Resilient Adaptive Design Practice: 
A Responsive Theory of Design Practice 
and Education 

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A Responsive Theory of Design Practice
and Education

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Declaration

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

Stephen Douglas Trathen

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Table of contents

Declaration ........................................................................................................................................i

Acknowledgements .......................................................................................................................... iii

Table of contents .............................................................................................................................. v

List of Figures ....................................................................................................................................... viii

List of Tables ......................................................................................................................................... ix

1. Overview of Thesis ......................................................................................................................... 2

2. Design in context ............................................................................................................................ 12
   Introduction .......................................................................................................................................... 12
     Understanding design ....................................................................................................................... 14
     Definitions of design ....................................................................................................................... 19
     Collaboration and interdisciplinary ............................................................................................... 24
     Creativity .......................................................................................................................................... 25
     Change and technology .................................................................................................................. 26
     Communication and information ..................................................................................................... 27
     User centred approaches ................................................................................................................ 28
     Problem and need identification ..................................................................................................... 29
     Social responsibility ......................................................................................................................... 30
     Future possible ................................................................................................................................ 31
     Conclusion to Understanding Design .............................................................................................. 31
   Design Education ............................................................................................................................. 33
     The content of design education: what should be taught? .............................................................. 33
     The process of design education ..................................................................................................... 36
     How should design be taught? .......................................................................................................... 42
     Models of education theory ............................................................................................................. 42
   Practice of Teaching ......................................................................................................................... 45
     Practice of teaching conclusion ....................................................................................................... 50
   Conclusion ........................................................................................................................................... 51

3. Approach and method ................................................................................................................... 55
   Introduction ......................................................................................................................................... 55
   Approach ........................................................................................................................................... 56
     Context ............................................................................................................................................. 56
     Research questions ........................................................................................................................... 58
     The role of the researcher ............................................................................................................... 61
     Ethics ................................................................................................................................................. 62
   Designing the interviews .................................................................................................................. 62
     Why interview graduates? ................................................................................................................ 63
     The AAD model ............................................................................................................................... 63
6. Resilent adaptive practice ........................................................................................................204
Introduction ..................................................................................................................................204
The context ....................................................................................................................................206
Our island home: Australia in a global context .............................................................................207
We are here: Canberra in the Australian context .........................................................................208
The Australian manufacturing sector and industrial design .........................................................209
The 1950s .......................................................................................................................................209
Transformations: the 1970s and 1980s .........................................................................................210
Today ............................................................................................................................................211
The Australian tertiary education sector .......................................................................................213
Impact of the context on industrial design practice and education ..............................................216
Design practice implications .........................................................................................................216
Design education ............................................................................................................................218
Applying the models ....................................................................................................................220
The past: stability ............................................................................................................................222
The past as viewed through the models: .......................................................................................224
Australian industrial design ecology framework of archetypes ................................................226
The present: A state of flux ............................................................................................................227
The present as viewed through the models: ..................................................................................229
The future: a post industrial design profession .........................................................................232
The future as viewed through the models: ..................................................................................234
Design Development Wave ..........................................................................................................235
Towards a resilient adaptive practice ..........................................................................................237
What is the problem? ......................................................................................................................239
What is the solution? .....................................................................................................................240
People currently inside industrial design ....................................................................................241
Existing design workforce ............................................................................................................242
People currently outside industrial design ..................................................................................244
Conclusion......................................................................................................................................245

7. Conclusion ................................................................................................................................249
Future research ...............................................................................................................................254

References .....................................................................................................................................256

Appendix 1: Interview Guide ......................................................................................................264
Appendix 2: A Graduate’s individual journey ..............................................................................268
List of Figures

FIGURE 3.1: ADOPTER-ADAPTER-DEPARTER MODEL .......................................................................................... 65
TABLE 3.1 TABLE OF RESPONDENT ATTRIBUTES ................................................................................... 69
FIGURE 3.2 ALLOCATED PSEUDONYMS AND AVATARS ......................................................................... 70
FIGURE 3.3 EXAMPLE OF PULSE PEN MIND MAP GENERATED DURING INTERVIEW ................................. 76
FIGURE 3.4 INITIAL THEMES ARRIVED AT FROM FIRST PASS OF PERSONAL NOTES ................................ 81
FIGURE 3.5 EXAMPLE OF A RESPONDENT’S TAG CLOUD ........................................................................ 83
FIGURE 3.6 EXAMPLE OF CODE TREE USING NVIVO SOFTWARE ............................................................. 84
TABLE 3.2 EXTRACT OF EARLY ITERATION OF MATRIX DESCRIPTIVE CODES FOR EACH INTERVIEW RESPONDENT .............................................................. 85
FIGURE 4.1 THE THEMATIC MAP OF AUSTRALIAN INDUSTRIAL DESIGN PRACTICE ............................ 94
FIGURE 4.2 COMMUNICATOR THEME AND INTERPRETIVE CODES ......................................................... 97
FIGURE 4.3 APPROACH THINKING THEME AND INTERPRETIVE CODES ............................................... 108
FIGURE 4.4 SOCIAL CONSCIENCE THEME AND COMPONENT CODES ................................................... 115
FIGURE 4.5 FACILITATOR INTERPRETER THEME AND COMPONENT CODES ........................................... 122
FIGURE 4.6 MOBILITY THEME AND INTERPRETIVE CODES .................................................................. 131
FIGURE 4.7 IDENTITY THEME AND INTERPRETIVE CODES .................................................................. 146
FIGURE 4.8 THE THEMATIC MAP OF AUSTRALIAN INDUSTRIAL DESIGN PRACTICE ............................ 158
FIGURE 5.1 EARLY CONCEPT SKETCHES OF PROTO-MODELS ................................................................ 166
FIGURE 5.2 TRIALLING ALTERNATIVE MODEL REPRESENTATIONS ....................................................... 166
FIGURE 5.3 TRIPLE AXIS MODEL OF INDUSTRIAL DESIGN EDUCATION ............................................. 168
FIGURE 5.4 DESIGN DEVELOPMENT CONTINUUM .................................................................................. 172
FIGURE 5.5 CURRICULUM COMPARISONS VIA THE CONTINUUM ....................................................... 173
FIGURE 5.6 RELATIONSHIP BETWEEN THE DESIGN DEVELOPMENT WAVE AND THE TRIPLE AXES MODEL ......................................................... 174
FIGURE 5.7 RELATIONSHIP BETWEEN THE DESIGN DEVELOPMENT WAVE AND THE TRIPLE AXES MODEL IN CURRENT EDUCATION ................................................. 174
FIGURE 5.8 THE AUSTRALIAN INDUSTRIAL DESIGN ECOLOGY FRAMEWORK ........................................ 176
FIGURE 5.9 SPIDER WEB GRAPHIC SHOWING SIX THEMES ..................................................................... 180
FIGURE 5.10 VISUAL CREATIVE ARCHETYPE SPIDER WEB GRAPHIC .................................................... 182
FIGURE 5.11 TECHNICAL PRODUCT DESIGNER ARCHETYPE SPIDER WEB GRAPHIC ............................ 186
FIGURE 5.12 DIGITAL MAKER ARCHETYPE SPIDER WEB GRAPHIC ....................................................... 191
FIGURE 5.13 DESIGN DEVISER ARCHETYPE SPIDER WEB GRAPHIC ...................................................... 194
FIGURE 5.14 DISSIDENT DESIGNER ARCHETYPE SPIDER WEB GRAPHIC .............................................. 198
List of Tables

TABLE 3.1  TABLE OF RESPONDENT ATTRIBUTES .......................................................... 69
TABLE 3.2  EXTRACT OF EARLY ITERATION OF MATRIX DESCRIPTIVE CODES FOR EACH INTERVIEW RESPONDENT .......... 85
Abstract

This thesis examines the development of the Australian graduate industrial designer in a period of significant change. It explores the mismatches between current industrial design education approaches, the lived experiences of recent graduates and the changing design employment ecology both globally and locally. It also highlights the instability generated by the lack of consensus on the role, function and parameters of industrial design as a discipline and a profession: instability which both contributes to and is caused by these incongruities.

