x 120 x 65 mm .................................................. 71
Figure 42, Bin Dixon-Ward, 2013, City Walls, nylon, ink, approx. 70 x 90 x 60 mm, photo: Jeremy Dillon .......................................................... 72
Figure 43, Bin Dixon-Ward, 2013, detail, M clip ............................................................................. 73
Figure 44, Bin Dixon-Ward, Rhino screen shot – ‘Flow along curve’ and ‘Array along curve’ ............. 73
Figure 45, Bin Dixon-Ward, 2014, Three Cuffs, nylon, ink, each approx. 70 x70 x 60 mm, Photo: Jeremy Dillon .......................................................... 74
Figure 46, Bin Dixon-Ward, 2015, study for Containing Brooch #1 .................................................. 75
Figure 47, Bin Dixon-Ward, 2015, Containing Brooch #1, nylon, dye, 70 x 90x 60 mm, photo: Jeremy Dillon .......................................................... 76
Figure 48, Bin Dixon-Ward, 2014-16, Containing Grid #2 (work in progress), nylon, dye, 90 x 70 x 600 mm, photo: Jeremy Dillon .......................................................... 77
Figure 49, Bin Dixon-Ward, 2014, Sketch for reconfiguring the cube .............................................. 78
Figure 50, Bin Dixon-Ward, 2013, Rhino screen shot of new links ................................................. 79
Figure 51, Bin Dixon-Ward, 2015, Grid Chainmail test print, nylon, ink ........................................ 79
Figure 52, Bin Dixon-Ward, 2014, HiViz neckpieces, nylon, ink, 200 x 300 x 10 mm .................... 80
Figure 53, Otto Kunzli, 1984, Susy (from Beauty Gallery series), photograph, cibachrome, 750 x 625 mm .................................................................................. 81
Figure 54, Bin Dixon-Ward, 2016, Enframing Grid 1, nylon, ink, 310 x 320 x 15 mm ...................... 82
Figure 55, Bin Dixon-Ward, 2016, Enframing Grid 1, nylon, ink, 310 x 320 x 15 mm, photo: Jeremy Dillon .......................................................... 82
Figure 56, Bin Dixon-Ward, 2016, detail, Enframing Grid 2, Rhino screen shot showing cube links and tilted platforms .......................................................... 83
Figure 57, Bin Dixon-Ward, 2016, *Enframing Grid 2*, nylon, ink, 230 x 280 x 12mm, photo: Jeremy Dillon ........................................................................................................................................... 83

Figure 58, Bin Dixon-Ward, 2014, *View of Shanghai from the observation deck of the Shanghai World Financial Centre Building* ........................................................................................................ 86

Figure 59, Bin Dixon-Ward, 2014, *Model of Shanghai, Shanghai Urban Planning Museum* ................................................................................................................................. 87

Figure 60, Screen shot of Rhino 3D desktop workspace showing 3D primitives, Bin Dixon-Ward. ....... 88

Figure 61, Bin Dixon-Ward, 2014, *Small City Rings*, SLS, nylon, ink, installation in *Grids*, curated by Debbie Prior, Craft Victoria, August 2014, photo: Heather Lighton ........................................................................... 89

Figure 62, Unattributed, *Shanghai, Pudong*; the three tallest buildings from left to right - Oriental Pearl Tower, Shanghai World Financial Centre, Shanghai Tower (source: Pexels.com) ................. 90

Figure 63, View from the Shanghai World Financial Centre, Observation deck, Shanghai, March 2014, photo: Bin Dixon-Ward........................................................................................................ 91

Figure 64, Bin Dixon-Ward, 2014, *Vertical Grids*, nylon, ink, photo: Andrew Bartram, Screaming Pixel, each approximately 120 x 120 x 140 mm ........................................................................................................ 92

Figure 65, Bin Dixon-Ward, 2014, *Melbourne Reflection*, Argus Centre Building, La Trobe Street Melbourne.................................................................................................................................. 93

Figure 66, Bin Dixon-Ward, 2014, *Shanghai Reflection*, Shanghai World Financial Centre, Pudong. ...... 93

Figure 67, Bin Dixon-Ward, 2014, *Manhattan Reflection*, Time Warner Centre, Columbus Circle, Manhattan.................................................................................................................................... 94

Figure 68, Bin Dixon-Ward, 2014, sketch of RMIT Building 100 ............................................................ 95

Figure 69, Bin Dixon-Ward, 2014, *Tower Brooch #1*, nylon, ink, 80 x 60 x 230 mm, photo: Andrew Bartram, Screaming Pixel .............................................................................................................. 96

Figure 70, Bin Dixon-Ward, 2014, *Tower Brooch #1*, nylon, ink, 80 x 60 x 230 mm, photo: Andrew Bartram, Screaming Pixel .............................................................................................................. 96

Figure 71, Bin Dixon-Ward, 2015, *Tower Brooch #2*, nylon, ink, 80 x 60 x 230 mm, photo: Jeremy Dillon ........................................................................................................................................... 97

Figure 72, Bin Dixon-Ward, 2015, *Grid Body*, nylon, 300 x 60 x 60 mm ........................................................................................................................................... 99

Figure 73, Toysmith wooden block fidget puzzle (date unknown) ............................................................. 100

Figure 74, Bin Dixon-Ward, 2011, interactive block brooch, timber, paint, elastic, stainless steel ...... 100

Figure 75, Bin Dixon-Ward, 2014, screen shot showing stl mesh triangles generated by a scan of my body........................................................................................................................................... 101

Figure 76, 3D print of my body scan, nylon, 100 x 30 x 30 .................................................................. 101

Figure 77, Bin Dixon-Ward, 2015, *Grid Body* screen shot .................................................................. 102

Figure 78, Antony Gormley, 2012, *Hold V*, 3 mm square section stainless steel bar, 78.3 x 42.6 x 61.5 cm (source: http://www.martinspeed.com/featured_artists.html) ................................................. 103

Figure 79, Dixon-Ward and Jon Osborne, 2015, *GridSounds*, installation view, Craft Victoria, August 2015, paper, timber, electronic components, nylon, approximately 400 x 200 x 10 cm, photo: Bin Dixon-Ward ........................................................................................................................................ 105

Figure 80, Bin Dixon-Ward and Jon Osborne, 2015, *GridSounds*, installation view, Craft Victoria. .... 106

Figure 81, Bin Dixon-Ward, 2015, Rhino screen shot of wallpaper for *GridSounds* ......................... 107

Figure 82, Dixon-Ward and Jon Osborne, 2015, *GridSounds*, Installation view, Craft Victoria .......... 108

Figure 83, Bin Dixon-Ward, 2017, Rhino 3D screen shot showing four views of the construction plane ........................................................................................................................................... 112

Figure 84, Bin Dixon-Ward, 2017, work in progress screenshot for *Squares #1*, showing the base group of four elements ready to be arrayed .............................................................................. 113
Figure 85, Bin Dixon-Ward, 2017, work in progress screenshot for Squares #1 showing the arrayed links .................................................................................................................................113
Figure 86, Bin Dixon-Ward, 2015, Squares #1, nylon, ink, 260 x 260 x 25 mm, photo: Giulia McGauran ........................................................................................................................................114
Figure 87, Bin Dixon-Ward, 2015, Squares #2, nylon, ink, 250 x 300 x 25 mm, photo: Giulia McGauran ........................................................................................................................................114
Figure 88, Bin Dixon-Ward, Squares #3, nylon, ink, 250 x 250 x 25 mm, photo: Giulia McGauran ........................................................................................................................................115
Figure 89, Bin Dixon-Ward, 2016, screenshot, work in progress, showing tightly packed interlinked elements ........................................................................................................................................115
Figure 90, Bin Dixon-Ward, 2016, Squares #1, Squares #2 and Squares #3, nylon, dye, installation view in Out of Hand: Materialising the Digital at The Museum of Arts and Sciences, 1 September, Sydney ........................................................................................................................................116
Figure 91, Bin Dixon-Ward, 2014, sketch for CrossBox links ........................................................................................................................................117
Figure 92, Bin Dixon-Ward, 2013, CrossBox 2, nylon, ink (source: Museum of Arts and Sciences, Sydney) ........................................................................................................................................117
Figure 93, Cornelia Parker, 1991, Cold Dark Matter: An Exploded View, The Tate Modern, London (source: tate.org.uk)........................................................................................................................................118
Figure 94, Wim Delvoye, 2012, Gloria Victis Rorschach, nickelled bronze, 44.4 x 21.3 x 29.6 cm (source: wimdelvoye.be)........................................................................................................................................119
Figure 95, Marius-Jean-Antonin Mercié, 1874, Gloria Victus, bronze, no dimensions recorded (source: metmuseum.com) ........................................................................................................................................119
Figure 96, Bin Dixon-Ward, 2015, CrossBox 6, nylon, ink, approximately 300 x 100 x 15 mm, photo: Andrew Bartram, Screaming Pixel ........................................................................................................................................120
Figure 97, Bin Dixon-Ward, 2017, Intersections, nylon, ink, 500 x 500 x 15 mm, photo: Giulia McGauran ........................................................................................................................................122
Figure 98, Bin Dixon-Ward, 2017, preliminary examination exhibition design ........................................................................................................................................140
Figure 99, Bin Dixon-Ward, 2017, preliminary exhibition floor plan ........................................................................................................................................140
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Abstract

The Grid Reimagined is a practice-based research project. The practice-based research is contextualised in this dissertation through the fields of art history, urban planning, architecture, urban history, human geography, philosophy and digital technology.

This research explored the constructed environments of the city in both the process of making the artworks and in the objects themselves. Through a series of experiments, the research revealed four states of the city grid and interpreted these as jewellery and small objects. These states of the grid are: rigid and incising, protecting and containing, mutable and changeable, and dissolving and disintegrating. The trajectory of the research followed these forms as they were found in the city grid, and re-created and imagined them as jewellery objects. The research travelled from rigid orthogonal forms that control landscapes to fluid forms that conform to the human body, while all the time maintaining the underlying structure of the grid. The means of making, computer-aided design and 3D printing, themselves grid-based; remained constant as I explored the limits of materials and technology. My research reveals the relationship between artist, wearer, material, and object as adaptable and mutable.

A parallel interrogation of the controlled logic of the urban grid and the organic nature of human interaction was thread through the research. Commencing with an examination of the city grid as an organising and framing device, shaping human activity, I proceeded to explore ways in which human activity shapes the grid. In isolating and downsizing the forms of the city grid, I produced work of a human and wearable scale. Through duplicating, layering and distorting forms of the grid, the objects are abstracted from their origin, allowing an organic interaction with the wearer, while a trace of the source, that is, the rigid grid, remains as a gesture to its origins.

The creative outcomes of my research reveal connections between the city and the digital grid. This jewellery contributes to contemporary debates relating to the role of digital technologies in making, and the relationship between the maker and the machine. I conclude that it is only through letting go of any sense of separateness from the technology that the complexity of these relationships could be revealed.
Introduction

*The Grid Reimagined* grew out of an interest in the complexity of forms that make up the contemporary urban landscape. It pays specific attention to the structure that underpins the planned city, namely the grid, and how people have affected its formal arrangement. The arrangement of the forms, patterns and structures of the city signify the evolution of humankind, the development of our societies, the ways we interact with one another and the cultural artefacts we create. The evolution of the city is evidence of the ingenuity of people’s capacity to create.

The objective of this research project was to develop a body of jewellery and artwork that investigates the evolving and connected relationship between people and the geometric forms that make up the city grid as an urban landscape. I undertook several creative experiments that result in the city grid being reimagined and rearticulated, utilising digital technologies including computer-aided design (CAD) and three-dimensional (3D) printing. These studio based experiments were supported by field based research and traversed the fields of art, urban planning, history, digital manufacturing, digital design, human geography and the function of jewellery. The field based research occurred in Melbourne, New York, Amsterdam and Shanghai.

This dissertation documents the findings of my historical, theoretical and studio-based investigations. In capturing the experiments, historical research and studio-based practice; the dissertation weaves together the historical and theoretical with a studio-based enquiry process. The studio-based aspect of the research is captured in the accompanying exhibition and in illustrations contained herein of the research outcomes in the form of artworks and exhibitions.

The research examined the tension between the controlled logic of the grid and the organic nature of human activity. Starting with specific reference to several cities with street layouts based on a planned grid form, I investigated the histories of these grids, the contexts in which they were developed, and how each of the city grids has been influenced by people’s activity. Examining the perception of the city grid form as an organising and framing device that shapes human activity, I explored the constructed environments of the city in both the process of making the artworks and in the objects themselves. In isolating and downsizing the forms of the city grid to wearable scale, I aimed to make them approachable and assessable, offering an expanded experience of the urban grid framework.
My artworks duplicate, layer and distort the grid forms, abstracting them from their original form, and allowing the wearer the freedom to impart their own interpretation of the forms, while traces of the originals remains as a gesture to their origin. Through the lens of field trips, literature, historical records and studio-based artmaking, my research reflected a multidisciplinary approach combining urban planning history, contemporary art and the discipline of jewellery making.

**About the Research**

The impetus for the research project was grounded in questions about the relationship between the city environment and its inhabitants.

**Research Questions**

- How can ‘the grid’ of the city be imaginatively reconfigured to expand people’s experiences of the urban landscape through wearable and small objects?
- In what ways can CAD and 3D printing be extended and applied to jewellery and small objects in order to investigate new ways of understanding the urban environment?

The main objective of this research was to develop a body of artwork (wearable and small objects) that investigated the evolving and interlinked relationship between people and the urban landscape. In so doing, the research included an investigation of the role of CAD and 3D printing technologies in making jewellery and small objects.

I aimed firstly, to reimagine the grid as jewellery and small objects that express its impact on people’s experience of the historical and contemporary city, and secondly, to experiment with designs and digital fabrication processes that integrate urban design and architectural theories relating to the grid. Finally, I sought to contribute to the knowledge of CAD and 3D printing technologies and their relevance to jewellery and small object making.

An interrogation of the idea of the *tool* underpinned the research project. For the purposes of this research, I defined a tool as any implement or device (including manual, digital and mechanical) used to carry out a function. In this instance, the grid was conceived as a tool for city planning. A digital manifestation of the grid in CAD and 3D printing was applied as a tool for making jewellery and small objects. As a result, my research moved from conventional notions of tools to interrogate common assumptions held in the jewellery and craft communities around digitally created artwork and
jewellery, contesting the value status ascribed to ‘machine made’. In doing so, I examined the interaction between people and technology on multiple levels. I proposed the grid as a technology of the city and developed ways that iterative interactions between people and the grid inject an organic quality to this structure. I also explored the interaction between the emergent technology of 3D printing and the maker, drawing principally on the writings of Heidegger and his exploration of the qualities of tools, as applied in the writings of Barbara Bolt and others (Bolt 2010). It was in my studio-based process of testing and experimenting with composition, form, and material that I came to fully appreciate the usefulness of a Heideggerian approach.

By sketching, drawing in CAD, reflecting on and reviewing the CAD drawings, sending the CAD files to be 3D printed, then further reflecting upon and analysing the objects, I was able to test the objects against the objectives for creating them and observe other effects. By applying a non-linear development process, I was able to work on a series of pieces, set them aside and return to them some time later. I could test a variety of forms using an experimental process to develop the jewellery using the CAD and 3D printing technologies. Often unforeseen aspects of the object were revealed once it was finished, that is, when it was cleaned and coloured. Through an iterative process, several versions of the object were created until a final piece was identified. Once I had completed several bodies of work I was able to reflect on the meta-narratives of the research and structure this dissertation accordingly.

Chapter One presents the city grid, jewellery and digital technologies as the context in which the research is positioned. The chapter positions my research within a broader examination of the role of jewellery and the practice of jewellery making. The grid is examined as both the subject of the research and the tool with which the practice-based enquiry was made. I establish the relationship between my tools and the grid-based urban environment, demonstrating the way in which CAD and 3D printing technologies are essentially grid-based. This chapter establishes a parallel between my exploration of human interactions with the city grid on one level and my own interaction with grid-based technologies on another.

In Chapter Two I examine the historical use of a grid-based street plan, employed by surveyors and city planners as part of colonising the landscape. I explore the impacts of the grid street plan on the landscape and its inhabitants in two cities, Melbourne and Manhattan, both of which have street
plans based on the orthogonal grid. The research was informed by historical maps, drawings and the urban planning histories of these two cities, and revealed the meta-narratives of history, mapping and colonisation through interpreting the shapes of the sites where grids have been laid. The research was underpinned with several studio-based experiments. The grid was identified as being a rigid, incising instrument, a technology of control; the jewellery objects created during the course of this enquiry relate in a similar way to the body of the wearer. This part of my research produced rigid forms that, while wearable through the methods of attachment, sit on the body rather than responding to its contours and movements.

In Chapter Three I move away from referencing specific cities and present the second thread of investigation, which focuses on the affective qualities of the grid city. This research evolved from the work presented in the previous chapter; the grid was transformed from being a rigid, incising device to a containing and protecting technology for its inhabitants. At the same time it became a barrier, an exclusionary device for outsiders. The works created in this series of investigations see the grid become more flexible, yet still maintain its structural foundations. They share common features: all are tightly grouped, interlinked, container-like jewellery objects, which offer a sense of privacy, protection and safety while also being exclusionary. Coupled with a reflexive examination of the material and making processes, in this chapter I articulate some of the specific characteristics of the 3D printing processes used to fabricate the objects. This phase of the research examined the material and tools that create the conditions under which a grid can emerge through digital fabrication technologies, from a rigid state to one that conforms to the human body.

Chapter Four describes the third enquiry, in which I embraced the mutability and fluidity of the grid in the context of human interaction. The resulting celebratory group of artworks, capture the ways in which people interact with the grid, and in so doing, the grid is transformed. The relationship between the grid and the body is examined through several lenses, with the human body as occupier of the city grid, as a shaper of the grid, and as the grid itself. The grid’s agency as controller is disrupted, opening up a space where the city inhabitants can create their own environments. The objects produced in this phase embody the grid, and demonstrate the capacity for people to transform the shapes of the grids they occupy.

Chapter Five sees the creative research realised to conclusion. Through disassembling and slicing the grid form into its constituent parts, the grid is reconstructed into new forms and artefacts. The

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¹ Orthogonal = at right angles
potential for disorder and order are explored and new forms emerge, such as the basic elements of the cube, its sides as planes, which when broken down form quadrilaterals. The disassembly and reassembly of formal shapes and forms within the grid emerges as the primary vehicle whereby new ways are found for the grid to respond to the human body. The research was led by my observations on the radical changes that city grids have experienced, as more than 50% of the world’s population are now living in urban settings (WHO, 2016). The multi-level, multi-dimensional 21st-century city has become a permeable arrangement of physical objects and digital entities. The grid is broken down and disaggregated, and reconstituted in a myriad of ways, as are digital files as they flow through the grid of the internet. People, infrastructure, utilities and services are flowing in, out and through at massive rates, yet, while potentially chaotic, an underlying order remains. Regardless, the grid structure is maintained as the base framework or foundation upon which cities function.

The trajectory of my research travelled from rigid orthogonal forms that control urban landscapes to fluid, mutable forms that conform to the human body, while maintaining the underlying framework/structure of the grid. Through the course of the research I explored the limits of materials and technology. The research outcomes reveal the porous and mutable nature of the grid through a series of jewellery, rings, neckpieces, bracelets, cuffs, brooches, small containers and a series of photographs that contextualise the jewellery with the body and the city landscape.

Background to the research

In previous employment I was closely involved with the city as a site of cultural activity and expression. As a planner and facilitator of arts and cultural activity in the City of Melbourne, my interests were focused on animating and democratising the city’s cultural offerings. A glimpse into the intricate and complex networks and mechanisms of the city led to my interest in the relationship between the built environment and the spaces between, where culture flourishes and gives the city a distinctive character that sets it apart from others.

Initially driven by a strong affection for Melbourne, the city in which I live and work, I wanted to understand the relationship between the formal shapes of the city environment and the people that inhabit it, day to day, as they live and work. My study of French artist Fernand Leger’s (1881–1955) painting The City (1919) revealed an energy derived from the flat angular planes that make up the composition. Its dark shadows and fragmented surfaces resonated strongly with my interest in the multifaceted and multilayered collection of shapes, objects, activity and flows that make up a city. This produced resonances with the public space and surrounding structures that make up Melbourne’s Federation Square (Figure 2, p. 8), designed by LAB and Bates Smart Architects (2002,
Melbourne). Federation Square consists of a collection of buildings positioned around an open public space. The public plaza has a gradient that slopes toward a large screen and a broad arrangement of steps and terraces that face the busy Flinders Street railway station. Federation Square houses several cultural organisations including the Australian Centre for the Moving Image, the National Gallery of Victoria, the Koorie Heritage Trust and some smaller commercial galleries.

Having spent time both programming, managing cultural activity and as a member of the general public using Federation Square for my own cultural and recreational activity, I view it as a micro-element of, and a metaphor for, the city of Melbourne. Federation Square is characterised by the use of a limited pallet of geometric forms. Comprised of rectangles and triangles, a limited palette of materials – zinc, stone and glass – and a variety of textures (rough stone, transparent and reflective glass, smooth metal), combined with the spatial arrangement of the buildings, offer a visually complex and cohesive environment that invites exploration and suggests a variety of paths and destinations. On the separate but connected buildings, façades are repeated geometric shapes and voids apparently haphazardly wrapped around steel frames.

![Image](image.png)

*Figure 2, LAB and Bates Smart Architects, 2002, Federation Square Atrium, Melbourne.*

No structure is alike, but they cohere through the device of the complex aesthetics of a building’s geometry. As the location of several buildings that house cultural institutions and retail businesses, Federation Square is comprised of both intimate and vast public places, private nooks, alleyways and
open spaces. Through its topography and building placement, it creates an open space that can accommodate a large crowd and at the same time is of a comfortable scale for individuals and small groups.

Federation Square has multiple entrances/exits on different levels, accessed directly from the pavement, through portals and via staircases and ramps. This variety of incursions simulates the multitude of ways one can enter, move through and leave the city. The porosity of the structures that make up Federation Square has a visual cohesion, yet they are differentiated by a unique application of the form and material. The façade captures light in different ways at different times of the day and during the changing seasons. The structure is ever-changing, both through its interaction with the elements and with the people who use the space.

As my proficiency with CAD tools grew, I came to recognise ways in which the architecture of Federation Square reveals its origins. The triangulated structures at the heart of its design are found in many CAD applications. Federation Square’s forms, unique in their combination, are commonplace elements of its time, the digital epoch, and provide traces of the tools with which it was conceived. The conglomeration of Federation Square’s intricate detail provided a stepping-off point for this research. Its geometric elements display characteristics that stand in for the greater city environment. It prompted a desire to understand the way in which geometry is at the core of the city, its structures and influences, and the way the city is used and formed by its inhabitants over time.

Hence, drawing upon the fields of CAD and digital tools, urban planning and architecture, history, design, philosophy and jewellery, my research explored the character of the city grid and how it can be transformed into jewellery objects. I took particular inspiration from the seemingly organic geometry of Federation Square and the geometric elements of CAD to explore ways in which this complexity and dynamism can be produced in 3D-printed small objects and jewellery.
1 Context to the Research

The City Grid as a Cultural Device

The city grid is an artefact of urban environments that have a four thousand year history. It is applied as an urban planning device in towns and cities across the world (Kostof 2012). The grid has frequently been used as the first street layout for British and European colonies and settlements. It evolved from the 16th Century Spanish ‘Laws of the Indies’ that prescribed one hundred and forty features for developing new colonial settlements in the Americas (Freestone 2010). The ‘Laws’, a neo-classical schema, was inspired by the Ancient Roman engineer and architect Vitruvius (c.70–15 BC) (Kostof 1997) and codified such things as how to deal with the indigenous peoples and site selection, the latter requiring fertile land and access to clean water. This schema prescribed that there should be four major streets that lead from a town’s plaza to the town gates, square street corners, and a public plaza and public commons for recreation. In addition, it stipulated that the church should be the focal point of the grid-based city; toxic and dirty industries should be located for easy waste disposal, and the buildings should be of the same appearance for aesthetic reasons (Mundigo & Crouch 2004).

Since the 16th century, European city planners adopted these grid pattern proposals. For instance, Dutch polymath Simon Stevin (1548–1620) proposed a rectilinear grid for the port city of Amsterdam, comprising canals and streets that capitalised on access to lengthy waterfront access for trade and transport (Kostof 1991). Stevin’s plan was influenced by his study of Ancient Greek and Roman military history (Weebers et al. 2011). Ultimately, Stevin’s proposal was not adopted; instead, Amsterdam settled on the semicircular grid pattern that radiated out from the horseshoe-shaped old canals and streets that we know today. Nonetheless, Northern Europeans and Scandinavian cities, including Stockholm, Copenhagen and Antwerp, did adopt this practical and efficient grid street plan for extensions to old towns (ibid).

The grid street plan has been used to design small rural settlements such as Goulburn (New South Wales, Australia) through to the settlements of entire countries, namely the United States of America (Higgins 2009). Often derided as a cold, logical, economical form, the street grid’s deep histories suggest a fundamental human desire for order. Essentially a device that developed within the rational, classical and empirical ideologies of the early modern era (1500–), the grid (or gridiron as it is known in the USA) street plan is a cultural artefact that embodies the dominant social values of an
era. A product of Cartesian mathematics, the grid town plan is perhaps the most ubiquitous and defining artefact of rationalism. The grid’s ordering logic, straight lines and regularity are equated with efficiency, economics, and industry. In his analysis of American cities, sociologist Richard Sennett (1990) argues that the grid plan operates as a form of “geometric repression” (p. 284), a means of establishing control, not merely over nature but also over humans. European colonising societies adopted the grid street plan for the establishment of new towns and cities across the world. The best recognised are the grids of the major cities of the United States of America: Manhattan, Philadelphia, Chicago, Los Angeles, and San Francisco, to name a few.

Confirming the sense of logic that a grid street plan presents, French anthropologist Claude Levi-Strauss (1908–2009) remarked that grids state the opposition between the chaotic and the ordered (cited in Higgins 2011). Australian urban historian Graeme Davidson suggests that the urban planners of colonial New South Wales utilised the grid street plan because they had “a deep seated fear of disorder” (Davidson 2006, quoted in Freestone 2010, p. 48). For these planners, the grid represented a technology that would ensure an ordered and logical environment in contrast to the wild, illogical and alien Australian landscape.

Urban historian Lewis Mumford (1895–1990) is more strident in his criticism, describing the grid street plan as an instrument of capitalism:

> But the resurgent capitalism of the seventeenth century treated the individual lot and block, the street and the avenue, as abstract units for buying and selling, without respect for historic uses, for topographic conditions, or for social needs (Mumford 1989, p. 421).

Mumford expresses his concern for the effect of the grid street plan on its inhabitants, characterising it as “an all embracing super-organism... devoid of a sense of community, and personal privacy” (cited in Higgins 2011, p. 74). Mumford’s perception of the grid street plan is one in which it has agency and plays a role in the diminution of human lives. However, my observations of cities suggest a more negotiated relationship between technologies of the city and human inhabitants, as they too have agency in the ways in which they move through the city.

The first land sales to which Mumford refers were dictated by the surveyor’s grid, and imposed upon the traces of prior use by colonisers and the indigenous peoples of the place. Over time the forces of habitation see the grid deformed and fragmented by human will. For example, Melbourne’s original grid, planned by Robert Hoddle in 1837 (eMelbourne, 2008), featured none of the alleys and cul-de-
sacs that intersect the main streets in 21st-century Melbourne. These incursions into and disruptions of the grid all emerged after the first land sales in 1837; they are artefacts of people’s intent to make their spaces functional and accessible.

The grid also lies at the heart of several movements in art history, Modernism in particular. American art historian and critic Rosalind Krauss addresses the form in *Grids* (1979), writing: “the grid is an emblem of modernity by being just that: the form that is ubiquitous in the art of our century” (Krauss 1979, p. 52). Krauss argues that 20th-century Modernist artists claimed the grid as their own. Its form is at once a containing, and framing, device that mirrors the formal shape of the canvas. At the same time it alludes to the infinite, extending beyond the frame of the canvas. These Modernist grids are evident in the work of artists Sol LeWitt (1928–2007, USA), Agnes Martin (1912–2004, Canada), Piet Mondrian (1842–1944, Netherlands) and Joseph Albers (1888-1978, Germany).

It is revealing to consider Krauss’s observation of how the grid is represented in art alongside the grid street plan for cities. If one identifies a grid in a work of art (or perhaps a city street plan) as a fragment of a suggested infinitely larger grid, then the artwork (city street plan) acknowledges a larger world beyond the frame or boundary. In *Grids* (1979), Krauss discusses two states of the grid in art: centrifugal and centripetal (Krauss 1979, pp. 60-64). The centrifugal grid offers a way out and beyond; conversely, Krauss’s centripetal grid is framed and contained by its boundaries. It draws the viewer inward and separates the artwork (or city street plan) from the world (Krauss 1979). Krauss’s centrifugal and centripetal grids offer a starting point to consider city grids and their relationship to movement. If the centrifugal grid is one of an infinite space and the artefacts that display grid-ness are fragments of that space materialised, then it follows that these artefacts reach beyond themselves. It is in this state of reaching that movement is occurring. So the grid is movement: within and beyond, in, out and through.

In the course of my research, I came to see that it was possible to understand wearable grid jewellery through Krauss’s lens. It has two states: centripetal, that is, one that is internal, personal and private and centrifugal, one that reaches out and is open to the viewer. The centripetal might be by way of use of negative spaces, incisions or incursions into the object, or by privileging the wearer rather than the viewer. The centrifugal is where the grid in the jewellery suggests a larger grid beyond the wearer, viewer or itself. Krauss’s insights into the grid in art offer suggestions as to how one could conceive of grids in the context of both a city plan and jewellery. Both the centripetal and centrifugal
state of a jewellery object are expressions of energy, be it intimate and inward focusing or
extroverted and outward reaching.

I focus on the public/private nature of the jewellery object later in this chapter and again in Chapter
Three. I argue in this chapter that in the context of jewellery, these states, centripetal and
centrifugal, are modes of communication in which maker and wearer have made a choice either to
retain the essence of meaning for them or to convey it to a wider audience. This section gestures to
jewellery’s social and cultural functions, beyond its personal resonances. These multiple functions are
explored in more detail now, as I consider jewellery’s longstanding role as a cultural artefact.

**Jewellery as a Cultural Artefact**

As a form of communication, jewellery is a multilayered expression of the complexity of human
desire and need. Art and design historian Marjan Unger (2011) notes that people have been making
and wearing jewellery for hundreds of thousands of years. Unger states that there are profound
similarities between the ways people of different cultures and different historical periods wear
adornments, and asserts that their reasons for doing so are also similar. In her view, humans adorn
themselves for five reasons: for protection against evil and other dangers, to hold our wealth close to
our bodies, as an expression of self-identity, as an heirloom, and as a reminder of our origins (Unger
2011).

German cultural theorist and philosopher Pravu Mazumdar describes the cultural role of jewellery as
setting humans apart: “a technique of enhancement peculiar to human animals, rooted in a daily
practice of fabricating one’s own image and generating *more being*” (Mazumdar 2016, unpaginated).
As a “technique of enhancement” (ibid.), Mazumdar argues, jewellery is essential, not only
supporting our survival but helping to define our cultural identity, born out of long traditions of
rituals and practices and intended to distinguish ourselves from others. He posits that one aspect of
this enhancement is appearing larger, stronger, and more dangerous, by adorning ourselves in animal
teeth, claws or hides. Subsequently masks, dress and jewellery have become symbolic gestures
intended to transform us beyond ourselves; symbolic gestures that in turn are used to protect
identity and inversely to be read by the viewer to determine identity and status (ibid.).

Jewellery writers Peter Dormer and Ralph Turner describe the way in which jewellery operates as a
monitor of “political, social and cultural change” (1985, p. 178). Where the city environment is the
norm for most people, jewellery will reference its forms, materials and shapes, the utilities and systems with which city dwellers engage, and the social environment they inhabit. If jewellery acts as a cultural artefact, an object that carries the cultural identity of the wearer, then in my research the jewellery of the urban dweller reflects the forms, space, materials and flows of the city environment.

As I argued in the previous section, jewellery can be seen as having two distinct dimensions, the personal and the public (centripetal and centrifugal). In the personal aspect, jewellery functions as reminder or memory device. The *memento mori* containing a swatch of hair or the locket containing likenesses of a loved one serve as memory triggers; a grandfather’s fob chain converted to a neck chain is a reminder of a loved one or a past event. Jewellery historian Liesbeth den Besten (2011), in discussing various functions of jewellery, notes: ‘jewellery carries reminders of people, events and happenings in life which are significant to the wearer yet invisible to the viewer’ (p. 12).

Jewellery is also valued as a social signifier. In the introduction to the expansive catalogue of the jewellery in the collection of the Staatliche Museen zu Berlin, *25,000 years of Jewelry*, Maran Eichhorn-Johannsen and Adelhied Rasche (2013) note that jewellery “conveys information about status, the affiliation, and the self-image of its wearer” (p. 11). This position is mirrored in many jewellery texts (Cohn 2012; den Besten 2011; Skinner & Murray 2014).

**The Body of Contemporary Jewellery**

The roles of jewellery have been questioned by a specific trajectory of Western European jewellery stemming from design and jewellery craft practice from the 1950s (Turner 1976). A comprehensive taxonomy of jewellery is beyond the scope of this project; however, in an effort to offer a broad context for contemporary jewellery, I suggest that there are a number of provocations with which contemporary jewellery is engaged. These include and are not limited to, an examination of *material*, where the role of traditional precious stones and metals are eschewed in favour of non-traditional and found materials such as plastic, non-precious metals, detritus, cloth, bones, found objects, to name a few. Some jewellery results from an exploration of technological possibilities, using existing technologies in innovative ways, and substituting new technologies for conventional processes. Jewellery can also be employed to make a *statement*; the jewellery overtly carries a social, political, personal or other cultural message. At times jewellery can function as an exploration or statement of *identity*, in that it refers to or comments on observations about the identity or origins of its maker. In other works, jewellery makes references to the *body* or the idea of the body as a site, a space or
material. Finally, jewellery can be self-referencing in that it reflects on all of the above, as well as the history and status of jewellery itself.

The artwork produced as a result of my research is located in this final genre of self-referencing jewellery through my examination of the tools and of the materials of the time in which it was made. My research drew upon the materials (plastics), tools (digital) and cultural artefacts (cities) of society to create jewellery objects that are contemporary cultural expressions; it was also firmly located in the realm of jewellery as a statement of identity, in particular that of contemporary urban identity. Moreover, I interrogated the nature of the relationship between the body and jewellery: not only the body of the wearer, but the body of the maker and its relationship to the digital tools of 3D printing and CAD.

The relationship between digital technology, jewellery and identity has been explored elsewhere. Jayne Wallace (2009) undertook an extensive examination of the capacity of digital jewellery to express the personal biographies of its wearers. My research is to some extent part of a similar trajectory, one that interrogates both the materials and methods of jewellery making. Whereas Wallace embeds digital electronic components in the material of the artefact itself, digital methods are the tools that I deploy in my jewellery making. My research focused on the underlying logic of technologies of both making jewellery and of urban design. Both practices can be traced back to a shift in approaches to jewellery making that Peter Dormer and Ralph Turner (Dormer and Turner, 1989) associate with the New Jewellery Movement (a term they coined). The New Jewellery Movement is distinguished by its interest in new materials and a rejection of traditional sources of value.

Contemporary jewellery and its theorists pay close attention to the relationship between the body and jewellery. Whereas jewellery has long been recognised as being worn on the body, its association with the body was made more pronounced from the 1960s onwards, as jewellers began to explore the relationship between the body and jewellery; no longer on the body, jewellery seemed more of the body. In fact for some jewellers, the body was the material. Dutch jewellers Emmy Van Leersum and Gijs Bakker recontextualised jewellery by using industrial materials and posing challenges to the narrow definitions of the relationship between jewellery and the body. For Van Leersum and Bakker, the role of the jeweller became to question the cultural role of jewellery, and the body became the means by which these conventions were challenged. Bakker’s 1973 series Shadow Jewellery (Figure 3, p. 16) shows the mark left on the skin after a tight wire is removed. Two parallel indentations encircle
the upper arm, evidence of the pressure from a tight bracelet or bangle. The wearer’s body has become the jewellery, and while traces remain, the object is absent. Bakker’s series highlights the body in the relationship between jewellery and body. The body is the site of the idea of jewellery. The body is transformed into a landscape onto which jewellery makes its mark.

![Image](image.png)

Figure 3, Gijs Bakker, 1973, Schaduwsieraad (Shadow Jewellery), photo: Ton Baddenhuyzen

Tiffany Parbs’ blister-ring 2005 (Figure 4, p. 17) also relies on the body’s response to intervention, albeit in a more disturbing way; it is a nasty inflamed blister created by the heat of a hot metal ring in the ring finger of the left hand, a place traditionally reserved for matrimonial rings. The blister has transformed the body, creating a new topography. Similarly, the topography of the body is brought to the fore in Parbs’ 2008 work, Tuck, in which a portal in a bandaged torso reveals a slightly podgy tummy. While this work is perhaps a commentary on contemporary plastic surgery reshaping the body, it accentuates the notion of the body as a landscape. It also reflects a more widespread theoretical approach that would close down the conventional distance between human and city, technology and the body.
As noted by jeweller and academic, Caroline Broadhead, the availability of and advances in new materials that occurred after the Second World War, led some jewellers to consider the traditional methods and materials they used. Broadhead stated that contemporary jewellery: “sloughed off the assumed connotations of wealth, luxury, durability and privilege concentrating instead on investigations into material, form, value, colour and movement” (Broadhead, 2005, p. 25). Gijs Bakker created jewellery using aluminium, exploiting its inexpensive, lightweight and malleable material properties to make large collars. At the same time, Emmy Van Leersum (Netherlands) repurposed prefabricated stovepipe to form bangles and collars (Figure 5, p. 17).
To some extent, all of the practices discussed so far in this chapter can be understood as self-referencing; in other words, they engage directly with the very question of what constitutes jewellery. I return to this aspect of contemporary jewellery later in this chapter when I consider the technologies with which I have engaged in my research, as they too raise questions of skill, materials, the handmade, and craft, concepts also challenged by the New Jewellery Movement as it moved more towards the conceptual. But before so doing, I examine one more genre of jewellery that engages with the body and the city, and in many ways might be regarded as a form of conceptual art.

**Jewellery, the city and the body**

While the intent of contemporary jewellers varies, many share a common reference to the body: either by making objects to be worn on the body, or by making comment on the role of the body in relation to objects. Some jewellery references the body as its primary site, as mentioned in my earlier discussion about the work of Tiffany Parbs and Gijs Bakker. For some jewellers the conceptual relationship between jewellery and the body is the more relevant factor for interrogation. In order to contextualise this with regards to my research, I had to consider the relationship between contemporary jewellery, the city and the human body.

Several jewellers have considered the relationship between jewellery, the body and the city. In her series *Urban Jewellery* (2011), Dutch jeweller, Liesbet Bussche approaches the city environment as a human landscape/body. Bussche created a series of objects that turn elements of the cityscape into jewellery, shifting from the human scale to that of the city by using oversized forms of common off-the-shelf jewellery findings, such as the stud earring, circular clasp, butterfly clip, chain, pendant and pin. Bussche also transformed concrete balls into pearl earrings and a chain fence was transformed to an outsized necklace with the addition of a giant heart pendant. Located on city streets in Amsterdam, Bussche’s project humanises the city, the city is not only the wearer of the jewellery but in so doing identifies the city as a body.

Like Bussche, Australian jeweller Caz Guiney creates jewellery objects for the city. However, Guiney’s works remain at a human scale with a wearer in mind. In *City Rings* (2003), Guiney adorned city infrastructure with identifiable jewellery objects. She created an 18-carat gold ornament for a city rubbish bin enclosure, a silver ring for an iron building girder, a mixed metal ring for a protective wooden tree surround in Melbourne’s City Square, and a diamond ring for an air conditioning outlet (Murray 2005). In these interventions into the seemingly prosaic items of urban infrastructure, Guiney prompts the audience to question the human body as the only site for jewellery. By placing them in public spaces, she asks us to consider the city as an organic site, a wearer of jewellery.
In contrast to Guiney and Bussche, other jewellers are interested in the materials of the city. For Rosanne Bartley (New Zealand/Australia), human interaction with the city provides her with materials for making jewellery and she often utilises the detritus of the city in her work, such as ring pulls and takeaway food packaging. Bartley took her interaction with the city further with her Link Up (2005) project, for which she invited a group of people to create a human-sized necklace in a public plaza in Barcelona, thereby engaging city dwellers in performing the act of jewellery making. Human Necklace (2005) (Figure 6) is a ring of people holding hands, forming the necklace, and a ball represents the pearl.

![Human Necklace](image)

*Figure 6, Roseanne Bartley, 2005, Human Necklace, passers-by, ball, town plaza, Barcelona. Photo: Roseanne Bartley*

The wearers become the material and the object becomes its wearer. There is little to locate the event in a particular place; the participants are wearing regular street clothes in a generic paved area in an urban setting. The participants stand flat-footed facing away from each other, while one woman steps outward toward the ‘pearl’. There is a sense of connectedness between the links (participants) as they hold hands with arms outstretched and all look sideways at the person next to them. Human Necklace is a performance of unknown duration, in which the artefact is the photographic record rather than a jewellery object.

The forms of the city and their relationship to people are at the centre of these artistic and small object explorations. Each of the artists and makers discussed in this section synthesises the relationship between the human and city scale, by taking one or more elements of the city and playing with scale. The jewellers have enlarged the jewellery item: Bartley has transformed potential
wearers into the object itself and the city has become its wearer; Guiney’s works also adorn the city, but are scaled to the individual objects to which they are attached; and Bussche renders city artefacts as jewellery for an oversized unknown identified wearer. These artists and jewellers engage with the city as a site of interaction between humans and the built environment. The jewellery created during the course of my research straddles the realm of wearable expression and urban visual culture, but rather than turn the city into a wearer, it seeks to examine ways of wearing the city grid in its various manifestations.

More than a tool: Digital Manufacturing Technologies

One of the key technologies used in this research project is CAD, otherwise known as 3D modelling software. CAD software has been available for several decades and is widely used in fields including engineering, graphic design, architecture, industrial product design, gaming and animation. CAD is undertaken in two-dimensional (2D) or 3D modes. 2D CAD outputs are through plans, technical drawings, designs (etc.), whereas 3D CAD can output to a range of functions including animated renderings, fly-throughs, plans, data for 3D printing or computer-controlled milling which ‘carves’ material away from a block to reveal a shape.

Rhinoceros 3D (Rhino) (© Robert McNeel and Associates) was the CAD software used for this research project. Rhino is one of the simpler 3D modelling programs to learn, but has the scope for developing very complex designs. Rhino is used by wide range of industries ranging from jewellery to architecture, product design to ship building, as it has many plug-ins and add-ons for specific applications. Rhino is a Non-uniform Rational Basis Spline (NURBS)-based modelling program which allows for accurate mathematical representations of shapes and forms. It is widely used in parametric and generative modelling applications. Polygon modelling programs are faster to render but do not have the same degree of smoothness or precision as NURBS models; for the purposes of making 3D models for 3D printing, NURBS objects are more precise and can create much smoother surfaces with complex multidirectional curves and sub-curves. The NURBS modelling platform assists in creating 3D printable files. I also made extensive use of Netfabb Basic (by Autodesk Inc. USA) as a simple file checking and repairing software in my workflow from 3D modelling to 3D printing.

At the heart of Rhino is a grid; it appears on the desktop when the program is opened. It is this grid that provides a sense of scale, of the location of objects in relation to each other, and offers units of

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2 Rendering: the process of representing, surfaces, shading, lighting in order to present a realistic view of a 3D model on the computer screen.
measurement for accuracy. Behind the desktop grid, which is a friendly user interface, is the grid of the program. This is an imagined, infinite space containing points that form the grid coordinates and are the connection points that anchor my drawings. It is this grid that allows for possibilities, because it is expansive and like Krauss’s centrifugal grid, it metaphorically expands beyond the computer screen, reaching into the world through 3D-printed manifestations of the objects drawn within.

Computer-aided design and 3D printing are often referred to or discussed in the same context. While each of these technologies has a separate historical precedent and application, their trajectories intersect when converting a 3D design to a physical object. It is at this point that the information from the CAD program is converted by ‘slicing’ software in preparation for 3D printing. Slicing is the process whereby the 3D model is sliced into layers that direct the movements of the printer to extrude material or fire lasers to form the object being printed. In order to position the technologies with which my research has engaged, it is useful at this stage to set out the range of processes and practices that are associated with 3D printing.

**3D scanning** is an associated technology involving data collection devices that capture the shape of 3D objects, converting them into data points that can then be printed or further modified. Now available in desktop or handheld units, 3D scanners enable users to scan a huge range of objects. Similarly, digital data from other 3D applications, such as medical scans and land surveys can be adapted for 3D printing. My project did not address 3D scanning, as it requires scanning existing objects, whereas the purpose of this research was to create new objects from within the grid of the Rhino software.

**Digital fabrication or digital manufacturing** are widely used catch-all terms that include computer aided manufacturing (CAM), computer numerical controlled (CNC) milling or any of the manufacturing technologies generally known as 3D printing. CAM refers to a range of additive and subtractive technologies including laser cutting, milling and 3D printing. Digital manufacturing falls into two broad categories, subtractive and additive, and both take instructions from a digital file generated by a 3D modelling program. **Subtractive Digital Manufacturing** (SDM) involves removing material from a pre-existing block or sheet of material. Subtractive processes include laser, plasma and waterjet cutting, and CNC milling. My research did not involve SDM. **Additive Manufacturing** (AM) includes technologies that build an object layer by layer from information supplied by a digital file, commonly called 3D printing or rapid prototyping.
3D printing has been widely adopted by industry and the media because it provides a general description of how the technology works. 3D printing is a catch-all phrase that describes technologies including fused deposition modelling (FDM), stereolithography (SLA) and selective laser sintering (SLS), the common feature being that they are additive processes that build objects through various methods, layer by layer. Rapid prototyping defines the technology by its use (to make prototypes) rather than the process or technology, and the term tends to be used in earlier articles describing prototyping products and components (Kochan, 1997). For the purposes of this research, the term ‘3D printing’ was preferred because it relates to the process of the tool in making an object rather than just the end use of the object produced.

Fused deposition technology produces an object by extruding fine filaments of melted thermoplastic alloys to form layers. Most FDM printers print with blends of thermoplastic polymers, including acrylonitrile butadiene styrene (ABS), polylactic acid (PLA), nylon, or high impact polystyrene (HIPS) (Hoskins 2013). However, the range of materials that can be used in this process is increasing, and now includes many types of plastics, wax, wood-based filament, filaments impregnated with metal powders such as bronze and copper, and carbon fibre (All3DP 2017; Fischer undated). The FDM process places material where the CAD file specifies and minimises wastage. Although some wastage does occur where there is a requirement to print supports for areas of overhang, this additional material is removed once the print is complete (Fischer undated). Stereolithography (SLA) printing is a process whereby, a beam of ultraviolet light is focused onto the surface of and cures the liquid photopolymer (resin). Each thin layer of the 3D model is produced each time a UV laser beam hits the resin, with each layer bonded to the next. (Hoskins 2013).

Selective laser sintering uses a wide range of powered materials, such as polystyrene, ceramics, glass, nylon, and metals, including steel, titanium, aluminium and silver. In this process, a laser beam fuses (sinters) the powdered material at the points prescribed by the digital file. The next layer of powder is applied and the sintering process is repeated until the object is complete. Each layer can be as fine as 0.0010 mm. All unsintered powder remains in situ and becomes a support structure for the object. At the end of the printing process, the object is embedded in a block of powder and must be manually removed. Direct Metal Laser Sintering (DMLS) is a similar process to SLS but works at higher temperatures to melt powdered metal. Materials used in this process include titanium, aluminium, gold, steel and bronze.

The performance of each of the 3D printing technologies discussed above varies in different
applications, and new technologies and new formulations of materials are being developed rapidly. As with any other discipline, it behoves the artist/designer to understand these processes and materials and their limitations in order to successfully realise their intentions. That being said, there is an inspiring diversity of applications being used by artists, designers and engineers. Coupled with developments in the capacity of the technology and the business models developed around them, it is a stimulating time to be involved in using these innovative technologies. The capacity of the technology is expanding as quickly. A sense of infinite applications inspires me to continually push my practice.

Despite the ever-increasing scope and possibilities of 3D printing, some limits had to be imposed on this research. The 3D printing undertaken in the course of this research project mainly utilised SLS nylon. This technology was selected due to my familiarity with the material, the design constraints of the 3D printing process, and the material properties of the printed object. Free from the constraints of learning and testing the technology, I was able to focus on a creative response to the city grid in the form of jewellery and small objects. However, in the course of my research and jewellery making, I came to realise that the relationship with the technology was not so straightforward. Through working closely with the technology I came to understand it as a tool, yet it seemed alien to the tools that I had used up until then in my jewellery practice. This led to a further level of enquiry, that of the nature of the relationship between me (the maker), my tool (the technology) and the creative expression: the jewellery or small objects. With each recurrence of the iterative processes of conception, design, realisation, reflection, design and so on, my relationship to the technology expanded and I sought a new understanding of this relationship. As suggested earlier, this led towards my exploration of tools and craft principles in an era of digital manufacturing technology.

The crafted object: skills; technology, material and tools

The introduction of digital tools recalls earlier debates about the nature of craft and skill that occurred in the 19th Century, and is particularly associated with British textile designer and social activist, William Morris and the Arts and Craft Movement (Morris 1888) and subsequent interventions by American architect, Frank Lloyd Wright and his text The art and craft of the machine (1901). In a thoughtful exploration of digital tools and the craft of furniture making, American design academics Amy Cheatle and Steven J Jackson (2014) identity the ways in which digital tools “can call into question the basic tenets of craft and the values assigned to these” (p. 968), yet suggest that this is nothing new. Moreover, they argue that “artists and their digital fabrication tools are engaged in
creative entanglements where technology and human making expand and inform one another” (p. 967).

Similarly, I argue that maker who uses digital technologies and the technology used to create the objects are not completely separate from each other and from the conditions within which we all labour. Skill cannot be discussed in the abstract, it is always context related. When tools become an important element in the art making process, a discussion on the role of the tool and its contribution to making is necessary to contribute to understanding all the elements that come together in the object. There are several schools of thought about where the value of skills lies. In this next section I examine three of these that resonate in my research. This enquiry will be interspersed with reflections on the role of the tool in craft making.

Peter Dormer, a key British craft theorist, has argued that skills in craft come from tacit knowledge or the knowledge that “exists in people” (1997, p. 147) of material and tools. This knowledge is acquired by doing and by experience. It is conveyed from person to person through teaching. It is not something that can be learned solely by reading. This tacit knowledge of material and tool is acquired through iterative practice and comes to take the form of what we might describe as body memory.

Dormer (1997) also suggests that there is an ethical imperative to making when he writes of “the craftperson’s determination to work excellently [as] an exercise in self-clarification and, in Aristotle’s meaning, moral” (1997, p 219). To paraphrase, to practice craft is an ethical activity of self-exploration through a search for excellence by reflecting upon lived experience. In the same essay, Dormer discusses his idea of “honest work,” by which he means craft making that is disciplined, reflective and true to the principles of functionality aesthetics. Dormer is concerned that craft work has integrity, and urges makers to be true to their intent.

This idealisation of craft activity places the practice of craft in the realm of rightness or the ethical by invoking words such as moral, honest, cheating and excellence. By romanticizing craft as a moral and ethical activity for those who want to live excellently, Dormer belies the conditions in which craft objects are often made. The potter in a developing country, turning hundreds of heavy stoneware pots a week in the yard of a family home/factory workshop with no health and safety gear, is not necessarily choosing the moral life. Instead, she may be focused solely on providing for her family with skills and knowledge passed down through a family or community tradition. She may not have a relationship with the end users of her work, who in turn are unlikely to think or know anything about
the maker. While she is producing her pots in an industrial model, she may well have pride in her skill and material knowledge. Nonetheless, the romantic idea of a craftsman’s activity as an ethical choice may be available only to the privileged.

David Pye (1968), an accomplished British woodworker and craft theorist, considered the processes of making and asked “Is anything done by hand?” (p. 25). Pye argues that a developed understanding of the role of workmanship is critical to appreciating the role of technology in the process of making objects, and proposes two types of workmanship: the “workmanship of risk,” where the quality of the resultant object is subject to and dependent upon the application of “judgement, dexterity and care which the maker exercises as he works,” and the “workmanship of certainty,” which Pye describes as “predetermined before a single thing is made” (ibid.). This “workmanship of certainty” is characterised in mass production of objects, where an idea is prototyped and tested and production problems resolved prior to the production phase. Tools are pre-set, workflows planned, labour scheduled; the process is designed before production commences, and the end goal is to minimise cost and the proportion of defective products. In contrast, the workmanship of risk focuses upon the role of an individual or individuals to the success of the final object.