While a time of flux and uncertainty, the current situation is also one of great potential. Traditional modes of practice are disappearing; however, the latent capacity of design is largely untapped. Guiding the realisation of that promise offers exciting prospects for design educators, practitioners and society more broadly.

The thesis is based upon primary qualitative research which investigated the career trajectories and practices of a group of industrial design graduates qualifying from the University of Canberra in the period 1996-2006. Participants took part in semi-structured interviews developed from predetermined themes drawn from a review of literature and reflections on my own practice as a design educator. The resultant rich narratives of the
graduates’ lived experiences provided the opportunity to identify and analyse the application of industrial design and industrial design education to the range of possible employment and professional sectors of practice. A key finding was the resilience and adaptability demonstrated by these graduates as they negotiated multiple forms of design practice.

On the basis of this research, a series of models were developed, comprising:

- The Adopter-Adapter-Departer model: which described three categories of industrial design graduates
- The Thematic Map of Australian Industrial Design Practice: which described the themes of practice which emerged from the interview data
- Triple Axes Model: which described the relationship between six competing priorities as continuums set on three axes.
- The Design Development Wave: which described the balance between back and front end design processes
- Archetypes of Australian Industrial Design Practice: which described a typology of existing and emerging practice
- Australian Industrial Design Ecology Framework: which described the location of the past, present and future areas of industrial design practice.

Taken together, these models and archetypes constituted the concept of Resilient Adaptive Design Practice. The value of the concept was tested first with the past and present: as it explained and aligned with observed reality.

The contributions made by this research have drawn in large part on the qualitative and rich data from in-depth interviews with participants. Their lived experience powerfully demonstrates that the future has arrived: while some may still speculate on the implications of a post-Design For Manufacture industrial design environment, many of our younger industrial designers are living and practising new forms of design in that reality.
This research is significant to Australian industrial design practice and education as it acts as a mirror, held up to the profession as a whole enabling the self-reflection required to lay the ground work for change. This is an important explanatory tool in considering and aiding the development of future industrial design education and practice in Australia. Implications for further research and design education are also discussed.
1. Overview of Thesis
1. Overview of Thesis

Australian undergraduate industrial design education generally maintains its traditional focus on Design For Manufacture (DFM) skills and knowledge. However as the domestic manufacturing base shrinks, fewer and fewer industrial design graduates find employment in the DFM sector. Employers bemoan a lack of relevant skills, students are concerned about their future employment prospects and a perception the profession’s status is undermined by ‘graduate oversupply’ is widespread. At the same time, many graduates are engaged in varied and satisfying forms of design-inspired work beyond established confines of industrial design. How can these apparent contradictions be understood, and what implications would such an understanding have for industrial design education?

Using the proposition that there is a disconnect between industrial design practice and industrial design education, my research investigated these contradictions. This allowed me to set up a number of proposed theoretical models and descriptors to illustrate, understand and describe this particular situation, to better understand and address the disconnect. My findings indicate Australian industrial design education remains geared to the needs of a vanishing manufacturing base, developing skills for jobs which no longer exist. At the same time, the potential of industrial design to be applied beyond its traditional manufacturing territory is almost completely untapped. If industrial
design is to continue to be relevant in the 21st century, fundamental reform of its educative processes and professional structures is urgently needed.

Like many other developed countries, Australia has seen a shift of its manufacturing base to emerging economies with lower production costs (McColl 2009). This has accelerated to an extent where the Australian brands survive but their products may be exclusively made overseas. The impact of the Global Financial Crisis is evident on both local and international demand for products and traditional industrial design services, with consequent staffing reductions including in design and development areas. As manufacturing’s share of national GDP continues to decrease, the contribution of services sectors, such as education, banking and health, has correspondingly increased (Australian Bureau of Statistics 2005).

As well as through the demise of large scale domestic manufacture, industrial design roles have also been impacted by advances in technology, such as computer aided design, computer software and the use of rapid prototyping technologies. Today’s industrial designers are expected to be skilled in these new technologies, new materials and new manufacturing processes. The context for these new jobs is also more complex: design is increasingly supposed to take account of social, economic and environmental factors, to operate in multi-disciplinary teams and to liaise across other knowledge areas.

As DFM employment has reduced, practising industrial designers have forged new applications of their skills and knowledge. Some have found supplementary revenue sources through low volume and bespoke production akin to traditional craft applications. Others have applied their skills in design and re-design to non-traditional fields such as health systems or the banking services sector.

These global changes have gathered pace and contemporary industrial design graduates in countries such as Australia face an uncertain future. Debate regarding the skills and knowledge needed by 21st century industrial designers is increasing (Design Institute of Australia 2005). Do future industrial
designers need to further specialise or generalise their skill sets? Should finding work focussed on ‘front-end’ conceptual design be the priority or should designers trade on their skills in technical manufacture processes? Do time-honoured skills in visual communication, such as sketching and rendering, have a place in workplaces dominated by computer aided design? To what extent is product design education needed if DFM jobs are scarce? Do graduates identify as members of the industrial design profession or do they see potential employment roles in terms that are too permeable and open-ended to be adequately reflected by this label? In reality, there are options for Australian industrial designers to be a specialist or a generalist but the decision is not always clear.

These uncertainties are reflected in industrial design discourse. The field has a diverse consensus on even basic boundary and definitional matters, with understandings of the scope and role for industrial design often contested. As the concepts of design and design practice are increasingly applied in non-traditional settings, the questions of ‘what is design?’ and ‘where does industrial design sit within that context?’ are being debated anew.

My research explored the experience of recent graduates to understand changes in industrial design practice and how these could inform needed reforms to educative and professional structures. I based my research on the proposition of a widening disconnect between industrial design practice and industrial design education and my thesis resides within this framed space. The generation and investigation of this proposition stemmed from my unique understanding of industrial design from the University of Canberra perspective.

I began my undergraduate industrial design education at this University and after 15 years professional practice in the industry interstate ultimately returned to teach at the same location. Over the past 15 years I have been involved in all aspects of the industrial design course: curriculum development and review, teaching and learning, assessment design and re-design, and building links with industry. I have established and maintained an extensive national and
international network with alumni and colleagues teaching industrial design courses at other Australian and New Zealand universities. I helped lead the foundation of the revamped and newly tilted Industrial Design Education Network, which brings together educators from Australian and New Zealand industrial design faculties and promotes national dialogue and collaboration. My national and international perspectives have been enhanced through ongoing engagement with my professional peers via presentation and attendance at national and international forums such as the Australian based ConnectED design conferences and the International Council of Societies of Industrial Design conferences. Taken together, these elements equip me with a distinctive breadth of understanding of the current context of and recent developments in industrial design teaching and practice at the University of Canberra, and enable me to locate this perspective within a national and international context of industrial design related courses. This was from the perspective of the Australian context, characterised by multiple shifts in course content and delivery processes, a mismatch between graduate and employer expectations of work role and lack of employment opportunities for the roles for which graduates were educated.

Importantly, my extensive networks with past and present students provided the opportunity to take a graduate-centred approach to my research.

In the past, research concerning industrial design education has focussed on an employer-based perspective, and primarily been concerned with discovering their employment needs and priorities (Higgs et al 2005). There has been comparatively little investigation of graduates’ perspectives. Understandings of emerging roles and achievements outside traditional notions of design among recent graduates in the Australian setting have been limited to anecdotal material, based on informal discussions with alumni and university colleagues around Australia. These discussions indicated DFM is not seen as a central or necessary element of design employment by many graduates of industrial design, and this is reflected among the current undergraduate student cohort at the University of Canberra.
I saw the population of industrial design graduates as offering a largely untapped and uniquely placed data source for understanding current changes in the field and emerging design roles. Recent graduates are navigating the complexities and tensions in the profession through their lived career trajectories: their perspectives are essential to understanding these changes.

A graduate-centred approach yielded perspectives quite different from research conducted through the lens of traditional industrial design employers and professional bodies. Most fundamentally, a graduate-based investigation allowed me to follow real-life applications of design and career paths, whatever the direction taken post the adaptor, adaptor, departer descriptors being applied. I wanted to understand graduates’ post-university experiences and investigate the extent to which they applied aspects of their industrial design education within their employment and careers. Conversely a selection of employers and professional bodies would have necessarily reflected accepted professional boundaries, it would have inherently limited the scope of my research, and raised the risk of missing the novel applications of design I sought to capture.

Taking a graduate-based approach was also feasible within my resources. Universities are generally well-placed to track alumni and my personal networks with graduates are extensive. On the other hand, gathering information about the breadth of application of design education in the employment market would have been difficult, as potentially all employment fields are in scope. In addition, employers may not always be aware of the design qualifications of their employees, especially if they are engaged in positions not traditionally associated with design.

My research approach was developed by exploring the current state of national and international industrial design practice and education while reflecting and comparing this with my own contextual environment within higher education and scholarship. As part of this approach, I am also proposing the use of models as a method to exploration. My research questions comprised:
Can models be used to explain the experience and career trajectories of recent industrial design graduates?

How can such models clarify the extent to which existing forms of industrial design practice remain relevant today, and identify emerging forms of practice?

How can the experience of recent industrial design graduates contribute to an understanding of factors influencing practice?

What models or concepts can help translate these insights into assisting design educators educate for the future, not just the present?

My approach comprised:

- Literature review
- Qualitative research through semi-structured interviews with industrial design graduates from the University of Canberra
- Development of theoretical models:
  - Adopter-Adapter-Departer model: describing three categories of industrial design graduates
  - The Thematic Map of Australian Industrial Design Practice: describing the themes of practice which emerged from the interview data
  - Triple Axes Model: describing the relationship between six competing priorities as continuums set on three axes.
  - The Design Development Wave: describing the balance between back and front end design processes
  - Archetypes of Australian Industrial Design Practice: describing a typology of existing and emerging practice
  - Australian Industrial Design Ecology Framework: describing the location of the past, present and future areas of industrial design practice.

My research indicated that despite the disappearance of Australian-based manufacture and its consequences for DFM employment, industrial design
curriculums remain largely backward looking. A disproportionate focus on design for manufacture persists, while potential non-traditional applications of design theory remain unexplored.

As a profession, as design educators and as individual practitioners, we can continue this status quo and witness the demise of industrial design. Alternatively we can embrace change and help create a future where industrial design, albeit in a different form, can flourish. To do so, we need to address the questions: what are the skills, knowledge and attributes needed by the next generation of designers, and how should educators, professional bodies and other support structures best equip them for these roles?

This thesis provides a basis to move beyond our current passivity to take a more proactive and informed role in shaping the future of the profession. In addition to this Introduction, it comprises:

Chapter 2. Design in context: theoretical frameworks of design, which considers the landscape of past and current literature regarding issues of design and design education, and how various authors have dissolved the challenges and problems.

Chapter 3. Approach and method, which details the project overview, the design of the research approach and the processes used in the data collection and analysis.

Chapter 4. Navigating design: the themes in design practice, which describes the analysis of the interviews, the findings, development of codes and themes used to describe the system of industrial design practice and provides a discussion about of each of the themes and how they relate to the model of resilient practice.

Chapter 5. Modelling design practice, Five Archetypes of industrial design practice are described to explore the various models of practice.

Chapter 6. Resilient Adaptive Practice, which outlines the context and environment in which Australian industrial design practice and education
resides. Three descriptive models are detailed and used to illustrate the past, present and possible future scenarios for Australian industrial design. The implications for practice and education are also discussed.

**Chapter 7. Conclusion**, which provides a synthesis of the overall thesis, the contributions made and possible future research directions
2. Design in context
2. Design in context

Introduction

Chapter 1 explained my recognition of a growing disconnect between design education and design practice. This Chapter analyses the elements of that disconnect and reviews the context in which they are sited in three sections: Understanding Design, Design Education and the Practice of Teaching.

The first section, Understanding Design, explores the lack of shared identity within design. At the most basic level, design itself lacks a broadly accepted definition. The real world practice of industrial design is in flux: previous links to design for manufacture have been broken, and lack of (Design for Manufacture) DFM employment and the migration of design thinking beyond these areas have seen design roles proliferate and diversify. Conceptual role definitions and professional boundaries may be quickly overtaken by changes at the coalface. In this context, I review the main lines of discourse regarding the definitions of design, and the features of design which are seen as essential characteristics emerging from this analysis. The articulation of these characteristics reflects the attempt to clarify what constitutes design when it is separated from its DFM birthplace.

The impact of this variety of shared identity on the practice and education of design is then discussed. As well as limiting theoretical analysis and study of the
field, the diverse opinions on scope and role of the industrial designer affects every level of the field: educators have an assorted range of areas to teach, students have varied understandings of the profession they are joining, and employers do not know graduates capacities (or limitations). In addition, those outside the immediate field remain unaware of the contribution which design could offer beyond the traditional DFM bounds. Australia historically has had a preference to educate specialists because of a stronger focus on skills, the workplace and professionalisation. Whereas, in other parts of the world, the mix may vary depending on the local context.

The second section of the chapter, Design Education, considers both the content and process of educating the new generation of industrial designers within this environment of flux. In this context, determining what should be taught requires a consideration of:

- Who decides what should be taught?
- What skills should our graduates have?
- Should we aim to educate graduates as generalists or specialists?

Returning to the key attributes discussed in the previous section, I describe how these are linked to a consideration of how design should be taught.

The third and final section of the chapter, Practice of Teaching, describes this structured approach to the renewal and improvement of teaching. I consider its importance in general terms, and suggest this methodology holds promise for addressing the current disjunction between design education and design practice.
Understanding design

Before proceeding in later chapters to investigate my overall thesis of a disconnect between design practice and design education, I first consider the meaning and scope of the concept of design. Many of the tensions and inconsistencies investigated throughout this study can be traced back to the conflicts inherent in definitions of design, and the lack of consensus and application of those definitions.

Most writers reflecting on design cannot resist the allure of putting forward their own views of its definition. In fact, given the plethora of definitions and the multiple meanings attached to the same words, this foundational step is necessary. Despite the number and range of definitions, many are general and provide little guidance in delineating a unique role for design and designer practitioners.

Regardless of the literature based discussions, the lived experience of design graduates reflects the changing nature and flexibility of work they undertake. These two factors influence each other in a cyclical fashion: that is, discussions of design definitions drive understandings of design practice, and likewise design practice changes understandings of what constitutes design. Ideally these changing comprehensions of both definitional issues and design in practice should lead to corresponding changes in design education. The problems in closing this feedback loop provided the genesis for this research.

Roles, capacities and potential are shaped by market forces: ultimately it is the preparedness of designers to undertake the work they are offered and of employers to pay for this that provides the realpolitik counterpoint to conceptual debates of scope and role. The focus of my research explores this lived reality as a previously untapped data source to inform our reflections on a renewed integration of design education and practice.

In the Australian context the public awareness and understanding of design and the work of designers, particularly around Australian industrial design, has always been, and remains, low. Historically, however, designers themselves
had a clearer understanding of their role and of employer expectations. While jobs were not large in number, their boundaries were clear: intrinsically linked with manufacture, the jobs entailed high-level skills directed to late-stage design problems. That is, designers were not involved in what we now understand as problem identification, solutions generation and user input. Instead of designing a better way to toast, they designed toasters with more options and sleeker exteriors. Although by today’s standards the scope of work for industrial designers was limited, it was valued, recognised, predictable and largely static.

The demise of domestic manufacturing precipitated a watershed in design: without manufacturing, the DFM basis of industrial design was gone. Practising industrial designers sought new applications of their skills and knowledge as either supplementary or replacement revenue sources, and the links between design and DFM became increasingly attenuated.