In the context of my research, I considered the “workmanship of risk” a key aspect of the making process. However, success is also subject to the trust I placed in the “workmanship of certainty” of the 3D printing service I used to print my objects. By relying on my skill to express my creative intent with the CAD tool, my knowledge of the SLS 3D printing process, and reliance on the competency of the 3D printing service to produce prints of consistent quality (workmanship of certainty), I am risking the success of the printed object. Once printed, the workmanship of risk comes into play once more when I choose and apply colour and other finishes to the final object. Again, at this point the success of the object is at risk; therefore, it is the application of my skill that comes into play.

The nexus between the hand, the body and the machine brings to the fore the work of US academic and philosopher Donna Haraway and her seminal Cyborg Manifesto (1991), which examines our relationships with technology. Haraway (1991) sees the interface between human and technology as permeable and asks, “Why should our bodies end at the skin?” (p. 178). For Haraway, a machine can serve as “prosthetic devices, intimate components, friendly selves” (ibid.). As we increasingly employ technology to improve our body functions with conventional prosthetics or portable technologies to assist in communication, navigation, or monitoring our fitness and diet, it could be said that the computer and software have become my “friendly self.”
Tools and Affect

As previously noted, two types of digital technology were integral to the creation of the work for this project: the first was CAD and the second was 3D printing. In addition to these, a digital camera and 2D design software programs (Adobe Illustrator, and Photoshop, Adobe Systems Software Ireland Ltd) were employed in the research and preparation stages for making the jewellery and artefacts. The maker’s (my) knowledge and intent, mental and physical skills combined with the computer and its programs and the 3D printer to produce artefacts. My experience was similar to that of a digital native: I learned jewellery hand skills and digital skills at the same time, and my body absorbed the iterative movements required to work with both the digital and pre-digital technologies.

My experience in working with digital tools also went hand in hand with acquiring knowledge of, and experience working with, traditional jeweller’s tools. My gold and silversmithing education took place at a time when digital tools had an established place in architecture and design but not so much in contemporary jewellery. Early significant users of the technology include Israeli industrial designer Ron Arad with his bangle Not Made By Hand, Made in China (2002, Figure 7, p. 26) and ever-influential Dutch jeweller Gijs Bakker’s Porsche bangle (2002, Figure 8, p.27) but the practice was not widespread.

Figure 7, Ron Arad, 2002, Not Made By Hand, Made in China, polyamide. Approximately 90 x 90 x 60, photo: chp...? jewelry
Just as skills in the use of tools are a vocabulary to be drawn upon and used to realise a particular idea, so was my familiarity with the digital manufacturing tools and CAD. In time and with constant use, skills became innate and unconscious. Left mouse button, or right, press ‘enter’ or click the mouse button. Hand–eye coordination is no longer a conscious activity as tools become a part of the maker’s physicality. This is the tacit knowledge that Peter Dormer describes, but it is also the tool as prosthesis, as Donna Haraway envisages. The mouse in my hand becomes a part of me as I move the object in the screen as easily as if it is in my hand in the same way with a hammer or a pencil. I know my material so well that even although I will not be able to touch and handle the finished object for a week or more, I know what it will feel like, how big it will be and what it might sound like.

Any discussion of the tool, technology and material cannot ignore German philosopher Martin Heidegger’s (1977) analysis of the tool. Australian artist and theorist Barbara Bolt explicitly describes her relationship with her own art making through the lens of Heidegger. By attributing co-responsibility for her artworks with paints, brushes and canvas, Bolt (2013a) eschews the notion of having mastery over her materials and tools. Bolt evokes Heidegger’s example of the hammer in *Being and Time*, where he describes “readiness-to-hand” as “the peculiarity of what is proximally to hand is that, in its readiness-to-hand, it must, as it were, withdraw ... that with which we concern ourselves primarily is the work ...” (Heidegger 1962, p 69 in Bolt 2013b).
In this example, Heidegger explained the way that we come to understand the world, the objects, the tools, relationships, ideas, and so forth through our involvement with it, our use of, or engagement with people, objects, spaces and ideas. By spending time with, using and working with these entities, we come to understand their complexities. This is a trial-and-error process in which the experience of doing, mistake making and succeeding is a cumulative and iterative process of skill development (Bolt, 2013a).

UK academic Alan Dix offers an interpretation of Heidegger’s text from a carpenter’s perspective. Dix argues that the carpenter’s knowledge of the hammer, developed over ten years of use of the tool, positions the hammer to be in a state of readiness-to-hand. He argues that ready-to-hand is a state in which the tool or technology is assumed by its user and its presence is not the primary focus of the use, rather, the work being done with the tool central is to the task. Contrasted with Heidegger’s concept of “present-at-hand” (Dix 2010, p. 3), where the tool is present in the mind of the user, occupies the thoughts or is in the view of the user. However, rather than the work at hand being in the thoughts of the user, Dix argues that the present-at-hand state comes from a breakdown between the user and the tool. That is, that the hammer becomes present-at-hand when one bends a nail or bangs a thumb or is not the right-shaped hammer for the job at hand and creates an unwanted impression in a sheet of metal. I argue that these ‘states’ of using a tool are not either-or, they can co-exist. A user may at one moment be using a tool in a state of readiness-to-hand and the next in present-at-hand.

Heidegger’s (1977) description of the hammer as a tool that has agency in the creation of an object brings to mind one’s knowledge of using a hammer. For instance, there are many types of hammers and while some have a myriad of uses, others have very specific roles. The carpenter’s hammer drives nails. It is shaped to drive nails and this shape does not successfully drive rivets. To drive a rivet, a riveting hammer is required; it is shaped and weighted for the job it is intended to do. In applications such as raising a bowl or forging an ingot into a sheet of metal, the shape, weight and size of the hammer is crucial. The metalsmith must determine what shape is required and shape the hammer to do the job. To do this one must be aware of the work at hand, forging an ingot, the tool and the shape, weight and size of the hammer.

In the context of my use of CAD in making artefacts, there were numerous situations in which I used this tool in a state of ready-at-hand or, as Dormer (1997) describes, with tacit knowledge coming to
the fore. The problem of choosing the appropriate tool or sequence of actions to make a form required me to think through, test and perhaps even research ways in which I might undertake the project at hand. In other situations in which I was trying to achieve an outcome not previously realised, this thinking and testing and problem solving tool use/outcome is perhaps a manifestation of Heidegger’s present-at-hand. For instance, the tool (CAD) is at the fore of my thinking. In approaching a new work using new forms and types of connections, my concerns were with the work sequences, methods and tools that would achieve my desired outcome. While undertaking the task I also engaged my tacit skill or ready-at-hand tools, that is, the fundamentals of the software, cut, copy, paste, move, rotate etc. At the same time I needed to learn and experiment with new methods, new work flows and new (to me) Rhino tools. It was in this process of experimenting and learning that I employed the two modes of ready at hand and present at hand in the making of a new object.

Upon reflection, I realise that these concepts of ready-at-hand and present-at-hand were operationalised as I made a key component of GridSounds (2016), a work to which I return in Chapter Four. Together with collaborator sound artist, Jon Osborne, I devised GridSounds as an installation at Craft Victoria (August 2015); we sought to articulate the human relationships with the city grid. The grid landscape was presented through this piece as a playful environment. The grid and its sounds were explored by offering the audience a visual, interactive and aural experience. It was based on a grid street plan and included a soundscape that responded to audience engagement. My role was to construct the tactile, physical elements of the installation and Jon’s was to create the soundscape. In developing the project, we decided that the tactile interactive element was to be shaped like a human heart. Initially I visualised the object by sketching it out on paper. I then used Rhino 3D to draw the 3D model and to work out how to make the object work. For this I needed to resolve how the electronics would be housed. How big and how fragile were the electronic components, and should we use Bluetooth or cables? Would the speaker be inside or external to the object? All these design factors had to be decided early in the development of the piece, because they determined the scale of the object and the size and shape of the cavity that was to contain the electronic components.

It took me several weeks of drawing to get the form right to meet the design constraints, and to make the object a printable artefact. There were things I did not know how to do. For instance, I had to make a lid that was secure and removable, and so I chose a screw thread. I drew over 45 versions of the heart object in Rhino before the piece was structurally printable and resolved enough to even contemplate printing it. When it was ready, I had it printed, effectively as a prototype of a working
model or a first physical iteration. The heart object had some functional design problems (some sections were not robust enough for six weeks of being handled by audiences, the ports for the electronics wiring were too small) but importantly it showed me a way forward to improve its functionality and that it would survive the exhibition.

Drawing on Heidegger’s notion of present-at-hand, the object became known to me through my interaction with Jon Osborne, Rhino technology and the resulting final heart object. This three-way collaboration was the means by which I came to know Rhino and the complete heart object. At this moment I came to understand Rhino, not as tool separate from me but as part of the becoming of the object. I only came to know the object through and Rhino and Rhino through creating the object.

**CAD and 3D printing as transformative of existing practices**

Computer-aided design and 3D printing are described by business technology academic Barry Berman (USA) and craft critic Stacy Jo Scott (USA), as disruptive industries or as destabilising (Berman 2012; Scott 2010), suggesting that 3D printing will affect the structure of the manufacturing, engineering, medical design industries substantially. Rapid prototyping for product visualisation is one of the key benefits ascribed to 3D printing, as it reduces the time required to build initial models and subsequent iterations, allowing designers to test a product or component for form, fit and functionality. Authors such as Berman (2012) and Scott (2010) highlight the possibility of 3D printing offering consumers the possibility of ordering prints online and the ability to create cost-effective short or single production runs. This just-in-time manufacturing strategy eliminates the need for keeping inventory in stock, reducing costs such as moulds, specialty tooling, warehousing, storage and the associated labour costs. Berman (2012) has also cited the economic benefits of businesses being able to manage working capital because items are paid for prior to manufacturing.

Ten years after the production of the first commercial 3D printing machine in 1987 by the US company 3D Systems, manufacturing industry analyst Anna Kochan (USA) reported the growth of the market for rapid prototyping machines. At the time she was writing there were only 2,243 machines in operation worldwide (Kochan 1997). While the article identifies the industries that have adopted the technology (automotive, aerospace, consumer product design) Kochan did not describe the types of uses to which these machines were being put, and her use of the term ‘rapid prototyping’ signalled the assumption that the technology was targeted toward modelling and prototyping uses rather than direct manufacturing.
It was only six years later that US academic Harry Hutchinson (2003) described an artistic outcome from the direct production of 3D printed artwork. Hutchinson (2003) discussed US academic and sculptor Dan Collins’s *TeleSculpture* (1999–2007) project, which sought to “transmit solid objects anywhere on the planet” (p. 80) through receiving emailed STL files from artists around the world. Collins then 3D printed these sculptures during an exhibition at the San Francisco science museum, *The Exploratorium*, in 2002. This use of the capacity to transfer 3D model files over the internet to be printed in another location was, for its time (1999), an innovative use of digital technology that tested the relationship between the digital and the physical form of a sculpture and the role of the artist in forming an object.

Although 3D printing is often associated with the production of multiples, it is also lauded for its capacity for single or small-run manufacturing such as individualised prosthetics or artificial limbs for the medical industry or crowns in the dental industry and small items in the jewellery manufacturing industry (Berman 2012). Jewellery designer and academic Uros Hohkraut (Slovenia) also cites the benefits offered to designers through outsourcing their manufacturing through 3D printing. This line of reasoning emphasises the way in 3D printing can facilitate a collaborative or team-based design approach by providing a visual model for discussion by all those involved in the development of a product or project (Hohkraut 2010). The democratisation of design is widely claimed as another benefit CAD and 3D printing offers. Through the increasing availability of online design software, it is argued that the simplified process allows less experienced users to create a piece of jewellery or a small object.

Misconceptions about the simplicity and potential ubiquity of 3D printing exist, with claims in the popular media that every household will eventually have a 3D printer. Recent marketing and news reports have served to build this myth that “all one needs to do is simply hit a button, and out pops a perfectly fabricated work of art” (Artist Chris Bathgate, cited in Hanus 2015). Jewellery writer Stephen Knott draws our attention to this point, and argues that “3D printing is not easy” (2013), as does *The New York Times* columnist A. J. Jacobs (2013): “3D printing is surprisingly hard — a fact its advocates don’t dwell upon. So much can go wrong: The nozzle clogs, the machine overheats, the print pad tilts, it’s also mind-numbingly slow” (para. 14). While Jacobs (2013) focuses on the technology, and implies that the machine is less than straightforward to use, there remains the difficulty of being able to create a file that captures what you have imagined. Craft and jewellery theorist Stephen Knott argues that there is a lot of hype about 3D printing and at the moment it is
seen as an end in itself (Knott 2013). In 2013 3D printing received widespread media promotion and notoriety when Cody Wilson (USA), a gun rights activist, 3D printed an operational hand gun and made the plans available freely on the internet. The Victoria and Albert Museum (V&A) acquired and displayed Wilson’s gun, increasing the visibility of both the weapon and of 3D printing. Knott (2013) is critical of the V&A’s decision, claiming that the true story of a gun is not revealed in its display in the V&A. The complexity and limitations of its design and fabrication were not explained, nor was the potential for violence as a result of the production of this gun.

The uses of CAD and 3D printing in the jewellery manufacturing industry

Developments and use of CAD and 3D printing in the jewellery manufacturing industry have focused on the ways in which the technology can substitute for existing labour-intensive or wasteful processes. Now an established section of the market, 3D printers that print wax or resin models for lost wax casting manufacture of rings and other small components are a standard tool in many jewellery design and production facilities. There are CAD programs specifically designed for jewellery manufacturing, providing the designer with a graphic user interface and the capacity to render designs for presentation to clients for approval prior to fabrication (Stamati & Fudos 2004). These programs have been developed further so as to meet the specific needs of the jewellery industry, including reduction in material wastage, elimination of labour contribution and resolution of technical design issues.

Design engineers developed variable-height slicing software for 3D printing to minimise material wastage in the post-print finishing process (Young, Yu & Kwong 2001). As discussed in the introduction to this chapter, slicing software translates data from a 3D modelling file to a set of instructions for the 3D printer as to where and when to deposit material during printing. The focus here is on refining the mechanical and software properties of the technology, with the goal of efficiency and cost reduction in the manufacturing process. Indian design and manufacturing engineers Vishal Gulati and Puneet Tandon have developed a jewellery manufacturing system based on voxels\(^3\), a design program they claim “eliminates the formal designer and provides the design tool in the hands of the user” (Gulati & Tandon 2007, p. 138). Their system creates a repeatable and more efficient manufacturing process for a wide variety of jewellery designs. Greek computer scientists Vasiliki Stamati and Ioannis Fudos (2004) identified issues associated with designing for 3D printers

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\(^3\) a voxel is 3 dimensional version of a pixel.
and focused their research on developing a CAD program that overcomes technical issues associated with designing jewellery containing pierced elements (cut-outs or voids) in their structure.

Singaporean industrial engineers L. Yap and W. Y. Yeong (2014) provide a summary of various additive manufacturing technologies for creating jewellery and fashion, including SLS, SLA, and FDM. Yap and Yeong also give a general overview of ways in which CAD is being developed to create generative parametric designs, and offer some examples of these developments. They identify that the primary motivation for 3D printing lies in reduced labour costs associated with the design and manufacturing of jewellery. While some writers mention aesthetics, the artistic or creative impulse is predominantly absent from their discussions (Stamati & Fudos 2004; Wannarumon and Bohez, 2013; Yap & Yeong 2014).

Moving to a more conceptual use, Thai industrial engineers and academics Somlak Wannarumon and Erick Bohez’s (2010) Jewellery Artform Generator is a software program that offers the jewellery designer a computational tool to design jewellery and then output to a 3D wax printer. The software involves an algorithm based on the concept of genetic code and fractals (as seen in living organisms) that self-generates designs based on user input. Lying part-way between experiment and art, Wannarumon’s Artform Generator leads us on to a closer examination of the use of CAD and 3D printing technologies by artist themselves.

**CAD and 3D printing in art practice (including ‘hacking the tech’)**

Artists have often been early adopters of emerging technologies. Of course, methods we now call traditional techniques were once emerging technologies; weaving, printing and photography are examples. So too are the solder torch, the handsaw, and polishing compounds; all were once new technologies in the making of jewellery. CAD and 3D printing are a part of this continuum, an argument that is developed elsewhere in this dissertation. Several artists have found creative and transformative applications for these technologies. Sculptor Chris Bathgate (USA), in an interview with Julie Hanus for the American Crafts Council (Hanus 2015), explains that an artist’s need for tools to achieve creative outcomes drives problem-solving-based innovation capacity and also fosters critical assessment of reasons to use digital technology.

A further aspect of 3D printing as art is the role that artists play in the expanding potential uses of CAD and AM technologies. As mentioned earlier in this chapter, Dan Collins, an early proponent of digital media, explored the use of email as a means of producing sculptures at sites remote from the
creator (cited in Hutchinson 2003). In Collins’ project, artists were invited to send .stl files from around the world for 3D printing. Collins’ TeleSculpture project (1999–2007) resulted in a series of exhibitions at a number of University Galleries across the US, of these 3D-printed sculptures and supporting seminars. Interestingly, US academic and robotic engineer Hod Lipson, in his article 'Design in the age of 3-D printing' (2012), argues that the potential of CAD and 3D printing is limited, not by the imagination of its users, but by the available design software and hardware. Lipson argues this problem is a legacy of the design of CAD software itself. Lipson calls for the development of new design tools that support artists and designers to creatively exploit the possibilities of 3D printing. These might focus on ‘natural’ user interfaces such as gestures, sketching and speech, arguing that this will attract more casual users. Posing the challenge to software developers to design 3D modelling software with new artificial intelligence, he suggests that design options are based on user input. Lipson proposes software that allows the user to select a variety of shapes or forms from the software menu, which are then assembled; the process is iterative so the user then selects her preferred options and from these the software suggests further iterations. The final preferred form is assembled by a ‘matter compiler’ that takes into consideration the intended use, context, material and design of the object and designs and prints the optimal form. Lipson goes on to describe similar innovations, such as apps offered by Shapeways and other online 3D print services that give the user parameters with which to personalise designs for consumer and domestic objects (such as an iPhone case, lamp or vase). Describing this process as the “gamefication of CAD” he cites the online game Minecraft as the world’s most used design tool (ibid., p. 4).

It is unsurprising that some artists are ‘hacking the tech’ – achieving their artistic intent through employing creative and problem-solving processes that extend or modify the technology. One such artist, Markus Kayser (UK), built a solar-powered sintering apparatus Solar-Sinter (2011) that focuses sunlight to fuse sand to build vessels (Labaco 2013). Chad Curtis’ (USA) artistic practice involves more than using 3D printers; he has modified the circuitry and hardware of desktop FDM 3D printers to create his ceramics (Brown 2010). This process of building the tool allows him to “explore a dynamic of technology and creativity” (ibid., p. 2).

Michael Eden (UK) is a ceramicist whose interests encompass the actual and the virtual, expressed in the form of the ceramic container. Eden maintains the use of CAD and CAM is in the making process, claiming that CAD gives him flexibility to explore form as “it is very easy to develop numerous iterations of an idea” (cited in Julis 2014 p. 27). Eden uses Rhino 3D as his modelling software. In his

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4 .stl is a common file format used in 3D printing.
first attempts he drew the form in Rhino then threw it in the wheel. When happy with the form (in
the ‘real’ world) he would then go back to the drawing in Rhino to make a full-scale model using CNC
milling. He would then apply the traditional techniques of slip casting and mould making. He
comments: “there has to be a reason for using them (digital technologies), a desire to explore, an
idea to communicate or a problem to solve” (ibid., p. 28).

Eden’s first totally digitally manufactured piece refers to the prediction that digital technologies will
lead the second industrial revolution. He does this by paying homage to Josiah Wedgwood, who was
at the forefront of innovations in mass production of ceramics during the Industrial Revolution. Eden
stated: “I decided to redesign an iconic object from the first industrial revolution” (ibid.). Eden’s
Wedgewouldn’t Tureen (2008) (Figure 9, p. 36) is a generic tureen form referenced from the 1817
Wedgewood catalogue (ibid.). The design features a pierced surface, referencing the microscopic
structures of bone “referring to the natural objects used by Wedgewood [...] as the inspiration of
many of their designs” (ibid.). Wedgewouldn’t Tureen was printed on a Z Corp 3D printer with its
gypsum/plaster material infused with a binder, then coated with a non-fired ceramic material.

Eden’s projects continue to reference traditional and iconic ceramics. À Rebours (2009) is based on a
1766 Séveres porcelain jar. Eden is acutely aware of the relationship of the digital world to his works.
Voxel Vessel (2013) refers to the emerging technology known as voxel printing. Mnemosyne (2011)
features a 3D version of a QR code which, when scanned, refers the viewer to a website containing
stories. Eden maintains that while the digital world offers much to his creative process, it must be
underpinned by working with the hand and understanding material qualities. Eden’s 2013
experiments with using a 3D printer to extrude clay bodies demonstrate his commitment to achieving
a greater understanding of how materials can be adapted to be used with digital technology.
Out of Hand: Materializing the Post Digital was exhibited at the Museum of Art and Design in New York during 2013–14. Curated by Ronald Labaco, it examined a range of applications of digital technologies applied by artists working in multiple fields. While the title of the exhibition perhaps refers to removing the artist’s hand from the making process, it could be ironically construed as digital technology being dismissed ‘out of hand’, or how ‘out of artists’ hands’ come art objects. However the meaning of ‘out of hand’ is intended, as the title of the exhibition, to foreground the role of the artist’s hand in the process of art making.
Impacts on craft, the handmade and the creative process

Much of the literature associated with digital technologies cites the ‘digital maker movement’ as the most significant outcome of the use of these technologies. The maker movement is distinguished by several features, most notably a DIY philosophy that encompasses open-source software and hardware modifications and a culture of sharing and adapting designs (Courtland 2013). The association between DIY/maker and artistic outcomes is often identified. The design of objects, whether functional or otherwise, may be creative, although it is not necessarily artistic, and a critique has been made of the amount of extraneous plastic objects that 3D printers are employed to fabricate (Arieff 2014). This ‘problem-with-3D-printing’ argument is akin to suggesting that everyone who owns a pen and paper is an author, or similarly, arguing that accessibility of cameras makes everyone who can point and shoot a photographer. This elitist argument falls short because, while some use the technologies (pencil, camera, 3D printer) for art making, others enjoy a pencil or camera to record and communicate their interests, or create and construct using 3D printers for the satisfaction of using the process.

British academics Peter Walters and Paul Thirkell (2007) summarise the theoretical debates associated with the use of digital technologies in art and design practice and identify several themes of criticism. The first theme of criticism comes from writers including Paul Virilio (2000), Jean Baudrillard (1996) and Malcolm McCullough (1996), who argue that digital design technologies have the potential to alter our relationship with the material world. For instance, Virilio argues that digital technologies have the effect of compressing time and distance and also blur the boundaries between physical and virtual worlds leading to a progressive digitisation of human sensory experience, (cited in Walters & Thirkell 2007, pp. 236–237)

Although 3D printing reduces the time required to fabricate an object, the process of conceiving and creating the 3D model in preparation for printing continues to require focused attention and duration. Developing a concept through sketching, 3D modelling, prototyping, testing, reflecting and reiterating is both a temporal and sensory process. While not all the stages of the process are tactile, from my practice, as I described earlier, it is clear that the artist’s hands come into play through manipulation of the digital objects in digital space. For example, revolving a digital object in digital space to view a different angle, changing scale or shape all require input via the computer mouse, tablet and keyboard. These are interface tools that must be manipulated by human interaction in order to realise an idea. The employment of tools in the making process implies intent. It is the
artist’s intent, combined with material and tool, that results in the creation of an art object. It matters little if the object is digital and the tool is computer based, the resulting artwork is the product of intent. 3D printing allows an artist to envision and fabricate digital objects by converting the digital object into a tactile 3D form independent of the computer.

US academic Malcolm McCullough wrote “there is the natural objection: What good are computers, except perhaps for mundane documentation, if you can’t even touch your work?” (cited in Walters & Thirkell 2007, p. 236). Both McCullough, and Walters and Thirkell, discuss emerging haptic feedback systems as means for makers to have direct tactile experience of an object as they are making it. However, these systems have yet to take their place on the shelves of either craft or computer stores. Perhaps a more useful argument is put by McCulloch (writing in the context of the late 1990’s) in Abstracting Craft: The Practiced Digital Hand, where he considers the role of the digital design as not just a set of tools but a medium for creating. Two decades on, I argue that McCulloch’s concept has been consolidated by the increasing accessibility and employment of digital fabrication and manufacturing, including CNC and 3D printing technologies. Further, as ‘media’, digital devices offer a unique set of tools and materials that can be used to create objects not possible in any other media. Each type of 3D printing technology has its own ‘fingerprint’ (evidence of the tool), and it is possible to identify the 3D printing process used by the unique features and materiality of the object.

Further Walters and Thirkell argue that Heidegger, in his essay The Question Concerning Technology (1977), finds that the essence of technology is not in the machine itself but in the human use and interaction with the physical object of the machine (Walters & Thirkell 2010, p. 237). Here Walters and Thirkell suggest that Heidegger could be read as predicting the downfall of human creativity, while simultaneously offering hope that humans might grasp the essence of the tech/tool as a part of the poiesis (the process of creation), an unfolding or revealing (ibid.). Walters and Thirkell suggest that Heidegger claims artists have a particular role to play in this revealing (ibid.); that is, in the course of creating artwork, the artist draws out meaning from the material in concert with the tool. It follows then that as 3D printing technologies mature and the range of materials and types of printers increase, so too does the potential for artists to engage with and expand the potential of these technologies. Once such example, as discussed earlier, is Michael Eden’s explorations of the traditional ceramic forms of Josiah Wedgewood (Figure 9, p. 36).

Artist and academic Stacy Jo Scott (2010) proposes a Marxist reading of the impact of digital technologies by recalling “the utopian project of craft-idealist, William Morris” (p. 1). Scott draws
parallels between the Industrial Revolution and the so called “next industrial revolution,” as digital manufacturing has been labelled, including by Bre Pettis, one of the founders of Makerbot\(^5\), and Adrian Bowyer, founder of the RepRap project\(^6\) (Scott 2010, unpaginated). Steven Knott (2013) also invokes William Morris by associating current popular media interest in 3D printing with the Arts and Crafts Movement of the late 19\(^{th}\) century. By arguing that the Arts and Crafts movement criticized technology, Knott refers to the quantity of articles naming 3D printing as the new industrial revolution (Knott 2013, para. 2). He cautions that the 3D printing industry has proclaimed “an overly optimistic assessment” of its capacities (ibid., para. 3). Referring to artists Michael Eden (UK), and Nervous System (Jessica Rosenkranz and Jesse Louis-Rosenberg, USA) who employ a parametric design process to develop 3D-printed jewellery and clothing, Knott asserts that these artists are playing into the rhetoric of the futurologists by relying on the fact that 3D printing is big news, with their techno aesthetic of predictable cell-like, honeycomb, crystalline, and mathematically derived forms. In my view Knott’s criticism falls short in his interpretation of these artists’ interest in 3D printing. For example, Michael Eden’s research into the intersection between 3D printing and ceramics has contributed significantly to new ways of thinking about the nature of ceramics and the role of the ceramicist. Nervous System is an amalgam of researcher, mathematician and software designer that employs generative design and digital fabrication techniques. They describe their relationship to these technologies as follows: “Rather than thinking of them as mere tools, we consider them our medium. These systems are digital materials with inherent properties and behaviors” (Nervous System, n.d. unpaginated).

In 2009, in a practice-based testing of the relationship between art and technology, sculptor Anish Kapoor (UK) and artist Adam Lowe (UK) created a machine that would generate form. After a period of research and development they created a three-axis machine that could extrude various concrete mixes. The resultant objects display none of the sharp, crisp geometry observed by Knott; instead Kapoor and Lowe’s sculptures were abject, visceral, gut-like, vermicular structures. In a Heideggerian reading of his own work, Kapoor observes “These event-things (have) a physical presence that is bodily (shit, intestines, flesh) and the feeling of object that might have been made by an animal” (Kapoor, cited in Lowe et al. 2009, p. 39). Lowe et al. describe the machine they created for the project as a key “performer in the act” (2009, p. 47) of making the sculptures. By attributing the resulting artworks to the other actors – the programmers, the technicians and operators, along with

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5 Makerbot is a USA-based desktop 3D printer manufacturing company and operator of Thingiverse, an online file sharing and 3D printer community. See https://www.makerbot.com/
6 The RepRap project is a open-source inexpensive 3D printer; the plans, parts list, software and instructions are available at http://reprap.org/
the machine itself – Kapoor and Lowe ensure all the players, including the technology, are seen as contributors to the final work.

If (as I argue) in the creative object making process the machine and maker are one, then what does this mean for the status of the art object, so often caught up with the status of the artist as a singular creative source? This question inspired Walter Benjamin and *The Work of Art In the Age of Mechanical Reproduction* (1936), which addresses the impact of technology on art and culture. In Benjamin’s view the handmade object has an ‘aura’ that is derived not only from the object itself but also what is known about the object, who made it and how it relates to the tradition in which it was created (1936, part 3). For Benjamin, objects produced or reproduced mechanically do not have this aura and as such are alienated from their cultural history. From the perspective of the value of the handmade craft object, a Benjaminian viewing would ascribe an aura to it, because its place in the traditions of craft and the maker is discernible. However, Benjamin (1936) argues that new technologies could give rise to new forms of art. He proposes that technologies such as photography and film represent aspects of the original because the camera reconfigures the relationship between the viewer and the original; importantly, they serve to make the idea of the “authentic” redundant (Benjamin 1936, part 4). In other words, new technologies raise new questions about the role of the artist, material and tools. Consequently, I believe it is not so useful to discuss a 3D print in terms of its authenticity. Instead, as Benjamin argued, it more useful to ascribe cultural value and meaning from its form, material and context.

It is this combination of factors that informed my research. In the following chapters I set out the series of experiments that I undertook – experiments that utilise a relatively new technology to engage with form, material and context. This chapter has positioned my work as part of a trajectory of contemporary jewellery, through its concern with non-precious materials and an emphasis on the role of the tool in the process of making.
2 The Grid on Topography

The starting points for my investigation of city grids were the cities of Melbourne (Australia) and Manhattan (USA). I studied early maps, notes and secondary historical sources that described how the landscape appeared before these grids were established and the land parcels were divided and sold. Interestingly, Melbourne and Manhattan have many common moments in their development. Both locales were inhabited by indigenous peoples who were subsequently disenfranchised, and both housed European settlers in the period between European arrival and the land being surveyed and subdivided. Both of these cities also have rectangular orthogonal grids and are important trading and shipping sites that service large tracts of hinterland resplendent with rich natural resources. Although their scale is different (Melbourne’s original grid was one mile (1.6 km) long and Manhattan’s was thirteen miles (21 km) on its longest axis), the two cities share many features as former colonial settlements. Hence, both cities’ street plans have their roots in the militaristic models of town planning, which offered characteristics attractive to authorities: a pragmatic rationale for the ease of surveying and dividing up blocks of land for sale. The blocks are ordered, have a speed of layout that are easily navigable, and are adapted to their site. Urban historian Lewis Mumford (1989) claims that economic expediency made the grid plan so readily adopted in new settlements:

The beauty of this new mechanical pattern, from a commercial standpoint should be plain. This plan offers the engineer none of those special problems that irregular parcels and curved boundary lines present. An office boy could figure out the number of square feet involved in a street opening or in a sale of land: even a lawyer’s clerk could write a description of the necessary deed of sale, merely by filling in with the proper dimensions in a standard document. With a T-square and a triangle a municipal engineer could… ‘plan’ a metropolis (p. 422).

Despite the grid plan offering the benefits mentioned earlier, Mumford argues that it is inefficient and a waste of municipal money. This is because cities that were developed with the grid street plan did not prioritise street hierarchies, nor designate main traffic roads and residential access roads. Therefore the one size-fits-all uniform street width was unlikely to be suitable. Similarly Mumford argues that by ignoring the topography on which the grid is laid the urban planner creates excessive maintenance costs and ugly streetscapes (ibid.). This was true in the case of San Francisco, where the
grid street plan scales hills regardless of the incline, thereby increasing the costs associated with building and maintaining roads and suppling reticulated services such as water, gas and electricity.

As a Melburnian, the shape of the orthogonally planned city is deeply ingrained in my sense of cities; it frames my understanding of the built environment. The chant “King William, Queen Elizabeth, Swanston, Russell, Exhibition, Spring” is how, as a child, I learned Melbourne’s city street names, and these names and their underlying structure are a part of my framework for navigating the city I know best. But what of the place before these streets and their European names? The histories of planned city grids such as Melbourne’s street plan provide insight into the political, social and cultural imperatives of the time. These histories are embedded in the streets and roads along with the long-gone surveyors’ pegs and marks. The stories shift and change over time along with the shape and uses of a city.

The pre-grid landscape

The pre-grid landscape is the landscape beneath Melbourne’s Hoddle grid prior to settlement. I sought to imagine what the site looked like prior to European settlement. This chapter tracks the making of a research experiment that focuses on the impact of applying a street grid to a topography through a case study of Melbourne’s Hoddle Grid. Through several studies for the final piece What Robert Hoddle Did (2013) (Figure 16, p. 48 ) I drew on histories of Indigenous use of the landscape on the banks of the Yarra River (early maps refer to the river as Yarra Yarra), early European paintings and accounts of the time.

The Hoddle Grid is one of many grid city plans applied to cities and towns across British colonies. The origins of this grid have been traced to the 17th century Grand Modell, a uniform urban planning schema Britain adopted as part of its colonial enterprise (Home, 1997). An 1828 British inquiry recommended prescribed uniform-sized lots, street widths, and the style of subsequent architecture. As a result, Thomas Mitchell, the Surveyor-General of New South Wales, recommended the generic grid street form be adopted throughout the colony.

The resulting square block plan, with a focus on regularity and uniformity, can be seen in many Australian country towns such as Goulburn, Williamstown and Grafton (Freestone 2010, p. 10). The first surveyor of the site, Robert Russell’s 1837 layout of Melbourne (Figure 10, p. 44) conformed to these regulations. Hoddle’s layout later that year saw the addition of the now iconic ‘Little’ streets that created the familiar rectangular blocks in Melbourne’s central business district, now known as
the Hoddle grid. Robert Hoddle applied the grid pattern to the towns he surveyed on behalf of the Crown, which included Liverpool, Campbelltown, Mudgee and Berrima, and was consistent with the town planning approach taken for Melbourne (Colville 2004, p 182). These grids paid little attention to the conditions of the site on which they were laid except to twist their orientation from the north, so as to lay parallel to a river course. The initial town plans represent expedient manifestations of the colonist’s desire to control and order the untamed landscape.

The establishment of the colony that was to become Melbourne was predicated on colonisation, entrepreneurialism, commerce and trade, in contrast to the military-governed penal colonies of Sydney and Port Arthur. The arrival of settlers on a Van Diemen’s Land investor and pastoralist, John Pascoe Fawkner’s Enterprise in 1835 was not sanctioned under British law, but they remained, attracted by the lucrative prospect of prime pastoral land. Within three days of landing on the banks of the Yarra Yarra River, the company of the Enterprise had begun to clear land for growing crops and had built a storehouse. Within weeks another pastoralist and investor from Van Diemen’s Land, John Batman’s business partner John Wedge led a party to the site of the new settlement (eMelbourne 2008: Foundation and Early History, unpaginated). The unofficial settlement continued to grow and by the end of 1836, the New South Wales government conceded that settlement was inevitable and set in motion the process of surveying and preparing land for sale. Governor Bourke officially named the settlement Melbourne in March 1837 (eMelbourne 2008: Early Settlement, unpaginated). In the space of two short years (1835–1837), Robert Hoddle, the surveyor appointed by Governor Bourke, had surveyed the new city of Melbourne and the first blocks of the grid were sold at public auction.

Robert Russell’s survey of the Melbourne site, undertaken in 1837 (Figure 10, p. 44) and housed in the State Library of Victoria, is the earliest European record of the site. It is a simple survey map indicating the Yarra River, and marks the point at which falls separate salt water from the fresh water at about the place where Princes Bridge now crosses the river. Russell’s map also indicates the density of vegetation, particularly at the eastern end of the site. The hills shown at the western end of the site, now flattened, are significant landscape features. The local Indigenous people had already been excluded from the land; other than place names (Yarra Yarra River), the map contains no evidence of their existence. Instead, Russell has marked and noted the locations of dwellings and other structures erected by the European settlers.
For this research project, I made 3D drawings (Figure 11, p. 44 and Figure 12, p. 45) to visualise the site of Melbourne with its indigenous vegetation and the Yarra River. I took the placement and density of the trees and the location of the street grid from Robert Russell’s plan. I undertook this experiment to create an object that represents the pre-grid landscape and vegetation in order to set a baseline for comparison with the site after European settlement.
Melbourne’s pre-colonial landscape was an undulating grassy valley with trees concentrated on the eastern side of the banks of the Yarra River and surrounded by low hills. Adjacent to a rocky dam that separated the tidal salt water from fresh water, this natural river crossing formed a meeting place and hunting grounds for lands of both the Bunarong and Wurundjeri peoples (May, 2008, unpagedinated). Within the first 18 months of arrival of European settlers, Robert Hoddle who had been appointed senior surveyor to lay out the township of Melbourne was charged with the job of surveying the site and preparing the first land sales (Tipping, 1966).

In my research I sought to represent the effects of the new Hoddle Grid on the inhabitants of the site – both the European settlers, who had constructed buildings, farms and gardens, and the Wurundjeri and Bunarong who inhabited the site prior to the European settler’s arrival. Photographs of early maps, landscape paintings and drawings sourced from the State Library of Victoria’s online digital image collection provided resource material. A painting by early colonial artist R. Hoffman, An early view of Melbourne from the south of the Yarra (after 1836) (Figure 13, p. 46) depicts the northern bank of the Yarra River viewed from the southern bank. In the foreground a lone Indigenous figure looks toward the developments and activity taking place on the site. Hofmann’s painting shows the topography of the site and the location of pre-grid settlers’ buildings, farms and vegetation, and is an early insight into the pre-grid landscape. My image, Forever Altered (Figure 14, p. 46) is a digitally altered interpretation of Hoffman’s painting, with all traces of fencing, gardens and buildings removed. This image reveals the Indigenous figure in the foreground of a treed, gently undulating landscape on a cloudy day, and is how the site may have looked prior to the arrival of Europeans.
Robert Russell’s plan of the Melbourne site (Figure 10, p. 44) indicates the location and orientation of what was to become the Hoddle Grid, as well as the names of early settlers and the location of their dwellings. While Russell’s map depicted these dwellings and other buildings cartographically, I wanted to see the impact of the first European survey of the landscape, how it changed the site, and the impact the resulting grid had on the inhabitants. I made a further digitally altered image to achieve an approximate representation of Hoffman’s painting by overlaying a photograph of Russell’s grid onto Hoffman’s landscape.

Figure 13, An early view of Melbourne from the south of the Yarra, probably reconstructed after 1836. R. Hofmann, after 1838.

Figure 14, Bin Dixon-Ward, 2014, Forever Altered, digitally altered version of An early view of Melbourne (Figure 13)

Figure 15, Bin Dixon-Ward, 2013, Russell’s Landscape, digitally altered image of Robert Russell’s Melbourne Map 1837 (Figure 10) overlaid onto R. Hofmann’s Melbourne 1836 (after 1838).
Figure 15 (p. 46) shows how the grid cuts through the dwellings and farms that had been constructed in the 18 months between the first European landing and the development of the site. It flows over the landscape like a net, separating the captive landscape and its occupants from the surrounds.

Having created these 2D visualisations of the impact of the street grid plan on the site of early Melbourne, I wanted to develop these into 3D objects. My research had presented further questions as to how the landscape responds to the street grid plan and how the grid affects the place on which it is located and those who inhabit the site.

The Incising Grid #1, What Robert Hoddle Did (2013)

The artwork *What Robert Hoddle Did* (2013) (Figure 16, p. 48) resulted from an effort to make an object that represents the transforming nature of the grid when applied to a landscape. As described earlier in this chapter, the application of a grid street plan onto a site creates edges and incisions into the natural environment. In this experiment I investigated topography and the negative space external to the grid as well as the negative space within the grid. Several early plans, maps and drawings of early Melbourne were valuable in this project because these documents depicted features of the landscape, the location of vegetation, the hills and valleys, the Yarra River and its confluence with the Maribyrnong River, and the locations of settler’s dwellings and other adjacent buildings. These landscape features were revealed in Robert Russell’s 1837 map (Figure 10, p. 44), and in particular the elevated land at the western end of the site. These hills, now obscured by buildings, are no longer a strong visual feature of Melbourne’s central business district landscape. *What Robert Hoddle Did*, a small container with brooch/lid and bracelet, represents the contemporary version of the Hoddle Grid that is incised into the original contours of the inner-city site.

In studies for this research I sought methods to represent the pre-grid landscape and then to contrast this with a representation of 21st-century Melbourne. My first study was to form the contour surface representing the pre-grid landscape of Melbourne. For this research, two sources were used, firstly Russell’s Grid (Figure 10, p. 44) and secondly an 1880 map showing Melbourne’s contours (Figure 17, p. 49). I first hand-traced a print of the map (Figure 18, p. 49), then scanned and traced the contours as paths in Adobe Illustrator (Ai), saved this as a .jpg file and then retracted the contour lines in Rhino3D. From there a series of surfaces were formed and subsequently solid forms constructed to create a 3D version of the map. This low-fi, intensive and time-consuming process seemed primitive compared to the hi-tech digital drawing tools in use. Each step in the process required careful
planning, checking and re-working; all flaws and digital glitches were identified and repaired before the next step could be attempted. Failure to do would result in ‘bad’ objects. Such bad objects prevent the 3D printer slicing software from reading the file correctly and cause print failures or prevent printing altogether.

Figure 16, Bin Dixon-Ward, 2013, *What Robert Hoddle Did*, nylon, ink, stainless steel pin, 95 x 95 x 40 mm
Figure 17, Detail, Map of Melbourne & suburbs [cartographic material] / compiled and photo-lithd. at the Melbourne Board of Works under the direction of G.R. McGowan, 1942. (Source State Library of Victoria)

Figure 18, Detail of my tracing of Figure 14
This process revealed the pre-colonial topography of the site on which Melbourne is located. Present day Melbourne is deceptively contoured, even although it has been flattened through the construction of buildings and roadways. For example, Elizabeth Street runs along the lowest point between two small hills that lay around what is now Spring Street to the east and William Street to the west. My work also revealed the steep banks of the Yarra River at the eastern end of the city; these have been disguised by the cutting away of the hillside to form the Jolimont railway yards. Not only has the landscape been flattened to accommodate the infrastructure of the city, it has now been buried under the bitumen, stone and concrete forms that have been built atop the treed marshes and grasslands depicted in Robert Russell’s first survey.

My first experiment into the impact of Hoddle’s grid street plan was to recreate the grid on a contoured surface representing the original landscape. I tested several versions. Firstly, I applied the square grid of Robert Russell’s survey onto the 3D contours of the Melbourne site. This resulted in Detail of Russell’s Grid (2013) (Figure 19, p. 50) Although not quite to scale, the resulting object (Figure 19) shows the grid flowing over the hills and valleys of the topography and the landscape. The topographic contour lines are visible, enhanced by the contours of the 3D printing process. However, the emergence of the contour lines through the square plates of Russell’s grid suggests that while the landscape is pushing up through the grid, its form remains uninhibited by the technology of the grid.

Figure 19, Detail of 3D print of Russell’s grid on the contours of the Melbourne site, 130 x110 65 mm
I then used Rhino’s ‘drape’ command, a different process, to form the contours of the landscape. This command creates a contoured surface by draping a surface over any given Rhino objects. This technique created a less detailed and more pixelated version of the pre-grid landscape (Figure 20).

Figure 20, Bin Dixon-Ward, 2014, test print for Rhino ‘drape’ command on the 3D model of the Melbourne site, nylon, acrylic paint, 80 x 285 x 40 mm

The next experiment was to create a sense of the contemporary city, with the landscape forgotten and hidden below and the skyscraper skyline and street grid above. It is an archaeology of the landscape, revealing the passage of time, in which the landscape has been changed and reconfigured by overlaying the grid. Lifting the lid on this container reveals a low polygon rendering of the pre-grid landscape7. The shape of the rectangular container mirrors the shape of the grid.

An outcome of creating a 3D version of the street grid for Study With Skyline (Figure 21, p. 52) was a form that could either be used as an incision tool or as an addition to the landscape. Figure 23 (p. 52) shows a 3D-printed version of this ‘cookie cutter’ form.

7 Low polygon refers to a process in which the polygons that make up the surfaces of the CAD object are reduced to the point where the smooth curves are replaced with triangular planes. The lower the polygon count, the larger the surface triangles, and the lower the computer memory required.
The next experiment was to create a small round container that would again offer the viewer an experience of discovery when lifting the lid (Figure 24, p. 53). By attaching fittings on the underside, the lid has a dual function as a lid for the container and as a brooch. For the base of the container, I made a cylindrical form with straight sides. Internally, the base features fittings for a brooch pin and representations of the trees found in Robert Russell’s rendering of the landscape. My intention was that the secret history of the grid is held close to the wearer’s chest while the grid faces the world.

A bracelet featuring an incised modern version of the Hoddle Grid (seen in Figure 23, p.52) was an experiment designed to disaggregate the grid into the rectangular shapes between the streets and
then reassemble them in a circle connected by nodes. Once assembled in the CAD drawing, the city grid was then used to deeply incise the Hoddle Grid into the bracelet, thereby adding textural disruptions and accentuating the incising nature of the grid.

![Image](image-url)

**Figure 24, Bin Dixon-Ward, 2013, study for What Robert Hoddle Did, nylon, ink, 80 x 80 x20 mm**

Once printed, both sections were polished to a silky texture and coloured in the grey tones of the bluestone with which Melbourne is now paved. Bringing the two elements together (cuff and container), into the fence-like enclosure around the container, added a new layer of meaning. The combination of these elements – the contour form, the grid, the container and the grey bluestone of Melbourne – means there is no mistaking the item’s place of origin. It has the appearance of a souvenir, a sweet object with a slightly dark flavour. It is modern in its materials and visualisation of the contemporary street grid, yet has the appearance of something that has a history. As a representation of Melbourne, this object functions to reveal a history of the site and its colonising street grid. The contemporary form of the street grid is a cover that hides this history, which is only revealed when the lid is removed.

This example has several technical flaws that make it difficult for the user to manipulate. The lid locking mechanism is too fragile and the posts for the brooch pins are too short. Therefore, another version was necessary.
The final version of the container (Figure 16, p. 48) revisited the contoured surface. In this instance, the grid-incised contours were placed on the lid as well as in the base of the container. The reverse
side of the lid reveals the grid inscribed into a flat surface, alluding to the surveyor’s plan. The form of
the container was slightly softened by curving the walls. In this iteration the lid becomes the brooch
component and the base of the container. This little container is a static form, and while it can be
worn and therefore animated by the wearer, it is essentially an object that sits on a surface waiting
to reveal its internal secrets.

Terra-forming: The Incising Grid #2 What Robert Randall Jr. Did

Manhattan’s iconic gridiron street plan tells a similar story to that of Melbourne. Although it differs in
scale, Manhattan’s grid was laid across the island, through swamps, rocky outcrops, across streams
and even beyond the island’s shoreline (Sanderson 2009). It too, cut through the homelands of its
inhabitants, including both indigenous and colonist farmland.

In 1609 Dutch explorers navigating a route to East Asia made their way across the Atlantic Ocean to
an inlet on the coast of a ‘new world’. The first group of 130 Dutch colonists settled on the island
(now Manhattan) to establish farms, and subsequent settlers spread across surrounding lands. The
Manatus Map 1665–70 (Figure 27, p. 56) depicts the sites of these farms, along with the names of all
the early settlers who had claimed landholdings at this time (Cohen 1997). Prior to colonisation
Manhattan Island was the home of the Lenape people of the Algonquin language group, who knew
the island as Mannahatta (“island of many hills”) (Sanderson 2009, p. 10). The Dutch built homes, a
fort, wharves and other community infrastructure on the southernmost tip of the island in 1694. The
site originally featured swampy coastal wetlands, rocky outcrops, streams, ponds and a topography
that was repeatedly altered and obscured to accommodate the developing city (Sanderson 2009).

Starting with a small village and fortifications, Manhattan Island was gradually covered with a
patchwork of farms and small hamlets. In 1800 the island population consisted of 95,000 people who
lived mostly on the southern tip of the island, with the rest of the land used for farming (Ballon
2012). As demand for more building space, new streets and roads grew, subdivisions were made and
approved on an ad hoc basis by the city’s Common Council. In 1807 the New York State Legislature
deemed this laissez-faire process to be lacking in foresight, and Commissioners were subsequently
appointed to oversee a master plan for the whole island of Manhattan. In turn, the Commissioners
appointed John Randal Jr. as Chief Surveyor who, on their instruction, created a street plan for the
entire island (Ballon 2012). It was Randal who was responsible for what has become an iconic
cityscape, a grid pattern of streets and avenues running at right angles.
More recently, landscape ecologist, Eric Sanderson (USA) led the *Mannahatta Project* (2007) for the Wildlife Conservation Society, seeking to identify the ecological history of Manhattan. In doing so Sanderson drew upon historical maps and accounts of the time of early Dutch settlement. He was able to re-create the pre-European landscape, fauna and flora using computational geographic visualisation techniques (Sanderson 2009). Sanderson’s research generated a simplified elevation diagram and is available online in an education package.\(^8\) I added further details by hand from *The British Headquarters Map* (1782), (Cohen 1977). Repeating the method I used when I created the Melbourne topography detailed in *What Robert Hoddle Did*, I made a 3D model of the island of Manhattan, with the contour data gleaned from several sources. This proved more complex than my rendering of Melbourne’s contours; early maps depicting the landscape features of Manhattan were made before the contour line system had been developed (Sanderson 2009). The solution was to

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8. See the results of Eric Sanderson’s research at https://wellikia.org
turn to those maps that depicted the lumps and bumps of the island and estimate the contours. This was then created as a Rhino file, and a 3D model produced. *Randall Grid Cuff* (2015) (Figure 29) attempts to represent Randal’s Grid as it sits on the original contoured landscape of Mannahatta.

![Mannahatta Contour Map, 1609](image1)

![Randall Grid Cuff](image2)

**Figure 28, Map of Manhattan Island showing elevation contours (Source: Sanderson 2009)**

**Figure 29, Bin Dixon-Ward, 2015, Randall Grid Cuff, ABS plastic, 80 x 80 x 55 mm.**

However, once again these elements remain distinct from each other and the work did not capture the ongoing interaction between the city and its inhabitants. The process and outcome of the experiments resulted in works that seemed overly literal. These objects spoke of the scale model, souvenir or designer object. The very recognisable Hoddle and Manhattan grids, along with the contour forms of the landscape, are more a direct representation of the place rather than a sense of the place and the impact of the grid. This project increased my interest in the protective and enclosing nature of the grid, as suggested by the bracelet component of *What Robert Hoddle Did* incised with the grid. This encircling bracelet functions to form a barricade around the grid site and suggests the city grid functions as an enclosing device used particularly in early European history (city walls), and which impacts upon the users of the grid and excludes unwanted visitors.⁹ At the same

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⁹ In Chapter 4, I further examine this containing and enclosing affect of the city grid.
time, I hoped to be able to create more flexible objects, objects that more organically combined the grid, landscape, incision and human intervention.

‘Flow Along Surface’: Towards the organic grid

On reflection, the previous two projects, *What Robert Hodde Did* and *Randal Grid Cuff*, revealed the grid as a rigid and inflexible device that cuts through the landscape. The resultant objects are not pliant and do not respond to movements of the wearer’s body. As objects to be worn, this consideration is paramount. My next experiments sought a way to represent the grid as an organic form that can flow over a landscape and in turn the human body. In the Rhino interface, a landscape can be represented as a multi-curved surface. Using the ‘flow along curve’ command, multiple objects can be spread over the surface while maintaining their interconnectivity.

![Image of 3 Rings, nylon, ink, each approximately 70 x 40 x 40, photo: Jeremy Dillon](image)

In 2012, as part of my Honours research, I undertook experiments with the interlinked cube as component for making 3D-printed jewellery. These works were explorations of both the use of CAD and 3D-printing technology to make a variation on a cube. The three rings in Figure 30 (p. 58) feature a ring shank with a square framework that has little consideration for shape of the human finger. Tightly packed and distorted cube forms create a grid of a fragile, tumbling digital forest. The interlinked cube framework enables movement and for the shapes to flow over a surface they are
laid upon. The image of the rings (Figure 30, p. 58) shows one of the rings standing on its shank with the links drooping toward the ground. The other two pieces are laid flat on the ground and show the crevices between the elements opening up on the top surface, whereas those on the ground are pinched together. The flowing nature of the interlinked cube in these rings suggests potential for flowing a grid over the topography of a landscape.