With the manufacturing jobs available to their predecessors no longer available, today’s design graduates compete for work in diverse settings, roles and work descriptions. Many such graduates may not identify as designers: they are instead ‘exploring new ways to think about the modern life’ (Kwon 2007, p. 1). Changes in design practice include both increasing specialisation and increasing diversity of application: both have contributed to a blurring of traditional discipline roles. These changes are evidenced by the move away from producer-centred traditional professions such as industrial design, graphic design and architecture, and towards emerging areas including sub-specialities including environmental design and sustainable design.

Diversification is demonstrated by the application of design processes and principles beyond traditional boundaries, which required the production of tangible products. New roles are described as strategic design, interaction design, and interface design. In service design, for example, design is applied to banking, finance and insurance industries. In experience design, another emerging area, design principles are applied to improving users’ experience of
dining out, attending a conference or using a service. However experience and product are integrally linked. As Vogel and Cagan note, ‘since products enable an experience for the user, the better the experience the better the value of the product to the consumer’ (cited in Tharp 2002, p.8).

This expanded view of possibilities for design practice has coincided with a range of converging issues of the last twenty years which fall mainly into two related categories: first, user-centred design and secondly, the awareness of the social responsibilities of design.

The term user centred design can be traced to the seminal work of Donald Norman which heralded the systems approach of areas such as ergonomics/human factors and psychology in relation to the design of items of everyday life (Norman 1990).

Social responsibility centres on the desire to design products which will meet basic human needs (as opposed to superficial or discretionary wants). Social responsibility has led to concepts of universal design, where design principles are applied to addressing the question of how to improve the experience of being alive – where ‘design can improve the experience for all people’ (Press and Cooper 2003, p. 84).

Companies such as IDEO provide an exemplar of user centred design and social responsibility in design practice. IDEO, a multidisciplinary international design consultancy founded in California, has forged a reputation in the application of design to a wide range of products and services (IDEO 2011) The company has successfully developed and marketed its services on a design research model that identifies relevant problems and needs and which has often led to innovative approaches and outcomes. These have gone beyond design for consumer-driven product consumption and have instead aimed for design with a social conscience which improves quality of life.

The migration of design thinking beyond traditional applications is also seen in community-centred fields such as health care and education. These share a
renewed focus on emerging concepts of social responsibility where design is seen as part of the solution not part of the problem.

In turn, these new roles and new influences have been reflected in the type of courses offered in design education (Yang, et al. 2005). The ‘d’ school, the Institute of Design at Stanford University, has strong links to IDEO through location, philosophy and founders (see above). The school is a multidisciplinary educational institution taking an overarching design approach to address multiple types of issues and problems (‘d’school 2009). The approach and philosophy of the ‘d’ school also became clearer to me when I visited Stanford University and the ‘d’ school in 2007 and I had the opportunity to discuss the school and its methods and thinking with key staff, William Burnett and Dr Banny Banerjee. (personal communication 16 October 2007)

New developments in design consultancy and design education, as exemplified by IDEO and the ‘d’ school, show the potential of design’s contribution beyond its DFM roots. At the same time, however, they underscore the blurring of design’s roles and function as the concepts of design and design practice are increasingly applied in non-traditional areas.

The radical change from design confined to the manufacturing context to design pervading all spheres of life has led to a review of the core features of design itself. The discourse is reflected in contemporary journals and the range of authors engaged with such issues is broadening (Friedman 2000; Buchanan 2001, Stening 2008, Yang, et al. 2005, Yee, et al. 2007, Zec 2007).

Contemporary discussions note that design is more than the outcome or artefact – that is, that design is not confined to using the term as a noun. Instead, design is also a verb, denoting a process that can be applied to an ever-increasing array of identified problems and/or a process that includes the identification of these problems. Taking this approach, the diversification of design applications should not be surprising. As Archer suggests, design should be seen as:
a cascade of issues moving towards a final argument expressed in a product strategy and then in a concrete resolution of a specific product, whether this product is a tangible artefact or any of the other forms that products may take (Buchanan 2007, p. 64)

Caplan for example, notes that:

*Design has moved beyond the object to strategies, systems, software and situations. Therefore process was/is more important than product* (Caplan 2006, p. 68).

Such discussions are also reflected in global forums of interchange between international industrial design professional associations. For example, during my attendance at the International Council of Societies of Industrial Design (ICSID) conferences in San Francisco 2007 and Singapore 2009, I noted the diversity of delegates from many design backgrounds, ranging from graphic designers to architects. The Conferences included discussions beyond manufactured products and explored service design issues such as health policy and implementation, demonstrating these matters are now considered part of core business for designers.

In addition to conceptual discussions in the literature, along with my own experiences working with students, graduates and employers, it is evident the expectations of various employers also influence boundary-setting for design, although such input may not be consistent. In Australia for example, on the one hand, some small to medium businesses expect industrial designers to ‘do it all’, from initial concept generation to detailing the final product. Other businesses however, underestimate the capacities of design graduates and tend to pigeon-hole them in basic drafting roles. In professional roles, designers are expected to be able to work with and have an understanding of other knowledge areas. They are also required to identify as well as solve problems, and to think reflectively and be lifelong learners.

The industrial design context is increasingly complex, with rapid technological change now commonplace. The application and more tangible links between computer aided design (CAD) and the new and more affordable output devices via a large range of rapid prototyping (RP) devices has also allowed for the
expansion of what designers and design practice are capable of producing. In response to the work of companies such as IDEO and greater acknowledgement of applied psychology and ergonomics/human factors, larger companies such as high tech manufacturing have increasingly recognised the need to research user needs and this has become an aspect of industrial design capabilities.

Changes to the environment and to role understandings mean design and industrial design are in the midst of a major paradigm shift developed from a growth in influence in a range of areas (Kwon 2007 cited in Trathen and Varadarajan 2009). The result is that the ever-present public misunderstanding and lack of awareness of the design role has now pervaded the profession itself. Agreement on the scope and role of designers, even among self-identified practitioners, is scant. It is therefore not surprising that design education is at a crossroads, in need of renewal before moving forward.

**Definitions of design**

This section examines the literature dealing with definitions of design, as an understanding of what constitutes design and design practice is a necessary precursor to a consideration of design education.

Dictionary definitions of design highlight the complexity of describing the scope of the concept. In considering definitions from the Concise Oxford and Macquarie Online, a notable point is that ‘design’ can be used as a verb or a noun, and that both include a range of meanings. As a verb, design can denote to plan, contrive and intend (Sykes 1987) and to ‘form or conceive in the mind’ (Butler 2012). As a noun, the term’s meanings include a ‘mental plan: scheme of attack’, ‘purpose’ and ‘preliminary sketch’ (Sykes 1987), and ‘a plan, project or scheme’ (Butler 2012).

Several writers including Heskett (2002) note the distinction between ‘design’ used as a noun, and the verb ‘designing’. In this view, design as a noun refers to an object or artefact – an outcome of a process. This can indicate a specification or plan for making a particular artefact or for undertaking a
particular activity. On the other hand, using the verb ‘designing’ denotes a process – that of undertaking the activity of designing.

It could be assumed that relevant professional bodies would unambiguously provide the demarcation of the field. Notably however, there is no industrial design specific professional association in Australia: this can be seen as both a cause and a symptom of the lack of cohesive industrial design identity (Schumacher and Trathen 2009). In this absence, relevant associations include both the DIA, the Design Institute of Australia or ICSID, the International Council of the Societies of Industrial Design – however neither provide clarity of role definition.

The DIA positions itself as Australia's professional membership body for designers and design businesses and seeks to represent designers from all disciplines. However architecture, graphic design and landscape architecture all have their own specific national bodies, and therefore the DIA provides an association for remaining design professionals such as industrial designers and interior designers. Its definition of the designer’s role therefore is not discipline-specific, and includes features such as the development of ‘solutions to commercial needs’ and planning of ‘things for manufacture’ (DIA 2012). It also emphasises that unlike craftspeople, things created by designers are in response to criteria set by external sources. The concept of design itself is poorly addressed, but is seen as a process which incorporates ‘human, cultural and aesthetic aspects’.