I re-considered the device of the interlinked cube framework for this experiment. The cube is a fundamental element of an orthogonal grid. This simple geometric form, when interlinked, can be assembled to enable movement in a way similar to a chain or knitted fabric. I made a sample sheet of interlinked cubes based on the connection strategy previously used in 3 Rings (2012), and tested this on the Melbourne contour form (Figure 31, p. 59). The experiment indicated the principle to be sound in achieving the flowing effect, but the uniform geometry of the sample sheet suggested that more interest and ambiguity could be achieved with further development work.

![Image](image_url)

*Figure 31, Bin Dixon-Ward, 2014, Test sample of interlinked cubes, nylon, ink, 80 x 285 x 40 mm*

My objective for the next experiment was to devise a method whereby the cubes themselves could form the contours. I created an array of interlinked cubes that could act as a mat to be laid over a surface framework. This can be seen in the top right of the image in Figure 32 (p. 60) I then created a
curved surface and implemented the ‘flow along surface’ command; Figure 33 (p. 60) shows how the 3D cube framework changed (part of the grid mat appears in the upper right corner of Figure 32). Further changes in the shape occur when a distortion command is applied.

The interesting aspect of this command is that it transforms the rigid rectangular grid into a flowing curved form, enabling me to capture the mutable nature of the grid that, with people’s interaction, takes on an organic form. For example, as we move about the city grid we cut corners or we look for shortcuts; these small movements change the shape of the grid and our experience of it. On a larger scale the grid is changed by the incursions into the streetscape of outdoor vendors and cafes, or through constructing an arcade or walkway through buildings. These subtle and long-term alterations to the grid soften its rigidity by wearing a radius onto right-angled corners by the paths we take as we move through the city grid. The city street grid has as many shapes as there are people who occupy it; each city inhabitant has their own version of the grid.

Figure 32, Bin Dixon-Ward, 2014, Rhino screen capture showing cubes flowed on a surface
In the process of undertaking the experiments described in this chapter I employed a reflective and generative process whereby historical research and critical examination informed their development. While not necessarily a linear process, this reflexive approach was informed by creative practice; that is, a process of knowledge was generated through the act of making and reviewing and making again in response to observations and reflection.
The first projects, *Forever Altered* (2013), *What Robert Hoddle Did* (2013), and *What Robert Randall Did* (2015), in which the work was made in response to historical research, proved unsatisfactory. The historical research provided a large amount of background material that served to drive, shape and inform the making process. My investigations of historical accounts were attempts to apply a commentary on these historical research findings. However, on reflection, an historical drawing, map or plan provided a set of formal shapes that formed the basis for the works created. While these pieces are able to demonstrate the rigid and incising aspects of the city grid, the resultant works (as mentioned earlier) are not satisfactory artistic artefacts. Instead, they are visualisations of the research data and overly literal artefacts that offer little in terms of a transformative experience for the viewer or wearer. However, my final experiment, *Flow Along Surface*, demonstrates the potential for using Rhino tools (along with the physical topographies and movements of the human body) to enable the grid to flow and move and to have a life of its own.
3 The protective, controlling (enframing) grid

In the previous chapter, the rigid and inflexible grid was identified and examined in relation to the landscape upon which it is applied. The works created during my experiments were evidence of the rigid grid being laid over a surface. These grids, characteristic of the street layouts of colonising societies, exploit the apparent efficiency and democracy of the uniform grid. Through the activities and interaction of its inhabitants, the grid form shifts and changes shape. In my experiments the formal rigidity of the grid was maintained until the grid became flexible through the device of interlinking 3D grids (or cubic frameworks).

In this chapter I examine the affective capacities of the city grid, in particular its containing and protective nature, and the inverse, the city grid’s capacity to exclude and make ‘other’ that which is external to it. The dynamic topography of the human body offers a constantly shifting landscape for my interactive grids. I devised a series of experiments in which my goal was to create a grid-like structure that displayed the flexibility for interaction rather than dominating its wearer. In order to do this, this chapter presents a twofold line of enquiry. The first section explains the relationship between the structure of the interlinked objects created for this research and the materials and technological processes employed to create them. Drawing on Roland Barthes’ essay ‘Plastic’ (1972) and Martin Heidegger’s The Question Concerning Technology (1977), I examined a theoretical underpinning for the choice and method of applying the tools and materials employed in the research project. The second section documents practical experiments that sought to develop methods for constructing flexible grids with CAD and 3D printing tools. The resulting works demonstrate that through the construction method the grid itself becomes a more dense form that begins to fold in on itself. The containers and tightly spaced textile-like forms created suggest armour-like protective or containing structures that sit on the body and offer the wearer a sense of protection. They also act as a container to protect precious secrets.

Material and tool

In this chapter I also examine the 3D printing process, and in doing so argue that the relationship between the material properties and the tools used in assembling those materials into an object are intrinsically linked. Jewellery created by employing the SLS process using a polyamide (nylon) powder has a unique texture, weight, colour capacity and ability to be formed into complex interlinked and encapsulated shapes. The flocked, velvet, wood-like surface texture is enigmatic to the uninitiated. The process of layering material employed by the 3D printer to build up forms is evident, and the result can be identified readily as a 3D-printed object by those in the know. Appearing as fine contour
lines on the surfaces, the objects become an amalgam of interconnected micro-landscapes. Again, topography becomes a feature of the material as it is of the subject and the function of the objects. The micro-landscapes allude to the topography of the body or the landscape on which city grids are laid. This micro-topography is created via the grid of CAD software interacting with the 3D printer to build layer by layer. The CAD drawing directs the robotic print head to melt the microscopic grains of nylon power to one another using the grid coordinates within the printer and the software. This SLS process (Figure 35) allows for a range of specific design characteristics not available in other 3D printing processes. Interlinking, encapsulating and creating complex overhangs are possible using this technology because the process leaves un-sintered powder in situ, which supports the object as it is being printed.

![Image](image_url)

Figure 35, (L) Bin Dixon-Ward, 2016, microscopic grains of nylon on a fingertip (the diagonal lines are finger print whorls).

Figure 36, (R) Bin Dixon-Ward, 2016, contour lines formed by layering in the 3D printing process (the squares are approx. 6-8 mm across).

Selective laser-sintered nylon technology is offered by many 3D printing services. The technology was developed and is manufactured by EOS Pty Ltd in the United States. As noted earlier, in this process the 3D printer forms a plastic material by a laser precisely melting particles of nylon together under instruction from a digital file. The melted nylon then solidifies to form the object to within a hundredth of a millimetre of the specification. This white plastic offers several qualities that suit the application of wearable objects: it is inexpensive, lightweight, strong, non-toxic and can be dyed or painted with a variety of paint types. The ability to colour the material after printing was important to my research, because it meant I could imbue each object with a unique character. Being nylon, the colour absorbency is high, drawing in non-viscous fluids such as dye and ink rapidly. Weight is also a consideration; the lightness of this material allows for great flexibility with scale and wearability. As SLS-produced objects are plastic, there are cultural values that impact on the way in which the work is read. For instance, French philosopher Roland Barthes (1915-1980) explores the meanings of materials and plastic in his collection of short essays, *Mythologies*, (1972) which contains ‘Plastic’ (pp.
Here, Barthes describes plastic as having an ethereal quality with no innate natural form and which allows it to take on any form. He proposed that plastic is a material capable of not only being a mundane object such as a bucket, but a “jewel” (Barthes 1972, p. 97) and so can be viewed as an imitation material: a “disgraced material” (ibid.), lesser than a natural material such as wood, precious metals or stones. But Barthes’ view is that plastic also has a material honesty; it does not try to be something other than what it is. In Barthes’ view, imitation materials such as plastic ‘gemstones’ or ‘ivory’ purport to be something they are not and aim to inexpensively replicate expensive and rare materials, and were often considered pretentious (ibid.).

Barthes believed that plastic, as a synthetic material, elevates us above nature. No longer must we rely on the materials nature provides, as plastic give us the power to shape any form we desire (ibid.). It has an apparent infinite capacity for transformation. Moreover, plastic has its own material allure (serious ecological issues aside); it has a wide range of states depending on the alloy of polymers – smooth, sticky, shiny, fluid, solid, rubbery, stiff, matt (the adjectives are endless). Despite its ubiquitous nature, nylon has a very specific materiality when used in a 3D printer to make a piece of jewellery. The laser sintering process I employed to make my jewellery creates a textured surface. Depending on the shape and size of that surface, the material takes on different characteristics. In its raw state the rough granular texture is evident. It is a bright white, which over time and exposure to light, yellows slightly.

The CAD/3D printing process contributes to my project of re-presenting the grid by providing tools that do not have long histories or the traditions of other craft-based forms. At the same time, these tools respond to interaction in ways that contribute to the design process, as they offer a palette of shapes and options for placement and scale. Similarly, the relationship between the tool and the maker is highlighted as the tool plays a significant role in the design process and in construction of objects. For instance, the function of the virtual grid in Rhino is to provide coordinates for the placement and manipulation of objects. The grid of the SLS 3D printer provides the coordinates for the placement of the laser beam that sinters the nylon powder and the position of the print bed in relation to the laser beam.

As US academic David Waddington notes in his explication of The Question Concerning Technology, Martin Heidegger challenges the conventional understanding of how an object is made with the concept of ‘co-responsibility’, used to describe the relationship between maker and materials and

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10 This was written from the perspective of the 1950s, when the wonders of synthetic plastic were still novel as they became increasingly used in mass manufacturing.
tools. Drawing on the four Aristotelian causes of material, form, the intended end use and the function of the actual object, Heidegger considered these elements as being co-responsible for the object existing: “The four ways of being responsible bring something into appearance. They let it come forth into presencing” (Heidegger 1977, cited in Waddington 2005, p. 568). Hence the artist’s role is one of “bringing forth” and “revealing”, while being indebted to the tools, materials, and form, and is “co-responsible for the object” (ibid., p. 4).

Heidegger argued that we have a different relationship with contemporary technologies. Through his concept of ‘challenging-forth’, Heidegger proposed that modern technologies (in particular, those with machine power) are essentially different to traditional technologies (Waddington 2005, p. 572). Although all technologies are revealing processes, with modern technologies this never concludes, it is never complete, it is a process of unlocking, revealing, stockpiling, in a process that exploits nature (Bolt 2011). Challenging-forth is a thinking paradigm that transforms materials of the natural environment from their essential nature to that of a resource for our use and to be available when we want them. This, as Heidegger explains, is a state of “standing reserve” and being “set-upon” (or ordered and systematised) (ibid., p. 10). Standing reserve, Heidegger argues, places material and objects subordinate to human agency, so that we have control over them (ibid.). It is in this way that the landscape upon which the colonial grid is located is subjugated to the technology of the grid. As such the landscape is challenged-forth and set-upon. To this end, Heidegger argues that to view our relationship with nature as subordinate is a dangerous path. He proffered that when we view nature this way we are enframing, that is, we are ordering, managing, controlling and training nature.

Heidegger suggests that when we understand that we have allowed technology to occupy the central controlling position in creating our world, we will be free to think of ourselves and technology, not as the centre, or as dominant in our relationship with technology, but as a co-contributor (Waddington 2005).

It is useful to think of the digital technologies employed in this research project as co-contributors to an art making process. By understanding their potential to enframe our thinking or to see them as standing reserve, their role can become clear and their contribution acknowledged. The complex interlinked forms developed in my last series of experiments using the flow along surface command, with which I interconnected cubic frameworks to form a flexible fabric-like structure, could not be made in any way other than 3D printing, and more specifically, the SLS process. It is the unique combination of the material, tooling and making process and CAD that allowed these forms to come into being. With this way of thinking about the role of the tool in my making, I felt liberated to acknowledge I was not the sole author, that the forms came into being through a collaboration between me, the digital tools and materials. This made sense to me, as it mirrored my thinking about
the ways in which human/grid interaction shapes the city. I began to see my making process as part of a wider engagement between humans and technology.

The concept of co-creation with materials and tools does, of course, have precedents. As mentioned in the previous chapter, in their project Greyman Cries, Billowing Smoke Beauty Evoked Work (2009) (Figure 37, p 67), Anish Kapoor and Adam Lowe (with Factum-Arte) created a concrete printer that Lowe (2009) called an ‘Identity Engine’ in homage to Charles Babbage’s Difference Engine.12 Lowe ascribes agency to the machine and materials, writing: “the Identity Engine [is] a cunning machine which is not a passive agent but a vital performer in the act (of making)” (ibid., p. 47). The sculptures produced by the Identity Engine begin as data entered into the machine. This data is then transformed into sculptural form by a combination of variables including the consistency of the concrete mix, the programmed path for the machine to follow and the speed of the nozzle depositing the concrete.

Figure 37, Anish Kapoor and Factum-Arte, 2009, Greyman Cries, Billowing Smoke Beauty Evoked Work in progress
(Source: Factum Arte)

12 Charles Babbage UK (1791–1871) invented the first automatic calculator (a precursor to digital computers), which he called the Difference Engine due to the way the machine calculated complex mathematical problems (Charles Babbage Institute, undated).
In contrast to the large scale of Kapoor’s machine-made forms, Australian designer Gilbert Riedelbauch’s *CHS Brooch* (2000) (Figure 38, p. 68) is an early example of 3D printing used in Australian jewellery making (McPherson 2013). Riedelbauch used FDM to print the brooch form in ABS plastic, and then used the resulting 3D print to make a cast in silver. The path of the print nozzle is visible in the textured surface of the brooch. This tool mark was not removed to produce a pristine surface, but rather left as evidence of the role the tool played in the creation of the piece.

![Image of CHS Brooch](image)

**Figure 38, Gilbert Riedelbauch, 2000, CHS Brooch, 925 silver, 11.5 x 66.4 x 52.9 mm**

Having affirmed the process of co-creation and the mark of the digital maker (i.e. machine) on the creation, I return to the relationship of the grid on the landscape and its inhabitants and my project of drawing on the grids of Rhino to somehow capture these relationships in my work. I set out to explore the concept of enframing, using the way in which the colonial grid enframes the landscape and determines the boundaries of cities as my stepping-off point.

The urban grid signals edges and boundaries, inside and outside. The inside is contained, protected, privileged, logical, rational and enlightened. The outside is wild, illogical, irrational and unenlightened. The binaries of inside/outside, logical/illogical, enlightened and primitive position the grid as a symbol of supremacy. Created by humans for our comfort, safety and enhancement, the
rational site of the grid city is essentially one of safety. Collected within the ordered boundaries of the grid city, citizens lead organised lives, governed by the rational logic of an enlightened society.

Returning to Melbourne’s Hoddle Grid, its enframing nature is evident. Clarence Woodhouse’s 1838 landscape (Figure 39, p. 69) shows the early impacts of the new town on the landscape just one year after the first land sales in 1837. The first farms and dwellings are replaced with streets, now familiar to Melbournians: King, William, Queen, Elizabeth, Swanston, Russell, Collins and Bourke Streets, clearly laid out, and the subdivisions of the lots reveal signs of building construction and development. The pre-existing trees are still in place, some in the middle of streets.

![Image of Melbourne in 1838](image)

Figure 39, Clarence Woodhouse, 1888, *Melbourne in 1838, From The Yarra Yarra*, colour lithograph, 16.0 x 32.4 cm

The Melbourne site was the homeland of the Kurnaje-berreing clan, a sub group of the Wurundjeri, whose lands extended up the Maribyrnong River toward Lancefield, where a quarry was the source of stone for axes and other tools. The clan would move around the area with the seasons. In winter, when the river flooded, they would move to higher land. In the warmer months they would travel more widely in search of seasonal food and to visit sacred sites (Howitt 1904, pp 71-76). *Wurundjeri near Collins Street, Melbourne* (1839) (Figure 40, p. 8), by W. Knight, shows a group of four indigenous people looking down on Collins Street populated with houses, gardens and people on horseback, carriages and on foot. In the background ships float on the Yarra River and the distant landscape of South Melbourne is uncleared. The trees in the middle of the streets have been removed. These people are observers from a distance; they are not participating in the urban life of the scene in front of them. They are depicted with their backs to the viewer, so like the viewer they are external to the subject of the picture. Their world is separate from the street life of Collins Street.
This land is no longer available to them. Not only has the grid ordered the site of homes, transport and commerce, the grid has imposed a boundary and the edge has been defined. The grid has become a technology employed as an exclusionary device, marginalising the traditional landowners. In the Heideggerian sense the grid enframes the landscape; it defines and orders and controls the flows and who comes and goes.

![Image](image-url)

*Figure 40, W. Knight, 1839, Wurundjeri near Collins Street, Melbourne, watercolour, 49.2 x 39.3 cm (Source: National Library of Australia).*

Along with Heidegger’s notions of challenging forth, and being set upon, the street grids of colonising societies create defining boundaries. While these edges and borders are permeable, they are also boundaries that control and order. My research experiments into making jewellery and objects sought to uncover ways to capture the enframing nature of the grid in ways that made explicit the acknowledged co-creative process that included the tools of CAD, SLS nylon and the 3D printer. I wanted to test the limits of rigidity and flexibility that this collaboration might produce.

**Cuffs**

Making jewellery that encloses the wrist creates a platform to exploit the interlinked, flexible characteristics of the SLS nylon process, and at the same time create a form that has protecting and enframing qualities. The cuff, bracelet and bangle are traditional jewellery forms of the ancient cultures of Egypt and Greece. What distinguishes them are the ways they can be placed on the wrist and forearm. Bangles are rigid, often circular objects slid entirely over the hand and worn on the wrist or lower arm; they must accommodate the width of the knuckles. A bracelet is a chain or other flexible material, such as textiles or leather, that can be wrapped around the wrist and clasped with a
mechanical closure or tied. A cuff, like a bangle, is generally a solid form that has an opening; this can be slid directly over the wrist or hand. A cuff may also be a wider form of a bracelet or bangle, covering more of the arm. Cuffs have historical connotations of entrapment (manacles, handcuffs, shackles) as well as protection and deflection: a shirt cuff protects the fabric of the sleeve and an armour cuff protects the wrist and forearm by deflecting blows from a sword. As jewellery forms, the cuff, bracelet and bangle offer scope for a medium-scale object that can be conceived in the round and viewed from all directions.

My City Wall Cuffs (2013) (Figure 41, p. 71) was the result of a series of experiments aiming to reveal the porous yet enframing nature of the grid city boundary. Through a process of trial and error, I created arm wear by linking a group of cubic forms into an enclosing form. The early iterations were built from stacked courses of cubes, with each layer offset in two directions (like brickwork), enabling the interlinking of the individual cubic framework structures. Using the cube as the layout shape of the bracelet, the walls were built up individually and then connected on the corners. The resulting cuffs have the appearance of small city walls or small buildings. I made several variations by changing the size of the cubes and the thickness of the individual sections that make up the cubes’ formwork. Structures with a thickness of between 0.7 mm and 0.9 mm, although printable, were too fragile to be worn. Testing with 1 mm and 1.5 mm frameworks resulted in stronger pieces that could withstand light wearing. The length of the framework sections also has an impact on the strength of the individual cubes; the longer the span, the more vulnerable the section. Without the support of the underlying cubes, these longer sections were prone to breaking.

Figure 41, Bin Dixon-Ward, 2013, Experimental versions for City Walls cuff, nylon, ink, fabric dye, ink, each approximately 120 x 120 x 65 mm

The diameter of a standard bangle is in the range of 60–70 mm. However it was difficult to determine how much allowance to make for the amount of play between the interlinked cubes or ‘fabric’, and
allow for this fabric to stretch over the knuckles, the widest part of the hand. Several concept pieces were made; some were too small and others too large, while others succeeded. This process of trial and error was employed until a suitable size range was achieved. After considering the parameters of size, section length, thickness ratio and form, the result was a group of three bangles, in varying sizes, with small cubic links. The effect of these pieces is similar in a way to that of a city wall, cyclone fence or chain mail. The tightly spaced links, the enclosing form and the wall-like appearance give a sense of enclosure, protection and containment.

Three more cuffs (iterations of enframing)

The City Walls series comprises cuffs that slip over the hand to wear on the arm. They require friction and the thickness of the hand to stay on the arm. This slightly awkward way of applying and wearing inspired me to create a bracelet with a catch that could be printed as a part of the object, integrated into the design, and at the same time durable and flexible enough to withstand many openings and closings. In metal jewellery, several types of mechanisms are employed to close a bracelet. After several attempts, a design based on a common clip with a tongue and socket was modified to accommodate the material characteristics of the SLS nylon. A double springy clip in the shape of an M (Figure 43, p 73), that fits into the square opening provided by the cube framework, proved sufficiently robust for the role, while maintaining a coherence with the overall design. The M clip works because there is flexibility and durability in the SLS nylon at these dimensions.
In this next series of three cuffs, the cuffs become bracelets when they are opened and rely on a catch to encircle the arm. Key to the construction of these bracelets were two Rhino commands: ‘flow along curve’ and ‘array on curve’. As discussed in the previous chapter, ‘flow along curve’ takes an object and bends it to the shape of a given curve, whereas ‘array on curve’ places a given number of items along a curve. Figure 44 (p 73) shows the effect of the two tools when applied to a cube form. By using either of these commands, the creation of a bracelet forms becomes an action of enclosing, encircling and connecting.
The terms ‘entrapment’ or ‘encapsulation’ are widely used in the design industry to describe objects that are contained within, interlinked or interconnected within the design in such a way as to permit 3D printing in situ rather than being assembled after printing. This notion of entrapment in relation to cuffs and bracelets brings to mind the connotation of the handcuff or manacle mentioned earlier. With this dark and oppressive overtone in mind, a series of wrist wear was made using light, bright colours as a device to impart a sense of fun and levity when the cuffs are handled. The resulting objects were exhibited in Close to Hand 2 (August 2014), an exhibition of postgraduate research in the discipline of object-based practice, at RMIT’s First Site Gallery. The cuffs were placed on a narrow shelf 1.2 m off the floor. The high viewing position enabled viewers to see the work at close to eye level, intended to encourage close inspection of the work. The three cuffs selected for this exhibition were iterations of the City Walls series. Each offers a variation on the mode of interconnectivity, the shape of the cube elements and the method of applying to the body. They were constructed using the SLS nylon 3D printing process featuring cubic geometry, and are intended to be worn on the arm.

Figure 45, Bin Dixon-Ward, 2014, Three Cuffs, nylon, ink, each approx. 70 x70 x 60 mm, Photo: Jeremy Dillon

Containing Grid 1

As a form of jewellery, the brooch can operate as a statement by the wearer. Whether it be a simple political button, a medal bestowed in recognition of service or a signifier of status, the brooch carries a long history as an expressive device. Former US Secretary of State Madeleine Albright highlighted this function in her book Read my pins: Stories from a diplomat’s jewel box (2009), in which she describes her practice of using brooches to communicate a message to people she met in carrying
out her official duties. Albright often chose her brooch as an amulet to arm herself with extra strength during difficult negotiations, and other times to express solidarity or diplomacy.

In this experiment I sought to develop a brooch that conveyed the protective and containing nature of the city grid. *Containing Brooch 1* (2015) (Figure 47, p. 76), worn close to the body, reveals an impenetrable wall to the outside world. Inside is a void, a dark, calm and quiet private space. The upward-facing opening evokes city walls or a brick enclosure. It could be a courtyard, but the interconnected cubic framework creates walls and a floor that are slightly unstable; these structures bow and topple slightly with the weight of the material and its cantilevered position on the body. The double brooch pin secures the piece firmly to the body. Protruding from the chest, the brooch reaches into the world while maintaining its internalising, private and elusive posture. As the wearer moves, the brooch flops and sways from side to side in a slightly dilapidated manner. Here the grid framework is maintaining its form while at the same time shifting organically in a similar manner to the subtle shifts in city forms as people interact with them.

*Figure 46, Bin Dixon-Ward, 2015, study for Containing Brooch #1*
Figure 47, Bin Dixon-Ward, 2015, *Containing Brooch #1*, nylon, dye, 70 x 90x 60 mm, photo: Jeremy Dillon

**Containing Grid 2**

My development of the theme of the personal protective container resulted in a reconsideration of its jewellery form, from a brooch to something that could be worn like a pocket around the neck (Figure 48, p.77). In doing so the scale could be increased, creating a deeper, darker, more private place. Slung low on the torso, the object is removed from the prominent badge-like position to one that implies a more personal, functional role. Each of the individual cube shapes that make up the front of the piece is extruded on the top face to create a 6–10 mm deep incursion, producing deep shadows that add another tone to the blue-grey-black colour range.
The ‘straps’ are rounded cube frameworks that morph at one end from a circular profile to an extended oval at the point where they connect with the ‘pocket’ (the main body of the necklace). The pocket is slightly distended in a serpentine form to accentuate the curves created when it emerges from the Rhino drawing into the physical world and succumbs to gravity. In the process of this twisting, achieved through Rhino’s deformations tools, the individual cubes deform slightly away from the square. Sitting on its base, *Containing Grid #2* takes the form of a human-like torso, in a contra-posta position further suggesting an organic presence. In this piece the grid is reaching beyond its rigid structure, taking the form of an organic being.

**Grid chain mail**

Up to this point the cubic framework was the form used to interlink individual components. In this experiment I sought to reconfigure the cube while maintaining its capacity for interconnectedness. After some initial sketches (Figure 49, p. 78), I developed a system to achieve this.
Figure 49 (p. 78) shows a four-sided cube with two sides open. By flipping one of these shapes on to its open edge and linking one of the forms on each side, I assembled an 180 mm x 180 mm x 8 mm sheet. I left a minimum of 1 mm clearance between the objects to prevent them fusing together during the SLS printing process. Working with such tight tolerances necessitated modifying the dimensions of some of the components, so not all are the same size. This variation – although unavoidable – created an inconsistency in the field of the finished object, each element finding its own angle, belying its orthogonal origins. In order to create further distortion and to add surface detail, I used Rhino’s transformation tools to slightly dome the top surface; the result was the contour lines seen in Figure 51 (p. 79). Creating surface texture from the printing process by imposing subtle deformations in the drawing process reinforces the role of the tool in the creation of the work. These are tool marks in the same way hammer marks may be left in a raised vessel, brush marks in a painting, or chisel marks in a stone carving.
Once printed, the textile-like nature of the sample became apparent. Dense in appearance due to the planar faces, and heavier due to the increased volume of material used in manufacture, chain mail was brought to mind. The two different-sized planar surface components created a cobblestone-like surface with deep voids and negative space, while allowing the overall work to flex while maintaining the grid form. The new linking strategy opened a new range of possibilities. I could now look to developing way of using these more impenetrable structures.
Framing and Containing Neck Pieces

My new-found strategy for creating interconnected grid structures enabled me to further develop the device of the grid laying over the topography of the body by enclosing and enframing elements. I was interested to test this process with a neckpiece that would enframe the wearer’s head and neck and contain and protect the wearer at the same time. The first experiments (Figure 52, p. 80) seemed inadequate as protection devices. The fluoro colours selected were intended as a warning, similar to that seen in hi-vis safety clothing. However, once coloured they took on a light summer grass and hot pink appearance and seemed too frivolous for the earnest role of protection. After considering again the metal chain mail of the Middle Ages, I realised that a range of greys would convey the armour-like quality I sought more clearly.

![Image of a necklace](image)

Figure 52, Bin Dixon-Ward, 2014, HiViz neckpieces, nylon, ink, 200 x 300 x 10 mm

Through further experimentation I created a sheet of these interlinked cube structures and deleted the central section to create a hole for the wearer’s head to pass through. The neckpiece sits on the wearer’s shoulders, draping forward and back while maintaining its overall geometric form, implying a weighty object. Swiss-born jeweller Otto Kunzli’s *Beauty Gallery* series (1984) (Figure 53, p. 81) proposes picture frames as neckpieces that literally frame the wearer’s head, neck and shoulders. This framing suggests that the frame wearer is a work of art in herself. While Kunzli’s *Susy* (1984)
wears a picture frame she becomes a gallery exhibit, and thereby is transformed from wearer into an object and subject. In the context of protection and containment, this objectifying framing of the wearer places her in a position of vulnerability. She has no agency as an image. While my necklace, *Enframing Grid 1* (2016) (Figure 54, p. 82) conforms to its wearer’s body, the body becomes the primary agent, and it forms the contours and shapes to which the necklace must conform.

*Figure 53, Otto Kunzli, 1984, Susy (from Beauty Gallery series), photograph, cibachrome, 750 x 625 mm*

*Enframing Grid 1* (2016) (Figure 54, p. 82) is an attempt to maximise the planar surfaces while retaining the flexible grid. By adding a surface onto each upright component I was able to cover the linking components, resulting in a tessellated field of cubes that created a grid with ‘cracks’ between each. When laid flat the impact is one of a tiled surface or a pavement, but when worn the piece flows over the surface of the body as with chain mail. I applied tones of grey to reference the protective metal chain mail mentioned earlier and to contribute to the concrete pavement appearance.
Figure 54, Bin Dixon-Ward, 2016, *Enframing Grid 1*, nylon, ink, 310 x 320 x 15 mm

Figure 55, Bin Dixon-Ward, 2016, *Enframing Grid 1*, nylon, ink, 310 x 320 x 15 mm, photo: Jeremy Dillon
Intending to further imply tessellated pavement, I divided each ‘platform’ into four tiles and tilted it on an angle. The field of smaller tiles was coloured with dark greys to suggest rain on the bluestone pavements of Melbourne, and has a rougher texture and more metallic appearance. When worn, the force of gravity over contours of the body creates a weight that sits firmly on the shoulders holding the item in place. This piece forms a collar, a sort of chest and shoulder armour that both contains the wearer and repels danger.
In this chapter I examined the grid as a containing and enframing device. In doing so I explained the nature of the CAD and 3D printing tools used in the fabrication of the jewellery. Drawing on Heidegger’s concept of indebtedness, I identified my relationship with these tools and the associated materials, without which the works could not have been realised. It is the tools of CAD and 3D printing that provide the specific conditions that enabled my interlinked jewellery to be created. By acknowledging that the tools of CAD used in the design of my jewellery have grids within, I drew upon the specific characteristics of these tools in my artmaking process and creative research.

In studying the impact of urban planning for the colonial city of Melbourne, I identified where the grid acted as an exclusionary device to create a barrier between the inhabitants of the grid, the colonisers and the ‘other’ on the outside of the grid, the colonised. Further, my creative research represented the city grid as jewellery to suggest containment, exclusion and protection (characteristics of the colonial street grid).

My research also revealed the enigmatic nature of the 3D printed nylon material. Roland Barthes offers an insight into the nature of plastic through his description of this synthetic material as having no natural form of its own, and it can therefore be anything (Barthes, 1972). The nature of the jewellery and small objects I created during this stage of the research revealed a tactile and interactive element to open possible interactions with both wearer and audience. My interaction with the materials and tools had also deepened. As a result of my awareness of the possibilities of co-creation through understanding the ready-to-hand nature of the digital tools. In the following chapter I report on work that arose out of a further immersion in a city grid – this time the vertical grid of the Shanghai cityscape.
4 Experiencing the City Grid

This chapter is focused on the affective characteristics of 3D-printed objects and jewellery and derives from a field trip to Shanghai I undertook during my research. This gave rise to several experiments in which I developed jewellery and small objects that represent imagined cities and city spaces. I argue that the interlinked and flexible nature of the work creates an object that is interactive as it allows the wearer or handler to change its form. These experiments allowed me to focus on the relationship between the wearer (or handler) and the nature of interactivity with the city grid.

In creating these works I drew on my personal experiences of the megacity of Shanghai, which in 2017 has a population of 24 million people (World Population Review, 2017). My interest was in exploring questions of scale and ways in which the inhabitants of Shanghai interacted with their overwhelming city and its grid. Rather than attempt to capture the physical scale of Shanghai, through jewellery and objects, I instead focused on micro-interactions in the city to explore ways in which human interaction dissolves the rigidity and fixed nature of the grid.

For inhabitants of grid cities, the day-to-day experience of the grid is so deeply embedded that the grid is rendered invisible, providing only the framework to which the functions of the city are attached. It is only when we are offered an alternate point of view and framework to plan and navigate a city, that the significance of the grid structure becomes evident. These views of cities can be attained in several ways: a city model in the foyer of local government offices; a map in an architectural office or city museum; a view from a tall building, an aeroplane window, or virtually through satellite images or Google Earth. The role of the model in city planning is of great interest to urban planner and geographer Michael Batty. His 2007 article ‘Model cities’ explores the meanings that the term ‘model’ can have in relation to imaginings of the city. Batty discusses models as physical representations of the city or symbolic models that simulate the relationship between function and form, and “iconic models,” where the focus is on representing form in two and three dimensions (Batty 2007, p. 125). By pointing out that models are abstractions of the real, Batty’s ideation of models resonated with this research project, in which I sought to devise abstractions of city forms. For instance the elevated view of a city reduces the intense agglomeration of form, texture and space to an abstracted version, thereby revealing the essential shapes that make up the city. The complexity of detail experienced at street level dissolves, bringing the larger forms and shapes of the urban landscape into focus. It is through these locations that the city grid appears.
Positioned somewhere in between the model or ideal city and the reality of the lived experience of the city grid, the experiments discussed in this chapter aim to offer the wearer/viewer the capacity for interaction through jewellery and small objects. These objects have their own agency, similar to the city inhabitant who interacts with the objects and spaces that make up the city environment.

**Bird’s-eye view**

In early 2014 I spent a month in Shanghai teaching Digital Contemporary Jewellery at East China Normal University and undertaking fieldwork. This section examines the notion of the bird’s-eye view through the lens of this massive megacity. Figure 58 (p. 86) shows the view from the observation platform on the 72nd floor of the Shanghai World Financial Centre Building. Located on in the Pudong district across the river from the old town of Shanghai, at the time of visiting, this was Shanghai’s tallest building. From this height, roads carrying apparently HO-scale (ie, model railway scale) vehicles are transformed into lines that delineate blocks of mini-buildings. From this view of Shanghai, people disappear as they merge into the colour and texture of the built environment. The telltale signs of life and movement are too microscopic to see. The flags waving in the breeze, leaves on trees and people walking all blur into unseeable nano-scale.

*Figure 58, Bin Dixon-Ward, 2014, View of Shanghai from the observation deck of the Shanghai World Financial Centre Building*
Figure 59, Bin Dixon-Ward, 2014, Model of Shanghai, Shanghai Urban Planning Museum

Figure 59 (p. 87) is a photograph of a 3D scale model of Shanghai at the Shanghai Urban Planning Museum, Shanghai. In this model the layout of roads and laneways defines the shape of the city and creates an idealised knowledge of place, devoid of day-to-day life as experienced by its inhabitants. There is no sound, no traffic noise, no weather, no breeze or humidity, no odours, no people and no movement, just the constant air-conditioned environment of the museum. From these distant vantage points the city grid becomes an abstraction, its physical essence comes to the fore, and our ‘on the street’ experience dissolves. In its place a collection of interconnected objects emerge. It represents an idea of city, rather than a place we can experience. The city becomes the miniature, a model and representation that gives us the perspective to see Shanghai as a mega-city.

Here the city is reduced to a world of exteriors, with only hints of interiors via windows and other incursions to the façade. From this bird’s-eye view we do not see the whole. We cannot experience the complexity of the interior, and while we may know it from our experience or our memory, it is not what we see from a distance above. What we see are the formal structures that construct the cityscape. The vertical and horizontal, the planes, textures and surfaces that intersect the x, y and z-axes of the 3D city world become a fixed, visual space where movement and activity are suspended.

This viewing of Shanghai enabled me to approach drawing objects in Rhino in a more engaged manner. The digital grid creates a space for the model city grid to emerge. The word ‘model’ has two meanings in this context: an ideal that may not be realised, and a miniature as captured in the model of the city of Shanghai. The CAD program allows us to manipulate simplified objects. Space and object become simulations of the ideal, while at the same offering the potential to be realised into the material world via a fabrication process.
In CAD, there is no ‘gravity’; objects can be constructed without the constraints of materials, conventional fabrication and assembly techniques. Surfaces can behave in impossible ways, folding in and around themselves. Structures can intersect and interact in ways that conventional fabrication materials and process cannot. CAD is a fantasy world, a world like Lewis Carroll’s *Alice in Wonderland* (1865) where the impossible becomes possible, where objects can shrink and grow and where space can be twisted and deformed. Applied onto a grid (which is itself a fabrication), CAD objects are at once ideal and real and are locations where the physical, the symbolic and abstraction intersect.

**Small City Rings**

*My Small City Rings* (2013–15) was an experiment which created a futuristic cityscape through jewellery objects comprised of interlinked grids. Thinking of the idea of the model, I sought to develop a model of a city that affords the viewer an opportunity to imagine and create her own city grid. By manipulating several given components, the viewer and/or wearer can build their own, perhaps playful, symbol of city. This work consists of rings with stands that can be positioned in a variety of layouts. Each ring and stand is individually coloured and can be mixed and matched. The purpose of this project was to create a fun and engaging work based on geometric forms that might be found in a future city – a city where architecture is further released from the bounds of gravity and where citizens can play with the structures they occupy. These rings do not refer to a particular city but rather to the ‘gridness’ of cities themselves. Part wearable and part plaything, *Small City Rings* (Figure 61, p. 89) offers the audience options as to how they engage with the work. Nestled in
stands on a reflective table, the rings can be taken apart to be worn, or repositioned and paired in
different configurations. The choice of garish vibrant pop colours convey an association with the
energy and vibrancy of the contemporary city rather than the intended safety warning of test
neckpieces discussed in the previous chapter. This is not the dystopian future city of film designer Syd
Mead’s *Blade Runner* (1982, directed by Ridley Scott) but rather an optimistic space where we see
human enthusiasm and energy reflected in the forms, colours and the shapes of our city grids such as
that of 21st-century Shanghai.

Although the objects do not literally represent a particular place or history, the grid is strongly
present. As small sculptural objects, the *Small City Rings* are also responsive to a wearer: they
respond to the movement of a human hand. The obvious ring shank instructs the viewer to become a
wear. The ring invites the finger to try it on. Once in place the ring is animated, it flops and jiggles.
The wonky, colourful forms are humorous and playful, and it is these properties of playful
interactivity that I continue to explore in this ongoing project.

*Figure 61, Bin Dixon-Ward, 2014, Small City Rings, SLS, nylon, ink, installation in Grids, curated by Debbie Prior, Craft
Victoria, August 2014, photo: Heather Lighton*

*Small City Rings* represents a shift in my approach to the research. Instead of working with historical
data, I synthesised a formal element found in the visual research material and used it to construct
abstracted structures. In this instance my art making was informed not only by the experience of the
previous experiment in process and knowledge gained in Shanghai, but more closely by knowledge of
the materials and tools employed in the creation of the jewellery. That is, by taking the grid of the
CAD model and applying knowledge of the technical capacity of the tools and material and applying it
to jewellery objects, I was able to further develop their symbolic role. This interpretation and
abstraction of the research, combined with practice-based experience and knowledge, resulted in
objects that convey a sense of the city grid and invite the viewer to engage with and influence the
form of the object.

Mega grids (Vertical Grids, 2014)

The visual environment of Shanghai is overwhelming, with its massive scale, repetitions of apartment
buildings, lights, colours and chaotic traffic. It is a city full of skyscrapers, glittering glass by day and a
vivid landscape of light shows and screen-based animations by night. The cityscape is filled with
vertical architectural wonders. Individual buildings appear to compete with one another for attention
as the tallest and dominant in the landscape. Shanghai Tower (2015, architect Jun Xia) references
modernist glass-walled towers but is twisted on its vertical axis. The famous Oriental Pearl Tower
(1991, architects Jiang Huan Chen, Lin Benlin and Zhang Xiulin) with its two orbs looks like a space
station, while the Jinmao Tower (1999, architects Skidmore, Owings and Merrill, USA) looks like a
hybrid of a pagoda and an ancient Greek temple, and the Shanghai World Financial Centre (2008,
architect Kohn Pederson Fox, USA) is topped with a bottle opener-shaped void (Figure 62).

![Shanghai skyline](image)

*Figure 62, Unattributed, *Shanghai, Pudong*; the three tallest buildings from left to right - Oriental Pearl Tower, Shanghai World Financial Centre, Shanghai Tower (source: Pexels.com)*

Often shrouded in a humid haze of pollution and low cloud, the number and density of these glowing
structures creates a sci-fi atmosphere (Figure 63,p. 91). Shanghai’s street plan is grid-like; it is not
rectilinear with the rigid right angles of the Hoddle Grid or Manhattan’s Randall grid, but is instead a
wonky grid of elevated ring roads entrapping a network of main roads intersected by smaller streets
where the vast forest of mutant towers is located. Close to the banks of the River Po remnants of 19th Century Shanghai remain, and 2-4 storey buildings create voids in the mass of high-rise apartments, hotels and office towers.

Figure 63, View from the Shanghai World Financial Centre, Observation deck, Shanghai, March 2014, photo: Bin Dixon-Ward

This field of uniform, replicated buildings and some wildly unique architectural forms is overwhelming in scale when viewed from above (Figure 63, p. 91). The distant horizon dissolves into a misty cubic landscape of high-rise buildings.

In response to the eccentric building shapes in Shanghai, I made several objects using a cube frame as the consistent base unit. Each is twisted, bent, stretched in different ways, some with voids incised into the walls. Vertical Grids (Figure 64, p. 92) is of handheld scale and is placed on a small contoured plinth. These objects are to be held and played with; the viewer becomes an animator, initiating the shifts in form, reshaping and repositioning the structure. Thus the object encourages one to explore, to experiment and to see what is possible to create with it. Like the rapidly changing form of Shanghai’s Pudong district skyline, these objects reflect the shifting forms of the rapidly changing 21st Century cityscapes.
High-Rise Towers

After developing the Vertical Grid series I sought to transform these desk play objects into wearable pieces, while exploring ways to further animate the interlinked cube form. Observing the vertical nature of cities such as Shanghai, New York and Melbourne, I noted the reflections that appear on glass façades of tall buildings. In particular the way these reflections fragment and distort other buildings. These distortions reposition the linear edges, making the reflected buildings appear to shimmer and shift on the reflective surfaces. Their rigid structure is disrupted, making them appear lighter and more permeable.
Figure 65, Bin Dixon-Ward, 2014, *Melbourne Reflection*, Argus Centre Building, La Trobe Street Melbourne.

Figure 66, Bin Dixon-Ward, 2014, *Shanghai Reflection*, Shanghai World Financial Centre, Pudong.
For *Tower Brooch #1* (Figure 70. p. 96), I sought to test two ideas. First, whether a repeated form positioned as a façade on a cube framework could create textural variation and permeability, as found in the distorted building reflections detailed in Figure 65 (p. 93), Figure 66 (p. 93) and Figure 67 (p. 94). Second, whether the interconnected cube forms could be used to animate a brooch as both a sculptural object and a wearable form. To reference the reflected buildings, I built a framework of 5 x 3 x 17 interlinked cubes to suggest a high-rise tower. I then attached disks oriented at various angles to each of the external cubes to create a façade. These disks were a reference to RMIT Building 100 (Design Hub) (Sean Godsell Architects and Peddle Thorp Architects, 2012). As the swivelling glass disks that comprise Building 100’s façade rotate according to climatic conditions to optimise air flow, the external appearance of the building changes. When closed, the uniform field of circles creates an impenetrable armour-like façade. When open, the stark field of disks is broken by horizontal lines where the light is reflected at a different angle (Figure 68, p. 95). In order to capture this disruption to the regularity of the façade and the shattered reflections noted earlier, I created variation on the surface of my brooch by swivelling rows of the disks.
On the back the brooch has two pins to attach it to the body. Located toward either end of the brooch, the position of the pins allows the wearer to drape and fix the brooch as she chooses. Another feature is the capacity for the brooch to stand on either end as a small tower that changes form depending on how it is placed on a surface. The shifting planes created by the circles and the fall of the interlinked cubes create a sense of shifting and shattered reflections. I coloured the brooch with tonal orange – fun, colourful and bold – to invite the viewer or wearer to play by picking it up and handling it, setting it down in different positions, or passing it from hand to hand.

Figure 68, Bin Dixon-Ward, 2014, sketch of RMIT Building 100
Figure 69, Bin Dixon-Ward, 2014, *Tower Brooch #1*, nylon, ink, 80 x 60 x 230 mm, photo: Andrew Bartram, Screaming Pixel

*Tower Brooch #2*, 2015 (Figure 71, p. 97) was an experiment to see what would happen if the circle was transposed with a permeable façade with more texture. In this iteration of the brooch, I replaced the disks with seven vertical bars on each cube. Repeating the method of orienting each of the façades at a slight angle, I covered the external faces of all the cubes that make up the brooch. Again I located a brooch pin at either end. In an effort to replicate the shattered reflections of buildings in Figure 67 (p. 94) and Figure 65 (p. 93), I coloured the piece black. The dark matt light-absorbing surface of the material resulted in a mysterious object that has many of the physical characteristics of *Tower Brooch #1*. It is tactile, interactive, can be worn in multiple positions and can be played with as a small object. However it does not have the light-hearted playful traits of the orange *Tower Brooch #1*. I return to the role of colour in the following chapter, as it clearly plays a role in the experience of
the viewer of the works – and appears to influence the extent to which they are drawn towards interaction.

![Image](image_url)

Figure 71, Bin Dixon-Ward, 2015, *Tower Brooch #2*, nylon, ink, 80 x 60 x 230 mm, photo: Jeremy Dillon

The previous three projects, *Small City Rings* (2013–2015), *Vertical Grids* (2014) and *Tower Brooches #1 and #2*, were all experiments to animate the objects via their own structures and to invite the wearer or audience to interact with them by playing with the forms. In these instances, the urban grid forms were designed to be placed on the wearer’s body and to be manipulated by the wearer or viewer. As a result these pieces raises questions about the relationship between the city, jewellery and the body.
I drew on my own experience of inhabiting the vastness of Shanghai and sought to reduce it to a level of tactile interaction with a small object or piece of jewellery. At some stage in my experience of the Shanghai city grids, as a result of its horizontal infiniteness and its vertical enormity, I felt as though I had been consumed by the grid. This perception led to the following works that imagine the grid and human body as one. As a result of Shanghai’s infiniteness and its vertical enormity, one feels they have been consumed by the grid, this perception of being absorbed into the grid led to the following works that combine the grid and human body as one.

In this next experiment I examined the relationship between the human body and the city grid in response to sensations of being overwhelmed by the scale of the horizontal and vertical grid in Shanghai. This left me questioning how the body interacts with the intense sensations of being encapsulated within a grid. Inverting the idea of placing the grid on the body as jewellery, I wondered what would happen if the grid were placed in the body. I sought to test the object/human relationship to the grid, and in turn to reimagine the human body as grid. In this series of small objects, the city landscape is articulated as a playful environment where the grid takes on human Manhattan, the resulting object examines the apparent binary between the rigid, controlled logic of the city grid and the organic form of the human body.

Here, Grid Body (2015) (Figure 72, p. 99) project employs the cube as a basic element of the city grid. Its origins are pure logic through the use of the platonic solid of the cube. However, when assembled into human form, external factors take hold. Its rigid boundaries are deformed with movement. Full of contradictions, the Grid Body (Figure 72, p. 100) has its own form and personality, yet is made up of the multiples of the cube form. The body is able to stand unsupported, and yet gravity causes a slumping of the form, with a sometimes catastrophic dilapidation. This semi-decrepit being has post-apocalyptic robot qualities. Is it world-weariness, or the exhaustion of containing and controlling its form that causes the figure to crumble? It is porous, with an underlying structure of individual elements that retain their form, yet it is also an interconnected whole that is floppy and malleable.

Alternatively, the fun and playful doll-like, poseable figure radiates sadness. Marionette-like, it takes on the pose determined by the puppeteer. This poseability suggests the architect, and urban planner, as puppeteer with modernist intentions to create cities with geometric functionality, cleanliness and lightness. However, the reality of time and constant use wearing out parts, reveals deep flaws. A lack of consideration to detail and human scale may alienate the viewer/user. The puppeteer is the planner, creating logical outlines that are re shaped by the land’s contours when laid upon the landscape. Like the city grid, the urban landscape is the natural habitat of these Grid Body creatures.
The Grid Reimagined

The detail, complexity and intensity of interconnected forms, allows the user/viewer to impose a personality onto the figure. The clear reference to the human form, with head, arms and legs, creates an empathetic response in the viewer. As identified in the phenomena of *pareidolia*, we create faces in a collection of shapes. So too, do we create a human form from two arms, two legs, a body and a head. In fact all there is the grid, interlinked, stacked and arranged. We create in our minds the things we want to see. So too with city grids, we shape the hard lines and edges to suit our needs, to yield to the human form and needs. We cut corners, we round off the sharp edges, and we carve out desire lines (eroded paths created by frequent foot traffic). We attribute the city grid with different body like functions: arteries like transport systems carry traffic around depositing and collecting resources; like the nervous system, the postal and telecommunication services carry messages; reticulated water and power provides energy as needed, sewers and garbage trucks carry away waste. The skin protects and contains its contents, provides monitoring and controls flows across the boundaries. City grid boundaries are permeable, and while there are obvious incursions and excursions via roads, railways and footpaths, less visible are the communication networks, radio waves, electricity, plumbing and sewerage that are constantly flowing through the city. *My Grid Body* was designed as and an open network, porous and constantly active.

![Image](https://example.com/image.png)

*Figure 72, Bin Dixon-Ward, 2015, Grid Body, nylon, 300 x 60 x 60 mm*

The genesis of the *Grid Body* was in a series of interactive brooches I made in 2011 (Figure 74, p. 100). The brooches were based on the children’s toy that consists of small coloured wooden blocks connected with an elastic cord (Figure 73, p. 100). The blocks in the toy can be repositioned and new forms created. My brooches were improvised with materials at hand in the studio, namely some square sections of wood that were already painted. The brooches were made very quickly, with little finishing other than the attachment of a rudimentary pin to facilitate attachment to the body. The
element of interactivity and ability for the wearer to play with and create their own forms with the brooch was my primary concern while making these pieces.

Figure 73, Toysmith wooden block fidget puzzle (date unknown)

Another element that contributed to my creation of *Grid Body* was a 3D scan of my body which was taken while visiting *Out Of Hand: Materialising the Digital* (2013-14) exhibition at the Museum of Art and Design, New York, (March 2014). The scanning device (in this case an Xbox Kinect) creates a surface image of the scanned object and represents it as a grid of triangles (Figure 75, p. 101). These triangles are read by the 3D printer slicing software and form the instructions for printing. It is in understanding the role of the grid in the 3D scanning and printing technology that it emerges again as the underlying structure. This time, instead of creating the plan for streets as in my earlier pieces such as *What Robert Hoddle Did* (Figure 16, p. 48), it forms a grid of the body that becomes the foundation of a 3D print.

Figure 74, Bin Dixon-Ward, 2011, interactive block brooch, timber, paint, elastic, stainless steel
Figure 75, Bin Dixon-Ward, 2014, screen shot showing stl mesh triangles generated by a scan of my body

Figure 76, 3D print of my body scan, nylon, 100 x 30 x 30

In the process of drawing *Grid Body*, I relied upon the foundation element of the 3D grid, namely the cube. This form was copied and pasted it 130 times layer by layer, to build the form from the feet up, replicating the layering in the 3D printing process.
Simple in construction, *Grid Body* appeared robot-like on the screen. With the apparent low resolution of a 16-bit computer image, *Grid Body* is feature-free with no eyes, mouth, hands or ears, just a body-like framework awaiting human interaction to give it life and personality. Viewed in this way, the grid provides the potential for the object to arrange itself into a recognisable form via human interaction. This metaphor also works for the city. The grid street plan is the footing, the foundation upon which a city can develop. Its personality emerges with use. The *Grid Body* takes on a complex jumble of intersecting lines with angles and corners jutting, limbs flopping and head bowing. *Grid Body* appears to inhabit the city space – or does the city space inhabit the human? The common perception is that the city grid demands that we conform to its constraint and controls. *Grid Body* proposes that instead, the grid conforms to the human form. We inhabit the space with our human form and the grid then adopts that form. Its edges are rounded, its right angles are shaved to softer lines, and its steps become soft contours.