Though stemming from an industrial design perspective, the ICSID discussion of design is also broad. It states that design is related to:

products, services and systems conceived with tools, organisations and logic introduced by industrialisation...[and] is an activity involving a wide spectrum of professions in which products, services, graphics, interiors and architecture all take part...these activities should further enhance... the value of life. (ICSID 2010).

ICSID also takes a confusing approach to addressing the particularities of industrial design within this context, and states that: ‘The adjective "industrial"
put to design must be related to the term industry or in its meaning of sector of production or in its ancient meaning of "industrious activity" (ICSID 2010).

It seems while striving to explain the breadth of application of the term industrial design, ICSID has confused rather than illuminated the issues. Such difficulties in definitions may reflect both the breadth of interdisciplinary thinking involving industrial design and also the tension inherent in reinventing the profession to remain relevant.

Unfortunately the lack of clarity and role demarcation evident in both dictionary and professional body definitions is continued in the literature, where definitions of design are ambiguous and contested. Love’s meta-analysis of approximately 400 relevant papers indicated the proliferation of design definitions (Love 2002).

Traditional understandings of role and scope are typified by fairly simple categorisations such as that put forward by Darter’s 1969 work (cited in Press and Cooper 2003). In this typology, Darter suggests three main categories to define the roles of design:

- Environmental design as places
- Product design as things
- Communication design as messages.

This typology can be seen as relating to the traditional fields and professions of architecture, landscape architecture (environmental design), interior design and industrial design (product design) and graphic design (communication design).

With industrial design no longer confined to, or defined by, product design and DFM, such categorisations have become less relevant, and definitions of design have sought to explain its meaning in more general terms. However, in attempting to broaden understandings of design, some discussions do little to assist in establishing new role demarcations. For example, Flusser suggests that ‘everything depends on design’ (2009, p.39). In a similar vein, Heskett notes the
term ‘design’ has many meanings and applications: a view epitomised by his statement that ‘design is to design a design to produce a design’ (2002, p.5).

Heskett attempts to define the necessary elements of a design definition as ‘the human capacity to shape and make our environment in ways without precedent in nature, to serve our needs and give meaning to our lives’ (2002, p.7).

Doordan is another author who proposes a theoretical understanding of the definition of design. He sees ‘design as a fundamental activity’ (Doordan 2004, p.1) where people use their available resources and skills to addresses human needs and desires. This type of definition makes design a pursuit for humanity past, present and future. As such it shares common features proposed by other authors such as Pieter Jan Stappers, who emphasises that design’s key function is ‘the conception and projection of human condition of living’ (Stappers 2007, p. 188). He argues that:

Design shapes communication and creates identity. It is a conscious act that aims to create meaningful order and thus are essential part of our culture. Ever since the early nineteenth century, design has been ideologically committed to transform the world for the benefit of human beings and helping to find intelligent solutions to problems. (Stappers 2007, p. 208).

Another attribute seen by some authors as a defining feature of design is that of innovation, where design brings a change or addition to existing knowledge. This concept is related to considerations of creativity and invention, which are also often seen as being closely involved in design. Love observes that a designer may be defined as someone who is skilled at addressing non-routine issues (Love 2002).

If creativity is an essential part of what it means to design, then it also implies that design is a process in response to a need or desire, the outcome of which can be considered a solution and often, a design or artefact. This links to understandings of design as a process of both problem solving, and perhaps more fundamentally, problem identification. For instance Skaggs (2005) identifies one of the attributes of creative thinking of industrial designers as
‘problem finding’. He states that ‘Design is about finding the right question; answers are easy if you know the question’ (Skaggs 2005, p. 211).

Love is concerned to establish a distinction between design and design process, two issues which, in his view, have incorrectly often been seen to be identical. Love describes the design process as ‘any process or activity that includes one or more acts of designing with other associated activities’, (Love 2002, p. 358) whereas designing is ‘a non-routine human activity that is an essential aspect of processes that lead to a design of an artefact’. (Love 2002, p. 359)

Another area of potential confusion in defining the scope of design is its relationships to craft. There are aspects in common between design and craft when design, like craft, is involved with the object as a focus of intent.

For example, Press and Cooper link craft to the craft of design by seeing the fundamental notion of designers as makers and seeing that craft knowledge is a way of ‘understanding quality, detail and sensual experience’ via creative problem solving and reflective practice (Press and Cooper 2003, p. 198).

As industrial design has moved beyond manufactured objects into the realm of services and systems, this connection has become more tenuous, and there are fundamental distinctions between the two worlds of design and craft. These emerge in part from the different focus each take. As Caplan explains:

When do craft and design diverge? I think it is at the point when the emphasis shifts from creating a form to meeting a need. The practice of design address the user in terms of a job to do, an irritant to remove…The practice of craft is closer to elemental form giving. (Caplan 2006, p. 65)

Caplan also notes that design is about meeting an identified need for a user: ‘In design the emphasis shifts as soon as possible from shaping the thing to solving the problem, from making it to the process of addressing someone else’s needs - the client, the consumer, the distributor’ (Caplan 2006, p. 63).

In citing Vogel and Cagan, Tharp noted that design moves beyond the object to interactions with products that lead to greater value and positive experiences (Tharp 2002). This developing understanding of the interactions with ‘products’ has led to new design applications, for example, ‘experience’ design.
Given the difficulties in defining the role and scope of design, it is understandable that attention has also been given to consideration of generic attributes which could be considered essential to design – those which exist outside of any particular field of application. In this section I outline features which emerge from the literature as candidates for such status, comprising:

- Collaboration and interdisciplinary
- Creativity
- Change and technology
- Communication and information
- User centred approaches
- Problem and need identification
- Social responsibility
- Future possible.

It should be noted that this list of attributes is a theoretical model: it does not mean all design jobs include all attributes, or that all designers exhibit these attributes. For example, while collaboration and interdisciplinary work is included as a key attribute, there are designers who work as solo practitioners.

**Collaboration and interdisciplinary**

Design practice often involves working in teams where collaboration, facilitation and an understanding of systems is integral to the role of a designer and the success of a project. This can involve the designers, producers and user of services and artefacts.

There is an increase in both understanding and application of interdisciplinary team work. For example, Thackara states that:

> "the days of the celebrity solo designer are over. Complex systems are shaped by all the people who use them, and in this new era of collaboration innovation, designers are having to evolve from being the individual authors of objects, or buildings, to being the facilitators of change among large groups of people" (Thackara 2005, p. 7).
Likewise Stappers (2007) feels the notion of the designer as an individual creative genius is defunct, as in the contemporary environment of information proliferation no single person can synthesise all required information alone. As it is impossible for designers to ‘know it all’, instead they need an awareness of how other disciplines inform design practice and processes. As Stappers argues:

*the amount of information designers need in order to solve design problems has grown dramatically over the past two decades, with the result that on their own designers are no longer in a position to collect all this information let alone assimilate and process it* (Stappers 2007, p. 213).

Collaborative teams of today do not only comprise a range of design disciplines working together (which has not been unusual) but various disciplines beyond design coming together to work on projects and problems. These new levels of interdisciplinary collaboration are developing to better address society’s emerging needs. As noted by Peter Zec, Chair of ICSID, interdisciplinary teams should not being limited to designers, but instead, ‘collaborations among designers, scientists, engineers, sociologists, politicians, business leaders and humanitarians can often produce the most innovative results’ (Zec 2007, p. 65). The ‘d’ school at Stanford University, is an example of a successfully promoted, interdisciplinary and integrated approach applied, via teams comprising people from the disciplines of marketing, engineering and design. (*d’ school Stanford 2009*)

**Creativity**

As noted above, design is often associated with creativity. For many, to be a designer is to be creative while the design process involves creative thinking. Zec proposes that creative processes use a combination of logical deduction and generative thinking, and these take place when working in teams (Zec 2007).

Despite advances in technology, creativity as a fundamental characteristic of design has not changed. For example, Buchanan states that ‘there remains the
central task of creative synthesis that characterises design thinking and practice’ (Buchanan 2007 p. 62).

**Change and technology**

According to some authors, such as Kwon (2007) and Skaggs (2005), designers have an ability to adapt to change and identify opportunities in environments of change. This seems reasonable, as designers need change to have opportunities to design new solutions. They can also make changes or improvements to a situation of an identified need. In the first case, they are responding to change, and in the second, they are helping to create change.

Technological advances, both in applications for everyday life and for design process and education, constitute an important driver of change.

The advent of powerful three-dimensional computer aided design (CAD) and better access to a range of rapid prototyping technology have had significant impacts on design practice. For example, on-site rapid prototyping can allow for exploration and testing of a number of possible solutions, whereas in the past costs of such development would have been prohibitive. As the output technology such as rapid prototyping or 3D printing becomes more affordable and accessible for students, institutions and businesses alike, the ability to truly rapid prototype concepts and test and evaluate them will become increasingly possible.

Developments such as CAD and CAM are obvious technological impacts on designers’ work, but the designer also has a role in linking technology to users. Designers not only help make technology easier to understand and use, but also use technology to address identified needs of individuals and society. It is important to note that design is not focussed on the use of technology per se: instead the important attribute of design is the ‘ability to connect technical expertise with larger questions of purpose, values and the relationships between means and ends’ (Doordan 2004, p. 352).
Communication and information

Designers need to be skilled at synthesising information into understandable forms – translating or interpreting, simplifying and then communicating, first to themselves and secondly to others. Such skills are of prime importance in problem identification and solutions generation. Translating this information to others through effective communication relies on the designer’s ability to transform the complex and unfamiliar into something more understandable and accessible for non-designers.

Technology has helped designers fulfil this role: for example the visualisation of complex data is a characteristic of graphic design in conveying concepts and information in an easily digestible form (Klanten and Van Heerden 2008). Hans Rosling likewise is expert at communicating complex concepts through data visualisation techniques (ICSID, 2007).

Some authors identify linked themes of design dealing with information and communication of information (Hara 2007, Stappers 2007). Hara notes that many in society can be overwhelmed by the volume of information available and that part of the designers’ role is to assist with this confusion. In a similar vein, Stappers observes design ‘not only provides orientation but also simplifies and renders comprehensible, complex and bewildering masses of data, information structures, processes and objects. Design simplifies the world, making it easier to understand’ (Stappers 2007, p. 209). Likewise Maeda, in comparing art and design, also emphasises the centrality of communication in definitions of design when he states that ‘great art makes you wonder, great design makes things clear’ (Meada 2006, p.70).

Caplan is another author who views the designer as an interpreter and communicator, when he notes that design is ‘a way to build understanding into products and polices’ (Caplan 2006, p. 101).

Stappers (2007) emphasises the iterative and cyclical nature of communication loops. He describes design as creative practice that combines evaluative and deductive thinking using the range of verbal and two- and three-dimensional
visual aids and notations as communication skills in an iterative process ‘of ‘divergent/convergent- generative/evaluative’ reflection (2007, p. 213). In considering how designers are also required to deal with ever-increasing amounts of available information, Stappers notes that ‘designers use a reflection dialogue and multi layered media discourse that are indispensable aspects of the design process’ (Stappers 2007, p. 213).

**User centred approaches**

An important emerging focus in design is the focus on user centred design. Prior to the advent of user centred design, design was seen as occurring in a vacuum, and the process of designing was understood as an individual creative process. Early pioneers of industrial design such as Henry Dreyfuss and Bell Geddes and authors such as Norman transformed this approach, by placing end users of products at the forefront of the design process (Norman 1990). From this perspective, design is understood as the process of identifying problems and needs of users and developing responses to those issues.

User centred design is a major theme in the development of theories and expanded practice of design. For example, making information understandable is related to user centred design because it helps users interface with information, technology, the design process and the final product. This can expand into areas such as experience design, where the psychological aspects are as important as the physical. This area of study considers our emotional and psychological responses to design, and how these interact with the usability and functionality of the product or system.

This understanding of the centrality of users has also changed over time as the definition of the concept has been progressively broadened. Current definitions of users include the whole spectrum of those who interact with the product – for example, those who manufacture and dispose of products are also included in this scope. Usability studies now consider the way different people interact with products over the entire life cycle of that product.
A theme that emerged at the 2007 ICSID conference in San Francisco was the proposition of three categories of design:

- **Design for** – doing it for people
- **Design with** – user centre designed
- **Design by** – the future, where people will design their own products (ICSID 2007)

Under this model, earlier approaches to design were based on the designer having control of the process and end users having to accept whatever they were given. Current approaches to design are those which strive to bring all users to centre stage in the design process, to ensure the end product meets the range of needs which users have. The third stage contemplates a future where users have far greater control over the products they use. This process has been described as the democratisation of design, where the locus of control moves beyond the minority, that is designers, to the majority, that is non-designers (Hippel 2005, Nussbaum 2007).

### Problem and need identification

Design is often seen as ‘solving problems’ and although this is not incorrect it does not cover the wider definitions of design that have been discussed here. Design is not just about solving the problem but identifying the problem. Problem identification is not a passive process but requires a range of skills including keen and active observation and is closely linked with user centred approaches discussed above. Such processes include user trials and design ethnography observational studies of people interacting with problems and systems. As Hara suggests, design, at least in part, is ‘the occupation of straining our ears and eyes to discover new questions from the midst of the everyday life’ (Hara 2007, p. 436).

Problem identification is closely linked to understanding, determining and addressing a need: although how ‘need’ is applied in this context is mutable. For example Campos argues that while designers previously focussed on developing basic products in response to population demands for labour
saving devices, the balance of discerning needs has shifted from the consumer to the designer. It is now the designer who is better positioned to discern the potential applications of high technology, with little input from consumers (Campos 2006). While some would see this as over-stating the significance of the designer, Campos justifies his position by reasoning that the designer’s ability to imagine the use of future technology is beyond that of the everyday consumer.

**Social responsibility**

Many people are increasingly concerned about the environmental, social and equity impacts of consumerism, product obsolescence and fashion-driven disposability of products. This is reflected in the range of publications, books, peer reviewed journals and general mass media addressing issues of social responsibility. These include the 1980s seminal work of Victor Papanec regarding environmental awareness and designers’ accountability (1985) as well as the more recent writings of Tony Fry (2009) which advocate a greater emphasis on designers influencing change for improved outcomes in environmental and other social responsibilities.

In this context, social responsibility is seen as including sustainability, environmental concerns and consumer safety. The development of such an agenda can be seen in design practice with the publication of IDEO’s ‘design for social impact’ (IDEO 2008) - a ‘how to’ guide for designers to become involved in socially responsible projects.

Some approaches consider that designers, at least in the past, were part of the problem. If design consists of nothing more than helping produce the consumption fuelled, newer, more desirable version of what we already have, perhaps it does nothing more than drive a fashion of disposability. The theme of being ‘part of the solution not part of the problem’ was evident at the ICSID 2007 conference. (ICSID 2007)

Others see the designer’s unique blend of skills as essential to respond to the global challenges we face. Press and Cooper also argue for a future which
‘connects design thinking and activity with social welfare and justice’ (Press and Cooper 2003, p. 198).

**Future possible**

Another related aspect of design which has been investigated by authors in the process of defining design is that of the future, the unknown and the possible – not that which is already in existence.

While the communication of existing knowledge is important, some authors have gone a step beyond this and discussed the need to focus on the unknown. For example, Japanese designer and academic Hara introduces the idea of the discovery of the unknown. He writes ‘It is possible to communicate not by ‘making known’ but by making understood how little we know? If we can recognise that we know so little, a method for finding out how little we know will become clear as well.’ (Hara 2007, p. 376). Hara refers to this concept as ‘exformation’ and making the world ‘unknown’.