The grid-based works of British artist, Antony Gormley also inspired *Grid Body* (Figure 72, p. 99). Gormley’s project places human bodies (frequently his own), at the centre of his practice. Gormley’s bodies are formed from a range of materials consisting variously of metal blocks, wire frames, concrete blocks and cast iron body casts and moulded, scanned or rendered in multiple iterations. In *Hold V* (2012) (Figure 78, p. 103), the figure consists of a series of 3D rectangular forms. These are arranged in rigid pose and the framework alludes to human features and posture.
My Grid Body (2015) (Figure 72, p. 99) also attempts to respond to its environment. It occupies space in a responsive and adaptive manner. Grid Body invites touch, to be held and played with. The Grid Body figure responds to its human manipulator with the softness and pliability of a rag doll. The scale of Grid Body invites handling. The materiality and scale of Grid Body invites curious hands to feel the material – its texture, weight, flexibility, nooks and crannies – to pose it, to play.

Upon completion of these experiments, while delighted with the humorous and playful nature of these doll objects, I was unconvinced about the capacity for these figures to contribute further in responding to my research questions. While appearing to embody the maker (i.e., myself), the representative nature of the human form introduced a myriad of new questions beyond the scope of this research project.
GridSounds

Debbie Pryor, the curator at Craft Victoria (Melbourne) invited me to participate in *Electric* (August 2015), an exhibition of four artists whose work is made through digital processes. The curatorial brief was open, and the premise of the exhibition was to show the work of artists who worked with electricity at some stage of their practice. After some consideration, I proposed to create a piece that invited audience interaction with the city grid. After my reflections on my exhibition *Grids* (Craft Victoria, 2014), I was keen to develop the interactive aspects of my objects. The wonder and excitement of audience members who picked up and tried on pieces from that exhibition highlighted to me the relationship between the small object, jewellery and interaction with the human form. These objects could only offer a minimal level of satisfaction while hanging or sitting as static forms in the exhibition. Once movement – of the kind that only wearing or holding can achieve – is possible, another dimension to the work is revealed. This exhibition offered the opportunity to further explore interactivity with my objects.

Interaction with my pieces materialises our interaction with the city grid. As one handles them they change from an inflexible fixed entity to that of a constantly changing organic form. In the gallery setting, where the mores of social behaviour prescribe that artworks are to be looked at and not touched, it was important to create a robust piece that clearly invited the audience to touch and hold the object. As I had very little prior information about the other artworks in the exhibition, I wanted to create a space in the gallery that defined this piece and created a focal point for the main element, which would be a relatively small object. Additionally, I was keen to have the object respond to handling by the audience in more ways than the movement generated when the object is worn or handled. My solution was to collaborate with Jon Osborne, a sound and electronics artist.

*GridSounds* (2015) (Figure 79, p 105) imagines the human relationship with the city grid. For this piece the grid landscape has been articulated as a playful environment where the sounds of the city grid are explored through audience involvement. A pulsing, glowing heart-shaped object, which flashed red and blue to the rhythm of a heartbeat, was placed inside a large wall-mounted framework. The audience were invited to approach and don a set of headphones, then pick up the object. As the viewer handled the work by moving it, shaking it or passing it from hand to hand, the urban soundscape emanating from the headphones changed from loud traffic sounds to people chatting in a café, to gentle sounds of birdsong or running water. The volume levels appeared to respond to the viewers’ movements, but they were in fact varied randomly. These sounds were collected from audio recordings in the field. The project exhibited similar characteristics to the grid
street plan of cities like Melbourne, Barcelona and Manhattan, through its rectilinear framework and examines the apparent binary between the rigid controlled logic of the grid and the temporal form of sound. The work itself has three components. The first is a wall-mounted 3D distorted frame of cubes set on a perspective view of a CAD grid. The other two elements of the piece are the soundtrack (as described earlier) and the central object which is an internally lit, interactive heart-shaped form.

![Image](image_url)

Figure 79, Dixon-Ward and Jon Osborne, 2015, *GridSounds*, installation view, Craft Victoria, August 2015, paper, timber, electronic components, nylon, approximately 400 x 200 x 10 cm, photo: Bin Dixon-Ward

The cube frame for this work references the x, y and z-axis and the faint grid lines found on the Rhino 3D user interface. This background element was intended to evoke the site in which the work was made, along with the tool that was used to make it. In this instance, I referred to the CAD software as a site, that is, the location in which the work was made. I also reference the conditions of that site and the software as a tool in the making process. Using one of CAD’s ‘primitive shapes’, in this case a cube, a 3D grid was constructed based on the grid in the Rhino software and Melbourne’s Hoddle Grid. The field of cubes was then distorted and the majority erased, leaving the framing cubes. Employing modelling aids such as a ‘rectangular array’, where the user specifies the number, location and formation of items, and ‘snap to grid’, in which the program locates objects along the grid of the software, a field of cubes was created. ‘Snap to grid’ allows the user to create a flawless, precisely placed object in the drawing, along the Cartesian coordinates determined by the software. The reference to the software and its tools create a link between the role of the digital and physical worlds, conveying how one is contingent upon the other in the contemporary city environment.
Interestingly, US design academic, Peter Lunenfeld (2000) argues that the command ‘snap to grid’ is a metaphor “for how we manipulate and think through the electronic culture that enfolds us” (Lunenfeld 2000, p. xvii). Lunenfeld also observes, “skew enough grids, one atop the other at odd angles, though, and their angularity begins to slide back into the curvaceous and unruly” (ibid.). It is this characteristic of the grid that I sought to exploit: how the grid can intersect with itself to create a soft organic chaos.

![Image](image.png)

Figure 80, Bin Dixon-Ward and Jon Osborne, 2015, *GridSounds*, installation view, Craft Victoria.

The digital grid is an increasingly important yet invisible component of contemporary cities. It offers not only a means of communication, commerce, data storage and entertainment, but increasingly provides a means for the production of artwork and objects. This is facilitated by online web-based 3D modelling platforms such as *123D Make*, *Tinker CAD* and *123D Catch* (these are designed to be beginner friendly) and further facilitated by 3D printing, CNC and laser cutting service bureaus including *Ponoko*, *Shapeways*, *Sculpteo* and *iMaterialise*. In order to place the *GridSounds* installation in the context of the digital grid, I placed the grid framework against a wallpaper representing the digital grid. The subtle secondary colours of red, green and blue denote the X, Y and Z axis, and grey represents the construction plane of Rhino’s user interface. My intention was that the shadows and light from the framework of distorted cubes would not only add to the works’ presence in the gallery environment, but also attract the viewer/user to interact with the internally lit heart form.
The addition of the sound component transformed the installation from a physical object to a sensory experience that engaged the senses of hearing, touch and vision. Ewan McEoin, Curator, National Gallery of Victoria, described this interaction in his opening address for the exhibition:

The way we hold the heart and pull it away from the grid and listen to the soundtrack, it asks us “what is our technical capacity to create an urban society that can support the emotional needs of people? What is the relationship between this urban society and the nature that takes over?” And then ... this is a big question for us all, “how does the Earth ... in a developed context and also with the rapidly urbanising underdeveloped societies, how do we maintain an emotional connection?” (McEoin 2015)

McEoin’s interpretation of GridSounds as post-industrial commentary revealed a different, though not inconsistent, reading of the work to the one I had envisaged. My motivation was to produce a work that derived from a deep engagement with the city and its human users, and in turn gave viewers/users of the work in the gallery the opportunity to experience this anew. The heart of the work resulted from a long process of experimentation with the materials and technologies of Rhino and 3D printing. It successfully drew people to it, offering a combination of tactility and visual appeal, which was not achieved through colour in this instance, but through the warmth of the internal LED lighting.
GridSounds represents a conclusion to my enquiry into the physical layout of the Melbourne grid. The installation reflects a transformation in my thinking toward larger-scale, venue-specific works. Adding sound to the user experience gave the work a temporal nature. While the narrative is not linear, it requires a commitment of time on the part of the viewer/listener/user. This invites a longer sonic, haptic and visual engagement to what I have asked of audiences in previous exhibitions, and was the first time I had produced a work that fostered a temporal experience. While the design and realisation of the physical and visual appearance of the work clearly drew audiences to it, the durational nature of the experience enabled a deeper experience that gave viewers (if McEoin’s experience was in any way typical), an opportunity to co-create meaning through enriching the multifaceted sensory engagement through sound.

GridSounds creates a relationship between the work and the human body: the work must be handled to be understood. The viewer/listener must step into the frame of the grid to grasp the object and to place the headphones over their ears to engage with the sounds. This creates a moment of intimacy and contemplation in which the viewer/listener becomes connected to the work. The heart object is hand-sized and its macro and micro-textures invite tactile exploration. In contrast, architect Andrea Mina in his article Miniatures, Poiesus and a few facts of Redemption (2004) refers to the scale and
apparent handle-ability of Russian goldsmith Peter Carl Faberge’s *Easter Eggs* (Moscow, 1837), observing “Similar to jewellery they are made to the most intimate of scales, that of the human body” (p. 38). Mina goes on to describe that, in spite of this scale, the *Easter Eggs* are not handle-able because of their fragility; they are only able to be explored with the eye, and brain (Mina, 2004, p. 38). With *GridSounds* this sensorial experience, of the visual, aural and tactile, immerses the viewer in the work, offering a wider awareness of the city grid experience than a purely visual engagement can offer. *GridSounds* furthers how viewers can interact and engage with my work. The addition of an aural element deepens the sensory experience and the invitation (in a gallery setting) to handle the work commands the viewer’s interaction. Identifying the grid in the digital drawing tool offers a further dimension to the role of the pervasive grid in the development of these artworks, and offers an insight into the relationship between the physical city grid and the grid of the digital world.

The experiments undertaken for *Small City Rings* (2013–2015), *Vertical Grids* (2014), *Tower Brooches #1 and #2*, and *GridSounds* (2015) resulted in a body of jewellery, small objects and a gallery installation. These works demonstrate that the relationship between the city inhabitant and the grid is symbolic and mutually affective. That is, the grid enables its inhabitants to shape its form through use and the experience of the grid can in turn shape its users. While the grid essentially maintains its fundamental structure, it is mutable. It is not only our physical interactions with the city that change its form.

My artworks discussed in this chapter invite physical interaction and enable the wearer, viewer and listener to influence the shape and perception of the city grid. These works present a grid that shifts and distorts its form through interaction and use. The introduction of sound in *GridSounds* represented much more than an aural element to my work. It provided the impetus to think beyond the physical grid to the more abstract and less visible grid of the city, namely that of communication technology. This led to a new and final set of enquiries, which is the subject matter of the next chapter.
5 The Grid 2.0

The artworks developed in my research to this point, have emphasised the physicality of the city grid. However, digital technology introduces a different form of grid alongside the hard surfaces of the city grid. By creating an additional means of communication and transportation, digital technologies obscure the grid’s rigid physical forms. In his book *The Media City* (2008), Australian academic Scott McQuire (whose research interest is the social effects of media technologies), argues that contemporary life is lived both in physical spaces and in the digital realm. He describes cities as nodes within the digital media network, where traditional boundaries are eroded to allow ready access into and out of commercial, media and social connections (McQuire, 2008). In this way, the city grid is dematerialising: its shape morphs and changes as the digital environment increasingly becomes the locus of our cultural and social and working lives. The application of digital technologies for entertainment, social connection, communications, and surveillance is at the heart of much of this change in our private domain as well as the spaces where we socialise and work. Digital technologies and urban landscapes have become more finely intermeshed and at the same time have rendered the grid permeable and mutable. Over time, the digital environment creates incursions and excursions in the space of the city.

We might understand McQuire’s concepts by way of the following examples: a streamed web cam from Federation Square takes a viewer in Wodonga (NSW) or Shanghai (China) into the heart of Melbourne; while physically elsewhere, their attention is in Melbourne. This digital incursion also happens in reverse, whereby an event such as the opening ceremony of a Commonwealth Games taking place in Glasgow, Scotland is streamed into the city grid via the large screen at Melbourne’s Federation Square. On a more intimate scale, phone calls, text messages, web-based working (cyber-commuting) all transport people in and out of the city grid.

**Digital Grid**

While in its physical city manifestation the grid shifts through time and use, its basic form remains central to the technologies used to design and create city structures. As one of the oldest design tools, the 2D grid allows a designer to place design elements in a logical (or contrary) placement on the page. Contemporary urban design, architecture, product design, engineering, graphic design and other design-based disciplines utilise the digital tools of CAD, with its embedded grid. The software I use in my practice, Rhino 3D, is one of many software programs available for modelling 3D objects.
These programs offer the user a 3D digital environment with visual and drawing aids including guide lines, rulers and snaps.\textsuperscript{12}

As demonstrated in previous chapters, both CAD and the city use the grid as their fundamental structural unit. The angles, lines and squares of the grid provide the elements that form the layout of cities. Similarly, the CAD user has a pallet of elements, known in the program as ‘primitives’, basic 3D forms such as cubes, cylinders, spheres, cones, tori and pyramids, that form the building blocks for drawing. These primitives are placed in the gridded ‘construction plane’ area of the digital desktop, then are combined, added to, subtracted from or distorted to create an object. The grid provides scale and guides the location of objects while a user is drawing an object.

The digital tools of the urban designer and architect have a relationship to the ways the contemporary city is conceived. In many ways, these tools determine the very possibilities of urban design. As I become more familiar with the scope and use of the digital in my own design, I see the influence of the digital in the built environment. The increasingly common readable digital artefacts in the design of buildings, street furniture and other infrastructure are evidence of the digital tool used for designing the urban environment, and they reveal traces of the tools of the maker. In this chapter, I discuss works created as a result of my exploration of the inherent structure of my primary tool – Rhino software.

Squares

By focusing on the digital grid closest to me, I have sought to deconstruct Rhino in order to understand it better. The digital grid in Rhino is square and divided into smaller squares. By defining the units of measurement and the scale of the object to be drawn, the relative and actual size of these squares can be altered. I work with small objects that will fit into a 3D printer print bed (the one I use is $650 \times 350 \times 550$ mm). My template is set to millimetres, with a construction plane\textsuperscript{13} which measures 200 by 200 mm. By zooming in and out, the size of these squares changes and the drawn objects are scaled relative to the construction plane. Figure 83 (p. 112) shows four views of the Rhino construction plane (with a sphere provided for reference). Each of the light grey squares is one millimetre square and the darker grey lines represent 10 millimetres square. For further reference, Rhino provides the x (red), y (green) and z (blue) axes to show the three dimensions up

\textsuperscript{12} Snaps are digital tools that align drawn objects either with the grid or any given object
\textsuperscript{13} The construction plane in Rhino 3D is the virtual grid provided as a guide for 3D modelling. The plane describes the x, y and z axes of the 3D modelling space and provides the reference points for drawing objects.
and down, side to side and backwards and forwards. By referencing Rhino’s grid squares, I sought to develop a method in which the squares could be interconnected to form a wearable chain.

![Image of Rhino 3D screen shot showing four views of the construction plane.](image)

*Figure 83, Bin Dixon-Ward, 2017, Rhino 3D screen shot showing four views of the construction plane*

As a result, I produced the necklace, *Squares #1* (Figure 86, p. 112) by linking the individual squares in groups of four. This piece foregrounded the graphic nature of the square, while also introducing visual complexity around the links. I created the necklace using the commands offered in the software, copy, move paste and array. *Squares #1* (Figure 86, p. 112) utilised some automating aspects of drawing in Rhino. The result of this process was an entire necklace constructed by interlinking individual elements together. Automating the process ensured even distribution of the group of four elements. By using this method, I was careful to create a piece that was of a large enough diameter to fit over the wearer’s head without a clasp.

Once the piece had been 3D printed and coloured, I was interested in the points of connection between the links. The complex interlinking created a confused mass of geometric elements that further disrupt the interconnections with a more haphazard approach. *My* necklace, *Squares #2* (Figure 87, p. 114) is the result of this intent. By manually placing the elements and adding irregular connections between the pieces, particularly in the centre of the necklace, I was able to create a much more densely packed chaotic effect. I designed this necklace with a clasp to enable the

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14 An array in Rhino is an automated systematic arrangement of objects, this could be along a straight line, curve, in a rectangle or in a circle.
wearer to lengthen or shorten it and also to reduce the space taken up in the print bed, thereby reducing the printing cost. In further developing this strategy to seek more chaos and multiple interlinkings, I redrew the base square unit to be thinner so more pieces could interconnect with each other. In this series of works, both my tools and my cities are digital and the physical cities which inspired my previous experiments have disappeared.

![Image](image1.png)

**Figure 84, Bin Dixon-Ward, 2017, work in progress screenshot for Squares #1, showing the base group of four elements ready to be arrayed**

![Image](image2.png)

**Figure 85, Bin Dixon-Ward, 2017, work in progress screenshot for Squares #1 showing the arrayed links**
Figure 86, Bin Dixon-Ward, 2015, Squares #1, nylon, ink, 260 x 260 x 25 mm, photo: Giulia McGauran

Figure 87, Bin Dixon-Ward, 2015, Squares #2, nylon, ink, 250 x 300 x 25 mm, photo: Giulia McGauran
I was invited to participate in *Out of Hand: Materialising the Digital* at The Museum of Arts and Sciences (MAAS), Sydney. This exhibition was curated by Ron Labaco of the Museum of Art and Design, New York and Michael Connell of the MAAS, and showcased the role of digital design and fabrication in art, science, fashion and architecture. I proposed the *Squares* series (Figure 86, Figure 87 and Figure 88, pp. 114-115) and that the three neckpieces be exhibited together as a way to draw attention to the iterative development process in which each piece is a development in complexity and disarray from the previous piece.
CrossBox (2013-17)

For Crossbox I sought to further explore the visual complexity developed in the Squares series by focusing on other ways to assemble the cube. In the previous Squares neckpieces, I disassembled the grid into squares. However, if I further deconstructed the closed square it would revert to a triangle, a form I was not willing to introduce as it was outside the scope of my research into city grids. The neckpieces in this next experiment, the Crossbox series, constituted an exploration and reconfiguration of the elements of the cube by my reassembling them en masse. The effect of multiple interlinked iterations of this form is a complex jumble of cascading geometry. There is a suggestion of barbed wire fencing, knitted textile, or textured lace. The ambiguity of the SLS nylon, along with the visually complex linked components, serves to create questions as to how the pieces are interconnected, or indeed whether they are connected at all. This Crossbox series of neckpieces seek to transcend the rigid grid of their origin, and reassemble the elements in such a way as to obscure the rational and rigid initial configuration. My project CrossBox 2 (2103) (p. 117) refers directly to its origins. It is a redrawing of the cube by the reconfiguration of its edges through removal and rotation to form a cross (Figure 91). These cross-cube shapes were then copied, repeated and assembled with a desire to capture the complex digital entanglements of the city. Through the process of disassembly and reassembly the pieces maintain a relationship with their origins while bringing a new meaning.
Figure 91, Bin Dixon-Ward, 2014, sketch for CrossBox links

Figure 92, Bin Dixon-Ward, 2013, CrossBox 2, nylon, ink (source: Museum of Arts and Sciences, Sydney)

Cornelia Parker’s sculpture Cold, Dark Matter: An Exploded View (1991) also uses the process of disassembly and reassembly. For this work a garden shed was destroyed (using military explosives) and reassembled as an installation in a gallery. Parker’s installation captures the moment of explosion, a transition, in which the object (a garden shed) is transformed from one state to another.
While we are presented with the actual shed in this moment of transformation, we have no reference to the original form of the shed. We are not offered a view of the shed-shards after the explosion, strewn on the ground at the site of its demolition. We are not invited to see the relationship of the whole shed to its exploded state and site; instead, the shed becomes a snapshot of the transition between object and fragmented material. While Parker’s technique of deconstruction and reassembly is common to CrossBox 2 (Figure 92, p. 117), the intent is somewhat different. CrossBox 2 is an experiment in transforming the rigid grid.

This idea of fragmentation and reassembly brings to mind Belgium artist Wim Delvoye’s Rorschach series (2012), exhibited at Galerie Perrotin (Paris, 2012). Delvoye 3D scanned antique sculptures and remixed them using CAD. In one example, he created a digital copy of Gloria Victis (1874) (Figure 95, p. 119) by French sculptor Marius-Jean-Antonin Mercié (The Met, New York, 2017) and made a 3D remix on CAD, which was then 3D printed and cast in metal (Johnston 2015), (Figure 94, p. 119). By rearranging the sliced and twisted original in CAD, Delvoye transformed Mercié’s original into a new and grotesque form.
Parker and Delvoye have disaggregated and reassembled their subjects (shed and classical sculpture), to ascribe a new context and meaning. Their techniques of disassembly and reconfiguration informed my experimentation as I disassembled the grid into elements and reassembled them so as to capture the seemingly random chaos of the digital grid.

*CrossBox 6* (Figure 96, p. 120) captures this chaos as a contemporary version of the multi-strand necklace, a style that has been in use for centuries. This reconfiguring of a traditional jewellery form reflects the way in which the traditional functions of the city grid are reconfigured through digital networks. The shape of the city transcends its physical forms and is now made up of myriad...
networks, exits and entrances and flows in and out as the city boundaries are dissolving. So too do these neckpieces represent the reconfiguration of the city grid into a more complex network of interlinked elements, as represented by the internet. The original orthogonal cube has made way for a framework that merely suggests the rigid geometry of the cube. However, the complex jumble of angles and connections serves to blur the boundaries, create openings and exits, and destroy any element of enframing imposed by the physical city grid.

Figure 96, Bin Dixon-Ward, 2015, CrossBox 6, nylon, ink, approximately 300 x 100 x 15 mm, photo: Andrew Bartram, Screaming Pixel

It is through this reconfiguration of the cube that I find a relationship between the process of taking apart the familiar tool and cube motif and Heidegger’s concept of ready-at-hand tools. In this instance, the cube as tool became present-at-hand. The cross-cube element and its form and function were important to solve the problem of how to make the links interconnect and the components withstand the 3D printing process. The altered geometry necessitated that the placement and relationship between each part was different to the cube connections previously
made for works such as the *City Walls* cuffs (Figure 42, p. 72). As I resolved issues of connectivity and printability, I had to keep in mind this reconfigured shape and how it could intersect with itself to create chain links. With the cross-cube element being present-at-hand, it provided a glimpse into a new method of assembly. For this piece I created a new form with new shapes, which transformed my representations of the grid. The grid had reconfigured itself through the transformative nature of the digital grid in the context of human interaction with the city. The digital grid serves to break down the city edges and cubes and re-emerge as a network of interconnections and intersections. The overwhelming scale of the digital grid in the context of cities prompted a simplification of this representation. The cross-cube form in *CrossBox* could be further broken down by focusing on the connections between the elements, and still retain the capacity to interconnect and represent the complexity of connections and networks that comprise the contemporary urban grid. This discovery led to my final work, a necklace that erodes and dematerialises the grid.

**Eroding and dematerialising grids**

In seeking to further understand the myriad intersections, connections and networks that comprise the digital grid of the contemporary city, I focused on the cross-cube element developed for the *Crossbox* series (Figure 92, p. 117 and Figure 96, p. 120) described previously. The resulting work is *Intersections* (2017) (Figure 97, p. 122) a necklace comprised of 867 iterations of the cross-cube structure that is interconnected to form a lace-like collar. Each cross-cube is connected to at least two, sometimes three and occasionally four other pieces to create a cloud of intersections. With the characteristic lightweight nature of the SLS nylon formed into fine rods (1–2.5 mm thick), the large collar is placed over the head to lie on the wearer’s shoulders like a shawl or lace collar. By using cross-cube components graduated in size (smallest in the centre ring, largest in the outer ring) along with a grey tonal variation from light in the centre to dark on the outer section, I was able to create a sense of the collar fading toward the centre as it sits on the wearer’s body. Here, Rosalind Krauss’s concept of centrifugal and centripetal grids (Krauss 1979) informed the design. *Intersections*, being both centrifugal and centripetal, spirals inward to the wearer, and at the same time outward to the world. This places the wearer infinitely in connection with others.

A red stripe across one side of the necklace creates a focal point by drawing the viewer’s eye to a starting or finishing point at the centre or the edges. The city grid is unrecognisable in this piece; instead, the piece is a gesture towards the digital grid, the ‘cloud’ and the internet. Spaces inhabiting of the cloud or internet are conceptual and as a physical form rarely seen. For example, while the cloud is in reality banks of computers located in large secure buildings; we envision this infrastructure
as ephemeral and an infinite net or cloud floating in space. In a sense, the actuality or physical nature of the digital city is of little consequence; it is the online social connections, the interactions that connect people, which make up the digital city. The physical forms of the built environment seem almost irrelevant to this city, as do the physical interactions of people with these spaces. The open lace-like network of Intersections with both positive and negative space reflects the openness and porosity of the digital city. It is possible to engage at any time, from any place and space.

![Image of Intersections]

Figure 97, Bin Dixon-Ward, 2017, Intersections, nylon, ink, 500 x 500 x 15 mm, photo: Giulia McGauran

These final neckpieces are more open and the spaces between the links and elements that make up the necklace are more pronounced than in previous works. They invite the viewer to peer deeper into the complexity of the assembled forms. In his introduction to The Open Work (1989) by Italian writer Umberto Eco, David Robey explains that Eco describes contemporary art as ‘open’, that is offering the viewer “a field of possibilities” (Robey, in Eco 1989, pp. ix-xii), and the potential for multiple readings.

Intersections (2017) (Figure 97, p. Figure 97) embodies Eco’s concept of openness. For instance, the object as a lace-like collar is made up of interconnected geometric shapes that reference the
countless connections of the digital city. There will, of course, be many other readings of the piece. The wearer or viewer contributes to the meaning of the piece by bringing her own interpretation and understanding of the object in the context of her experiences and knowledge. In one (of the many) possible readings of *Open Work*, I contend that in the same way as Roland Barthes (1968) declared “the death of the author,” the agency of ascribing the meaning of a text (or work of art) is transferred from the writer (or artist) to the reader (or user/wearer/viewer). Further, Scott McQuire (2015) argues for a link between Eco’s sentiments in *Open Work* and network culture, which he attributes to an “emergent paradigm of distributed authorship” (p. 257). McQuire suggests that distributed authorship is made possible by participatory media; the internet and social media platforms create the environment that allows communities of interest to emerge in new ways unconstrained by geographical location or the physical city grid. In drawing the openness of Eco, Barthes’ placement of meaning in the reader and McQuire’s concept of distributed authorship together, these ideas describe the phenomena of unlimited connection, edges, boundaries and experiences. Both temporal and sensorial, *Intersections* is designed to shift and change as a wearer moves. Each interconnected element moves in relation to its neighbours. They rearrange themselves and create new spaces and new forms with each movement. This metaphor for the digital city demonstrates the incomprehensible possibilities of the digital environment, which all depend upon the perspective and experience of the individuals who inhabit it.
6 Conclusion

At the outset of this practice-led research I sought to understand how the grid of the city could be reimagined to expand people’s experiences of the urban landscape through small wearable objects. My intention was to examine ways CAD and 3D printing can be extended and applied to jewellery and small objects in order to investigate new ways of understanding the urban environment.

Through the course of this practice based research I have interrogated art history, urban planning, architecture, urban history, human geography, philosophy and digital technology. The research took the form of a conversation between practice-based object and jewellery making, fieldwork, literature-based research and consideration of my community of practice. I have sought to explore stages of urban development from colonisation to the digital city, with each stage revealing new insights into the grid and its limits. This process revealed four states of the city grid. I identified the first of these grid states as a rigid orthogonal form that served to control the landscape and its inhabitants. The research revealed a second form of the city grid as a device that protects, contains and enframes its occupants while also excluding outsiders. I identified a third state of the city grid as mutable and fluid, demonstrating that where people interact with the city grid they transform it. The theme of mutability set the scene for the final state of the grid which sees it disassembled and reconstituted through other vectors of movement and intersections in the contemporary city grid, most particularly that of digital interactions.

I have produced a series of works; each has examined the characteristics of the grid as it is manifested in the urban environment. The works have been the means whereby I have sought to test the extent to which the grid based technology of CAD design can accommodate the human interactions with the city, that occur in each of the phases that I have identified. The structure of this dissertation reflects the exploration process and documents the experiments undertaken. The meta-narrative is one of a parallel between the role of the grid in city making and the digital grid’s role in my jewellery making.

The creative outcomes of my research demonstrate the connections between the city and digital grids and the role my jewellery and objects play in theoretical debates regarding art, the hand of the artist and digital technologies; the role of the grid as an elemental structure of urban
development; the potential for art making to be enabled by digital technology; and the limits of the grid as a foundation component in my jewellery and objects.

The use of 3D printing technologies has placed the jewellery created during the course of this research, within a community of practice of makers, artists and designers whose work is at the forefront of innovation in materials and technology. The inclusion of my jewellery in the exhibition, *A Fine Possession: Jewellery and Identity* (Powerhouse Museum, 2014-15) positioned my work as an innovative contemporary jewellery practice and at the end of a continuum from ancient Egyptian stone carvings through to contemporary digital technologies. Jewellery developed in the course of my research was also included in the prestigious *Out of Hand: Materialising the Digital* (2016-17) exhibition at the Museum of Art and Science, Sydney, alongside that of international artists and designers. The exhibition represented a significant acknowledgement of the innovative nature of my practice, in the company of worked described as demonstrating “exciting relationships between art and innovation, materials and techniques” (Lyons, 2016, p. fly cover notes), its interdisciplinary nature evident in the range of scientists, artists and designers that were included in the exhibition.

The jewellery and objects created for this research have connected to a community of practice grounded in philosophical texts examining art and the handmade object. I have argued that my use of technology can be understood as an extension of the Heideggerian approach to the tool. The digital design process has been shown to be both ready to hand and present at hand. I have demonstrated how the technology in my practice has shifted between these two states, at times problem solving with the technology as ready to hand, but also working alongside the technology in a form of co-creation. This formulation of Heidegger’s theoretical work is a novel way of viewing CAD and 3D technologies as deployed in art.

The research outcomes include jewellery including cuffs and neckpieces, objects, exhibitions and installations. These representations of the rigidity of city grid are evident in *What Robert Hoddle Did* (2013) and *What Robert Randall Did* (2015), and the human form as a grid is depicted in *Grid Body* (2015). I developed a process of dismantling and reassembly made possible only by the digital technologies used in the making of my objects. My creative journey through this research has enabled an understanding of the role digital tools and materials play in making jewellery and objects.
The research has revealed further questions for interrogation which include collaborative projects researching and employing grids to address questions of how the forms of city grids in urban design affect city inhabitants. While the research outcomes from this project are representations and interpretations of forms of the city grid, I am intrigued by how virtual reality and hologram technology could examine the experience of the city grid through the perspective of jewellery. By expanding jewellery to the virtual experience, I anticipate new ways of understanding one’s experience of the city. Imagine virtual reality explorations and fly-throughs of *Intersections* (Figure 97, p. 122), or wearing hologram jewellery! As we have seen, the experience of jewellery continues to offer new perspectives on our interaction with the urban environment.
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Maps and Artworks


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*Amsterdam DNA: The story of Amsterdam*, Amsterdam Museum, Amsterdam permanent exhibition, viewed March 2014.

*Anish Kapoor* Museum of Contemporary Art Sydney, Curator Elizabeth Ann MacGregor 20 December 2012 to 01 Apr 2013, viewed February 2013

Cohn, S 2015, *UNcommon Moments*, Anna Schwartz Gallery, Melbourne, 27 August to 3 October 2015, viewed 27 August 2015.


*A History of the Future: Imagining Melbourne*, City Gallery, Curator, Clare Williamson, Melbourne 12 May to 12 August 2016, viewed May 2016


*Radiant Pavilion: Melbourne Contemporary Jewellery and Object trail*. 1 to 6 September 2015, viewed several times.

*Rising Waters: Photographs of (Cyclone) Sandy*, Museum of the City of New York, New York, October 29 2013, to 20 April 2014

Shanghai Urban Planning Exhibition Centre, Shanghai, viewed 15 April 2014.

*Schmuck* 2014., Handwerksmesser für München and Oberbayern, Munich. Viewed
Appendix 1 Bin Dixon-Ward CV

Awards and Prizes
2017  Finalist, Victorian Craft Award
2016  Diana Morgan Post Graduate Prize for Jewellery
2015  Finalist, Victorian Craft Award
2013  Itami Award Museum of Art and Craft, Itami, Japan

Solo Exhibitions
2014  *Grids*, Craft Victoria, Melbourne
2012  *Urbanhabits*. First Site Gallery, RMIT Melbourne (31 July- 14 August)

Group Exhibitions

/kyōō|/k, Kipp Gallery, University of Indiana, Pennsylvania
2015  *Electric*, Craft Victoria, Melbourne

*Victorian Craft Award*, Craft Victoria, Melbourne

*Danger Research in Progress* (Pop-up exhibition) RMIT, Melbourne

2014  *A Fine Possession: Jewellery and Identity*, Powerhouse Museum, Sydney

*The Future is Here*, RMIT Design Hub, Melbourne

*Grids*, Craft Victoria, Melbourne

*Schmuck*, Internationalen Handwerkmesse, Munich.

*Digital Promises*, Artscape Triangle Gallery, Toronto Design Offsite Festival, Toronto

*Close to Hand II*, First Site Gallery RMIT, Melbourne

*Sweet Abundance*, Oneofftwo Gallery Metung.

*Ephiphyte Truss*, Greenwood Street Projects, Collingwood

*New Weave*, Object: Australian Design Centre, Sydney

2013  *Melbourne Now*, National Gallery of Victoria, Melbourne

*[CTRL][P] Objects on Demand*, Object: Australian Design Centre, Sydney

*Au-Delà du précieux..audelà des mers (Beyond Precious)*, (invited) Gallerie 19 Paul Fort, Paris

2013  *Itami Contemporary Jewellery Exhibition*, Museum of Art and Craft, Itami, Japan

*Making it Real* (selected), Open Gallery, OCAD University, Toronto
New Edition (invited), Gallery Funaki, Melbourne

Atlas For the Devil (Curator, Donald Holt), Greenwood Street Project, Melbourne

Public Collections

2013, National Gallery of Victoria, Melbourne,
2013, Museum of Applied Arts and Sciences (Powerhouse Museum), Sydney
2015, Musée Des Arts Décoratifs, Le Louve, Paris
2013 and 2016, The McMillan Collection, RMIT University, Melbourne

Teaching

2014  Guest Lecture and workshop series, Digital design for creative industries. East China Normal University, Shanghai.
2013-17 Lecturer (sessional) - Rapid Prototyping for Jewellery and Small Objects. RMIT, Melbourne

Residencies

2015  Seaworks Maritime Museum, Williamstown
2013  CTRL-P Object: Australian Design Centre, Sydney

Education

2013  PhD (current) RMIT.
2012  Bachelor of Fine Arts (First Class Hons) RMIT.
1995  Graduate Diploma Arts and Entertainment Management, Deakin University
1983  Graduate Diploma Leisure and Recreation, RMIT (Formerly Phillip Institute of Technology)
1981  Bachelor of Arts, La Trobe University.

Talks and lectures

2013  Artist talk [CTRL][P] Objects on Demand, Object: Australian Design Centre, Sydney
       Artist talk, Melbourne Now, Talking Now: Contemporary jewellery in Melbourne, with Blanche Tilden, National Gallery of Victoria, Melbourne
2014  Artist talk, Close to Hand II, First Site Gallery RMIT, Melbourne
       Artist Talk, East China Normal University, Shanghai.
       Artist talk, The Future is Here, RMIT Design Hub, Melbourne
       Artist interview, Grids Craft Victoria, Melbourne https://vimeo.com/104696003
       Artist Talk, Penguin Pool, Arup Consulting, Melbourne

*Jewellery 3 Ways ‘Skill’,* seminar, Northcity 4, Brunswick,

**Media, publications and reviews**


Chi, YF 2014, Between national technology and perceptual practice: the humanism of digital application in contemporary metalsmithing, *Taiwan Crafts*, vol. 53 no. 6, pp. 6-11.

Cohn S & Clemens, J 2014 *The Future is Here*, <https://www.youtube.com/watch?v=bfuZvX2PqYk>


nZeoUM>


Appendix 2, List of abbreviations

acrylonitrile butadiene styrene (ABS)
additive manufacturing (AM)
computer-aided design (CAD)
computer aided manufacturing (CAM)
computer numerical controlled (CNC)
direct metal laser sintering (DMLS)
fused deposition modelling (FDM)
high impact polystyrene (HIPS)
non-uniform rational basis spline (NURBS)
polylactic acid (PLA)
subtractive digital manufacturing (SDM)
stereolithography (SLA)
selective laser sintering (SLS)
three-dimensional (3D)
two-dimensional (2D)
Victoria and Albert Museum (V&A)
Appendix 3, Presentation of the research

The Grid Reimagined

Venue- RMIT University, Site 8 (formerly the School of Art Gallery)
Dates: 24 August – 1 September 2017, Mon-Sat 1-5 pm, opening event Thursday 24th August 5–8pm

This appendix outlines planning for the final presentation of the research project for examination. The presentation will take the form of an exhibition will consolidate previous approaches and contexts for exhibiting the research outcomes undertaken during the course of the research project. The exhibition will take place during Radiant Pavilion (a Melbourne-based festival showcasing international and local jewellery). As a result, the research will be positioned as a part of the jewellery community of practice.

The jewellery and objects created during the research will be presented and arranged to reflect the four states of the grid identified and discussed in this dissertation.

- rigid and incising,
- protecting and containing,
- mutable and changeable, and
- dismantling and reassembly

I plan to create an environment where the works are foregrounded. The provisional selection of works represents key moments in the research.

The layout of the exhibition will take the viewer on a journey through the research and will feature works that represent key themes and findings. The primary element of the installation will be a suite of tables laid in a grid formation upon which the artworks created during the research will be displayed. The table layout will reference the grid of the ceiling of the gallery and the square cube of the gallery space, while also referencing the focus of the research, city and digital grids. The configuration of tables will contain openings to enable the audience to move in and through the grid. By making the tables 900 mm tall, I will invite viewers to peer into the works.

Modelling the exhibition space

To assist in planning for the exhibition I made a model of the gallery space and proposed furniture. This model has enabled me to test configurations of the exhibition and material to be exhibited.
Figure 98, Bin Dixon-Ward, 2017, preliminary examination exhibition design.

Figure 99, Bin Dixon-Ward, 2017, preliminary exhibition floor plan.
### Provisional pieces for exhibition

This table shows the works I provisionally plan to exhibit for examination.

<table>
<thead>
<tr>
<th>Group 1- Rigid and incising</th>
<th>Group 2-Protecting and Containing</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /> Bin Dixon-Ward, 2013, <em>What Robert Hoddle Did</em>, nylon, ink, stainless steel pin, 95 x 95 x 40 mm</td>
<td><img src="image2.png" alt="Image" /> Bin Dixon-Ward, 2013–16, <em>Containing Grid #2</em> (work in progress), nylon, dye, 90 x 70 x 600 mm, photo: Jeremy Dillon</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image" /> Detail of 3D print of Russell’s grid on the contours of the Melbourne site, 130 x110 65 mm</td>
<td><img src="image4.png" alt="Image" /> Bin Dixon-Ward, 2013, <em>City Walls</em>, nylon, ink, each approx. 70 x 90 x 60 mm, photo: Jeremy Dillon</td>
</tr>
<tr>
<td><img src="image5.png" alt="Image" /> Bin Dixon-Ward, 2013, study for <em>What Robert Hoddle Did</em>, nylon, ink, 80 x 80 x20 mm</td>
<td><img src="image6.png" alt="Image" /> Bin Dixon-Ward, 2015, <em>Containing Brooch #1</em>, nylon, dye, 70 x 90x 60 mm, photo: Jeremy Dillon</td>
</tr>
<tr>
<td><img src="image7.png" alt="Image" /> Bin Dixon-Ward, 2016, <em>Enframing Grid 1</em>, nylon, ink, 310 x 320 x 15 mm, photo: Jeremy Dillon</td>
<td></td>
</tr>
<tr>
<td>Group 3 - Mutable and Changeable</td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td></td>
</tr>
<tr>
<td><img src="image1.png" alt="Image" /></td>
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<tr>
<td><img src="image2.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td><img src="image4.png" alt="Image" /></td>
<td></td>
</tr>
</tbody>
</table>

- Bin Dixon-Ward, 2013, *Small City Rings*, nylon, ink, each approx. 40 x 40 x 70 mm, photo: Jeremy Dillon
- Bin Dixon-Ward, 2014, *Tower Brooch #1*, nylon, ink, 80 x 60 x 230 mm, photo: Andrew Bartram, Screaming Pixel
- Bin Dixon-Ward, 2015, *Tower Brooch #2*, nylon, ink, 80 x 60 x 230 mm, photo: Jeremy Dillon
- Bin Dixon-Ward, *Grid Sounds* (heart), 2015, nylon, 230 x 120 x 120.

<table>
<thead>
<tr>
<th>Group 4 - Dissolving and disintegrating</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5.png" alt="Image" /></td>
</tr>
<tr>
<td><img src="image6.png" alt="Image" /></td>
</tr>
<tr>
<td><img src="image7.png" alt="Image" /></td>
</tr>
</tbody>
</table>

- Bin Dixon-Ward, 2016, *Squares #1, Squares #2, and Squares #3*
- Bin Dixon-Ward, 2015, *CrossBox 6*, nylon, ink, approx. 300 x 100 x 15 mm, photo: Andrew Bartram, Screaming Pixel
- Bin Dixon-Ward, 2017, *Intersections*, nylon, ink, 500 x 500 x 15 mm, photo: Giulia McGauran
Appendix 4, Exhibitions

Melbourne Now, National Gallery of Victoria

Meet the Artists  Bin Dixon-Ward

Gallery Funaki invites you to

NEW EDITION

A curated exhibition that explores the idea of the multiple, featuring classic and new works from 20 jewellery artists

23 April - 18 May, 2013

Please join us for the opening on
Monday 22nd April from 6 to 8pm

Gallery opening hours:
10am – 4pm Tuesday to Thursday,
10am – 6pm Friday,
11am – 4pm Saturday.

4 CROSSLEY STREET MELBOURNE VICTORIA AUSTRALIA 3000
TELEPHONE +61 (0)3 9662 9446  WWW.GALLERYFUNAKI.COM.AU

NEW EDITION

A curated exhibition that explores the idea of the multiple, featuring classic and new works from 20 jewellery artists

Gijs Bakker (The Netherlands)
Renee Bevan (New Zealand)
David Bielander (Switzerland)
Susan Cohn (Australia)
Paul Derrez (The Netherlands)
Bin Dixon-Ward (Australia)
Maureen Faye-Chauhan (Australia)
Therese Hilbert (Switzerland)
Svenja John (Germany)
Jiro Kamata (Japan)
Benjamin Lignel (France)
Neil Linssen (The Netherlands)
Sue Lorraine (Australia)
Marc Monzó (Spain)
Thaïs-Truc Nguyen (Germany)
Ribbonsia (Japan)
Lucy Samuel (The Netherlands)
Linusje Skala (Australia)
Blanche Tilden (Australia)
Manon van Kouwijk (The Netherlands)
Au-Delà du précieux..audelà des mers (Beyond Precious)
Gallery 19PaulForte
Paris
24 September – 20 October 2013
Epipyte Truss,
Greenwood Street Project Gallery,
Melbourne
February- March 2014
The Future is Here
RMIT Design Hub, Melbourne
28 August 2014 to 11 October 2014
A touring show from London’s Design Museum co-curated by RMIT Design Hub
Melbourne Curators Fleur Watson, Kate Rhodes
The Future Is Here - Susan Cohn + Justin Clemens

Toby Reed
Fashion Forward Festival,
Hong Kong December 2014, (with Gaffa Gallery)
CTRL P- Objects on demand
Object: Australian Design Centre
Surry Hills, NSW.
15 October 2013- 25 January 2014

The Grid Reimagined
**Close to Hand II**
First Site Gallery  
RMIT University  
7-16 August 2014

This exhibition explores the role of the hand in object making for 12 postgraduate jewelry and object-based artists. It seeks to investigate the vastly differing modes in which we employ our hands, whether through the forging of metal or the 'click and drag' of the mouse. Together these artifacts reveal the complexity and diversity in the role of the hand in new object-based practice.

**Opening**  
6 Aug, 5:30 pm

**Dates**  
7 Aug – 16 Aug

**Artist talk**  
16 Aug, 1:00 pm

**FIRST SITE GALLERY**  
Storey Hall Basement, 344 Swanston St, Melbourne

**Opening hours:** Tuesday to Friday, 11am–5pm  
rmit.ed.au/link - facebook.com/RMIFirstSiteGallery

Installation View
Itami Contemporary Jewellery Exhibition

Museum of Art and Craft, Itami, Japan

16 November - 23 December 2013
Azimuth
Post Graduate Group Show
RMIT School of Art Gallery
12-21 November, 2014

BIN DIXON-WARD
Grid Container, 2014.
Container/Object: SLS nylon, ink. 120 x 120 x 100mm.
Photography: Andrey Walkling.

In my work, the grid becomes a formal property that at the same time can be infinitely permeable and malleable. The street grid pattern is the planning foundation of many modern cities across the world, but when people begin to interact, they cut corners, they build structures that do not conform, and infrastructure intersects at irregular angles. The grid begins to break down, to crumble and erode.

"I have also thought of a model city from which I deduce all others", Marco answered. "It is a city made of exceptions, exclusions, incongruities, contradictions."
(Italo Calvino, Invisible Cities, 1974, p.64.)
**Grids**, Craft Victoria
Solo show 1-31 August, 2014.

**GRIDS**

Bin Dixon-Ward’s exhibition is a playful exploration of the grid as it appears in the urban form. 

Grids are everywhere, in the layout of our cities and towns, in land dresses for agriculture and housing, floor plans and building standards. The urban grid has welded translations. As a fundamental unit of our efforts to manage and control our environment, we use the grid to subdivide space to navigate our way and to mark and control our boundaries.

The grid maintains a structure that is both self-sustaining and flexible. These foundations remain intact even when the surface is altered and mixed through use.
Electric,
Craft Victoria, 22 August - 3 October 2015

Craft Victoria Gallery
ELECTRIC

Through a combination of artists, materials and ways of making, Electric explores the collaboration of the handmade with digital technology. Crafted objects across metals, plastics, ceramics and textiles engage the body in participatory gallery experiences with installations referencing interaction, wearability and function.

ARTISTS
Altered (Ben Landsau and Lucie Scialane), Mark Edyvean, Douglas McManus and Bin Dixon-Ward with Jon Osborne.

SHOWING
22 August - 3 October
At Craft Victoria, 31 Flinders Lane Melbourne
New Weave
Object: Australian Design Centre
Surry Hills, NSW
6- February- 9 March 2014
A Fine Possession: Jewellery & Identity
24 September 2014-20 September 2015
Powerhouse Museum, Sydney
Curator: Eva Czernis-Ryl
Schmuck
2014
12 – 18 March 2014
Internationalen Handwerksmesse, Munich.

Dear Sir,

Following to our letter with the jury information I send you herewith the pieces that Janun selected for Schmuck 2014. With kind regards,

Eva

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Fax +49 89 5139 245
eva.sennwald@hvk-muenchen.de
www.hvk-muenchen.de

 +++ Kosteneins Einsendung und Verkauf im Innenverkehr unter www.hvk-muenchen.de/inneverkehr +++
Making it Real

Open Gallery, The Ontario College of Art and Design University (OCAD) University, Toronto
14-28 May, 2013
University of Waterloo in Cambridge ON. The exhibition ran from
21 October - 4 November 2013
http://makingitreal.ca/
Curators Jesse Jackson and Greg Simms
Making It Real is a juried exhibition of digitally fabricated objects co-curated by Jesse Jackson at Clare Trevor School of the Arts UC Irvine and Greg Sims at OCAD University. Virtual objects submitted electronically from around the world are “made real” locally using a variety of 3-D printing technologies. See a selection of Making It Real’s collection at the McFarland Architecture Library at the University of Waterloo in Cambridge ON, October 23-November 4, 2013 and as part of Digital Promises at Artscapes’s Triangle Gallery in Toronto, January 20-26, 2014.

Making It Real showcases innovative works by artists and designers ranging from jewellery, industrial design, fine art, and other small objects that take maximum
Digital Promises
http://www.digitalpromises.org/

Artscape Triangle Gallery
38 Abell St. Toronto, Ontario
20-26 January, 2014
Curator Ian Devenney;
Appendix 5- Documentation of Examination Exhibition

Floorsheet

The following pages were provided to Examiners at the exhibition.
Bin Dixon-Ward

The Grid Reimagined

24 August - 3 September 2017
Site 8 Gallery
RMIT, Melbourne

Exhibition Images
Examiners copy
List of works
1. p. 3, What Robert Hadcul Did, 2013, nylon, ink, stainless steel
2. p. 4, What Robert Hadcul Did (2), 2013, nylon, ink
3. p. 5, Russell's Grid, 2013, nylon, dye, 993 silver, stainless steel
4. p. 6, City Walls, 2013, nylon, ink
5. p. 7, Containing Brooch #1, 2015, nylon, dye
6. p. 8, Enframing Grid 2, 2016, nylon, ink
7. p. 9-10, Enframing Grid 1, 2016, nylon, ink
8. p. 11, Small City Rings, 2014, nylon, ink
9. p. 12, City Cuffs, 2014, nylon, ink
10. p. 13, Tower Brooch #2, 2015, nylon, ink
11. p. 14, Tower Brooch #1, 2015, nylon, ink
12. p. 15, Intersections #1, 2016, nylon, ink
13. p. 16, Containing Grid #2, 2014-15, nylon, dye
14. p. 17, Squares #3, 2016, nylon, dye
15. p. 18, Squares #2, 2016, nylon, dye
16. p. 19, Squares #1, 2016, nylon, dye
17. p. 20-21, Intersections #2, 2016, nylon, ink
The Exhibition

The works in this exhibition were made during the course of the PhD research project. Each piece or group of works represents a key point in an investigation into the city grid. The city grid is presented in the four states identified in the course of the research. These are rigid and incising, protecting and containing, mutable and changeable, and dissolving and disintegrating. The exhibition layout follows these forms as they were revealed through the research and created as jewellery objects. The grid form of the tables is in conversation with the geometry of the gallery ceiling and the square shape of the room. The viewer is invited to enter the space of the grid and navigate their own journey through the exhibition.

The exhibition experience mimics the architecture of the Rhino 3D software, the technology deployed in the design of the works. Entering the room, one sees the works from the perspective view, looking down on the tables from above, the works appear in plan view. The central column is the axis around which all construction pivots.

Bin Dixon-Ward, 2016, Enframing Grid 1, nylon, ink, 310 x 320 x 15 mm. Photo: Giulia McGauran

Cover photo: Bin Dixon-Ward, 2016, Enframing Grid 2, nylon, ink, 230 x 280 x 12mm. Photo: Kate Mollison
Abstract

The Grid Reimagined is a practice-based research project. The practice-based research is contextualised in the dissertation through the fields of art history, urban planning, architecture, urban history, human geography, philosophy and digital technology.

The research explored the constructed environments of the city in both the process of making the artworks and in the objects themselves. Through a series of experiments, the research revealed four states of the city grid and interpreted these as jewellery and small objects. These states of the grid are: rigid and incising, protecting and containing, mutable and changeable, and dissolving and disintegrating. The trajectory of the research followed these forms as they were found in the city grid, and re-created and imagined them as jewellery objects. The research travelled from rigid orthogonal forms that control landscapes to fluid forms that conform to the human body, while all the time maintaining the underlying structure of the grid. The means of making, computer-aided design and 3D printing, themselves grid-based; remained constant as I explored the limits of materials and technology. My research reveals the relationship between artist, wearer, material, and object as adaptable and mutable.

A parallel interrogation of the controlled logic of the urban grid and the organic nature of human interaction was thread through the research. Commencing with an examination of the city grid as an organising and framing device, shaping human activity, I proceeded to explore ways in which human activity shapes the grid. In isolating and downsizing the forms of the city grid, I produced work of a human and wearable scale. Through duplicating, layering and distorting forms of the grid, the objects are abstracted from their origin, allowing an organic interaction with the wearer, while a trace of the source, that is, the rigid grid, remains as a gesture to its origins.

The creative outcomes of my research reveal connections between the city and the digital grid. This jewellery contributes to contemporary debates relating to the role of digital technologies in making, and the relationship between the maker and the machine. I conclude that it is only through letting go of any sense of separateness from the technology that the complexity of these relationships could be revealed.
Bin Dixon-Ward, 2013, *Russell's Grid*, nylon, ink, 120 x 100 x 20mm. Photo: Bin Dixon-Ward
Bin Dixon-Ward, 2015, *Containing Brooch*, nylon, dye, stainless steel, 70 x 90 x 60 mm: Photo: Jeremy Dillon
Bin Dixon-Ward, 2016, *Enframing Grid 1*, nylon, ink, 310 x 320 x 15 mm. Photo: Kate Mollison
Bin Dixon-Ward, 2016, Three Cuffs, nylon, 70 x 70 x 60 mm. Photo: Jeremy Dillon
Photographic record of the exhibition installation
Photo credit Keelan O’Hehir’