The concept of design being about the future and future possibilities is a consistent theme amongst authors of design theory. Design makes a distinction between itself and, for example, science. In this understanding, design is concerned with investigating and designing the future while on the other hand science is investigating what has been, or currently exists. As Jonas explains, ‘Design is about what is NOT (yet)’ (Jonas 2007, p. 200). Archer also discusses the designer’s role in conceptualising possible futures:

> inquiries that could inform design practices would have to start by acknowledging that design is concerned with how we want to live in the future worlds....At any one moment in time, these futures reside in narratives that are sufficiently compelling to coordinate the stakeholders in these futures and encourage them to do their best to make them real (Archer 2007, p. 75).

**Conclusion to Understanding Design**

In the preceding sections I outlined the complexities involved in defining the scope and role of design. The demise of domestic manufacturing precipitated the spread of design thinking beyond traditional DFM applications, resulting in
diversification to such an extent to make boundary setting problematic. Professional organisations and writers have responded by developing concepts of design which can be ‘content free’, and which reflect the emergence of more integrated and holistic approaches such as user centred design. While this adaptability, responsiveness and flexibility has positive aspects, the lack of consensus on fundamental issues gives rise to a cascading series of related problems.

At a basic level the lack of a clear and accepted definition of design limits the development of theoretical understandings. For example, Love feels that without a clear definition of design it is unlikely ‘that any substantive, coherent and unified body of theory can be developed in a situation where the most important core concepts are indeterminate’ (2002 p.355).

The same ambiguities of scope and role undermine the profile and identity attached to the profession. If those within the profession cannot agree on these issues, it is not surprising that non-designers struggle to grasp the potential contribution design approaches can offer. Some authors identify this barrier as a key reason to clarify and understand what designers do. As Doordan argues, ‘we need a narrative conversation that is a description of continuous effort to engage, refine and amplify our understanding of what we do’ (Doordan 2004 p. 78). Lacking exclusive professional accreditation in a way analogous to architects, designers themselves often do not share a sense of belonging to a specific profession.

An increasing mismatch between graduate and employer expectations also stems from these uncertainties. For example a graduate may believe they have the knowledge and skills to contribute to overall product design but is employed as a draftsperson detailing individual components of the product. In such situations, the graduate may feel dissatisfied and frustrated with their limited role, while the employer may be taken aback by the graduate’s desire to have an input perceived as beyond their assigned role.
From a design education perspective, the most significant impact is the debate concerning the content of design curriculums. As theorists have struggled to define the essential defining attributes of design, what designers do in practice has continued to evolve. Both the theoretical and the practical continually interact, and the outcome is shifting aims for the skills needed by today’s design students to equip them as designers in the future. As design educators, we continually need to be informed by the debate and emerging trends as each new generation finds answers to the question of ‘what is design?’

The next section focuses on the discussion of what is to be taught and how it should be taught.

**Design Education**

As outlined in the previous section, the literature reflects considerable discussion of evolving understandings of definitions and attributes of design and the role of the designer. This section builds on this discussion by considering its ramifications for design curriculum: first, what should the next generation of designers be taught, and secondly, how should this educative process best be undertaken?

**The content of design education: what should be taught?**

As the roles of designers have continued to expand, the issue of what material should be included in undergraduate degree courses has been the subject of debate within the profession.

An understanding of the definition of design knowledge is considered fundamental to the development of a design education. Kwon poses the questions ‘What is design knowledge? How does one come to know and understand design? How shall we decide what to teach?’ (Kwon 2007, p.1). Kwon suggests reviewing the basics of design knowledge and learning
processes as a starting point for addressing these questions. To do this he recommends a consideration of the epistemology for design education and contemporary pedagogy for new design learning.

ICSID (cited in Yang, et al. 2005, p. 158) suggested that: ‘a comprehensive ID education program should at least educate students in three categories of competency: generic attributes-problem solving, communication skills, and adaptability to rapid changes’.

Donald Norman in his Core 77 essay ‘design education brilliance without substance’, outlines his perspectives on design education stating that

.... "today design is more than appearance, design is about interaction, about strategy and about services. Designers change social behavior. So shouldn’t designers understand the fundamental principles of human and social interaction, of how to assess the validity of a claim? The designer’s role is not easy; in addition to their traditional design skills, they must now be expert at human behavior as well as understand how to deploy new technologies emerging from the rapid advances in computers and communication, materials and sensors, actuators and displays. (Norman 2011)

With all these new and additional responsibilities for designers, he feels design educations needs to address these changes and not be so defence about taking on change in design education

The implications of such theoretical discussions may be difficult to apply in practice. While recognising the potential breadth of scope and being theoretically free to set their own course content, decisions about course content must be made within external realities and finite resources. The broader university and funding environment influences design-specific choices: pragmatic considerations of staff capabilities and preferences, quantum of contact hours and available resources (including studio, computer and other technologies) must be balanced with drivers of course reputation and appeal to prospective students.

External agents, such as professional representative bodies and current employers, also seek to influence course content from different perspectives. This can be done informally through personal contacts between academics and
those working in design practice or more formally through university-initiated course consultative processes. In contrast to some of the conceptual discussions outlined above on the need to broaden undergraduate design education, some professional bodies appear to give precedence to achieving competence in the skills and knowledge needed for currently available employment (Trathen and Varadarajan, 2009). Universities also need to consider whether an alternative curriculum should be provided that endeavours to meet broader societal needs beyond the confines of a marketing-led design for manufacture focus.

In short, choices must be made and priorities must be set: it is not possible to cover all potentially important subjects to an equal depth within a 3-year undergraduate degree course. The extent to which course content has responded to the significant shifts in design practice, and how the process of course renewal can be improved, is largely the focus of this research.

Based on the expanded and expanding definition of what designers do or must know the questions becomes what to teach or what should students learn? Should students endeavour to learn all possible knowledge or to learn strategies to acquire up-to-date information when needed, and how to apply this knowledge in meaningful ways?

There are different views about the extent to which design education should produce generalists or specialists. The application of the generalist approach could be likened to the outcome of a liberal arts graduate, while the specialist approach could see design being taught as a postgraduate specialisation, to be taken after attaining an undergraduate liberal arts degree.

The need for breadth of understanding is reflected by authors such as Boyle, who argues:

*All forms of scholarship require a broad intellectual foundation. To prepare adequately the coming generation of scholars, we must ensure the quality of both their undergraduate and graduate education. Simply stated, tomorrow’s scholars be liberally educated. They must think creatively, communicate effectively, and have the capacity and the inclination to place ideas in the larger context.* (Boyer 1990, p. 65).
This argument, while applicable to all forms of academic endeavour, is particularly relevant to the education of industrial designers who, to be successful need to be creative, to effectively communicate their ideas, and understand their role and the outcomes of the work in the wider world context. The notion of design as a basis for a liberal education also arises in the design education literature (Buchanan 1998, Nussbaum 2007, Bill 2004).

There is acknowledgment that designers need to be more than expert in only one area. Buchanan states that to be effective designers need to have a broad base and ‘be familiar with the basic concepts and methods of the natural sciences and engineering, the social and behavioural sciences, and fine arts and humanities’ (Buchanan 2001, p. 24). Buchanan calls this ‘a specialised knowledge with a wide perspective’ (Buchanan 2001, p. 24).

The design firm IDEO describes the same concept as the need for designers to be educated as ‘T’ designers ‘not just ‘I’ shaped designers. The ‘I’ shaped designer has a deep and narrow professional expertise but the ‘T’ designer combines this deep expertise with broad interdisciplinary empathy (Burns and Ingram 2004). Design is seen as having the potential to be the catalyst between various disciplines and technical areas and to apply and integrate this knowledge in tangible applications (Buchanan 1998).

In considering design research and traditional research methods and their application in postgraduate and undergraduate design education, some authors have questioned whether the aim of design education is to train for a specialist professional design career or to ‘educate students that can apply design thinking outside of the discipline?’ And therefore ‘will design research require a separate pedagogic model to cater to its objectives? (Yee, et al. 2007, p. 5).

**The process of design education**

Given the state of flux of design parameters and attributes potentially considered core to design which may be identified as necessary to a design curriculum, what are the implications for how design should be taught? To investigate this issue, I discuss below four attributes identified as significant in
this process: communication and technology, creativity, interdisciplinary and user centred. Other relevant attributes are revealed later in the thesis as an outcome of the iterative process of developing my research approach, the subsequent interview analysis and development of models of design practice and education I then examine how this discussion may be applied to the question of how design should be taught.

**Communication and technology**

Communication is seen as a key attribute of design, and has multiple applications – between designers, as they explain, test and develop their thinking; between designers and other professions, as they participate in collaborative projects, and between designers and the users and stakeholders throughout the design process. Effective communication is essential in all contexts.

Communication and visualisation of ideas and solutions is critical to success as a designer. Some form of visual material often supports written and verbal presentation or communication. Visual materials can include two or three dimensional representations, scale or full size mock-ups, and virtual or real working models.

Effective communication involves a level of skill acquisition and mastery across a range of professional settings. Such skill acquisition within design education course is time-consuming, and the proportion of contact hours allocated to this area requires careful consideration.

The priority attached to various types of communication skills is further complicated in the current context of rapid change and technological advancement: this environment impacts on design education at a number of levels.

Technology can make some skills redundant overnight. For example, detailed scale plans which, in the past required a skilled draftsperson working with specialised tools, can in some cases now be accomplished by amateurs with freely available software.
While new technologies can make some skills obsolete, others require the development of new skills, or at least the adaptation of existing skills to the new environment. Some adaptations are relatively simple. For instance, drawing skills, which remain essential design communication tools, are today likely to be assisted with the use of linked drawing tablet technology and appropriate software (Olofsson 2005; Skaggs 2005). Other adaptations involve greater investments of resources: time devoted to particular skill development, as well as additional funding in software or hardware capacity. For example teaching competence in the CAD and rapid prototyping technologies which have revolutionised the work of industrial designers requires investment in computer labs, specialised equipment for students and appropriately skilled teachers. New software and technology advances continually proliferate: however not all will stand the test of time. Given the finite teaching and funding resources of design courses, choices between emerging technologies must be made despite these uncertainties.

Authors such as Buchanan emphasise that in the climate of rapid technological change, designers need to learn to adapt to this change by the understanding of inquiry based design process (Buchanan 2001). Kwon also discusses change and how the learning of design needs to incorporate the educating of students to be flexible and to adapt to change (Kwon 2007). Likewise Friedman notes there is a change from the ‘craft skills and professional knowledge’ (Friedman 2000, p. 17) and that ‘intelligent’ designers incorporate these other and wider areas of knowledge and understanding into their practice.

There are some authors such as Yang, You et al who feel that technology is developing and changing so rapidly that ‘design educators are not able to predict the possibilities of technology’ (Yang, et al. 2005, p. 175). In this understanding, required and learnt skills are also constantly changing to the extent that the only constant aspect of industrial design education is the design process. This needs to be emphasised along with the new knowledge and skills to be able to contribute to the solution of new but not yet identified problems.
In addition to issues relating to skills prioritisation and teaching, the expansion and improvement of digital communications technology has also lead to the application of online learning tools in tertiary design education settings. Some of these take the role of administration and information sharing, while others facilitate networking between individuals and groups. These tools become fundamental in not only a design student’s understanding of technology but also the understanding of design process within their discipline area.

**Creativity**

Creativity is another attribute often identified as an integral part of being a designer, and in the design education world it is a valued if not always understood concept. Creativity is considered a core element of a designer’s practice and therefore an important element within education. The need to see creativity as a learnt ability within education has been championed by people such as Sir Ken Robinson (Robinson 2006). The concepts of risk and play fall under the heading of creative activities a designer requires to develop ways to identify problems, and to develop ideas and solutions.

Creativity is also an acknowledged component of the concept of value adding and thinking smarter for economies such as Australia, which compete with emerging economies. Creativity is the ‘extra magical ingredient’ (Bill 2004) and is a proven component in developing an ability to compete in the world economy. Design and creativity are intrinsically linked and together they are being recognised as key to the development of innovative ideas and solutions.

Creativity is therefore regarded by some authors as a required component of a design education (Solomonides and Reid 2007). Solomonides and Reid propose that for students to be truly engaged in a creative design educational environment, they must both see the benefit of, and be deeply involved in, the process. A deep understanding of one’s own field is also considered an asset to team-based creativity: Marc Tucker (cited in Zec in 2077) states that:
One thing we know about creativity is that it typically occurs when people who have mastered two or more quite different fields use the framework in one to think afresh about the other’ (Zec 2007, p. 65).

Play and risk are important components of creative exploration and of learning design process. In The Art of Innovation, Tom Kelly describes how risk and play are integral to the processes and success of IDEO as a consulting design company (Kelly 2001). Kelly describes how IDEO explicitly encourages play as part of the creative design process, and thereby creates an atmosphere where staff naturally take chances and solve problems. Designers could stumble, as long as they fell forward. They articulated the practice of rapid prototyping: which enables the making, playing, exploring and experimenting with ideas and forms to create creative solutions. In other words, the approach was to ‘have a go’ and ‘take a risk’ to investigate the possibilities of a proposal. This play within teams allows a freedom which enhances and facilitates exploration.

The literature logically includes discussions of risk taking being able to be incorporated in design education theory and application. For example, Ehmann states that:

An emphasis on process supports learning for understanding and has the potential to encourage independence, risk-taking and discovery, rather than work that is aimed ‘to please the teacher’ (Ehmann 2004, p. 3).

The encouragement of risk taking within the design process as part of a design education model depends at least in part on the way students are assessed. Issues related to assessment are addressed in the final section of this chapter dealing with the practice of teaching and how to teach.

**Interdisciplinary collaboration**

The next attribute examined is that of interdisciplinary collaboration. Interdisciplinary and collaborative modes of working are critical to design practice, and as such, must be acknowledged in design education. As in the design practice section, the issues of collaboration and interdisciplinary team work arises as key themes in the design education literature. For example some feel that interdisciplinary studies are important but that not many schools
are engaged with this focus or exposure of working with disciplines outside design (Yang, et al. 2005). Collaboration is also seen as a key theme of curriculum review and design in industrial design education (Kwon 2007).

Placement of interdisciplinary collaboration in undergraduate courses should be carefully considered. Such collaboration cannot effectively occur until a student has developed sufficient knowledge about their discipline to make an informed contribution to the interdisciplinary group. Therefore early in undergraduate studies is not appropriate, even when the student may be enrolled in different discipline courses, because discipline specific skills, knowledge and approaches have yet to be taught.

**User-centred approach**

The final component seen as central to design practice and education is that of a user centred approach. A key aspect for design education is the ability and importance of being able to identify needs or the problems for designers to investigate and solve. This has come from a more developed focus on user centred approaches. Such a user centred approach includes factors ranging from basic physical and physiological ergonomic/human factors criteria to more developed understandings of psychological, social science and anthropological aspects of users of products and services.

If design education is moving away from simply skills and knowledge acquisition and towards the communication of solutions and the solving of problems, then, as authors such as Solomonides and Reid suggest, design is not so much an ability to solve a problem but to identify one (Solomonides and Reid 2007). This, the authors propose, has ‘implications for design education as it implies that assessment methods should give students an opportunity to first find a problem and then solve it.’ (Solomonides and Reid 2007, p. 1).

This problem identification component within a design process is emphasised in aspects of IDEO (Kelly 2001), Jane Fulton Suri 2007 ICSID conference discussions (ICSID 2007) and Kees Dorst (Dorst 2008). New paradigms of problem identification and industrial design application include aspects of
social responsibility and environmental sustainability. For example, if
designers are privileged by their capacity to influence and design for the future,
they also have social and ethical responsibilities.

As highlighted in the review of design definitions, the topic of future thinking
arises in design education. Evans and Sommerville suggest that design
education has to respond to the acknowledged changing world (including
technology and user needs, wants and desires) by being part of ‘shaping
change’ (Evans and Sommerville 2007). These authors identify a range of
techniques and approaches that can be applied by designers as part of a
designing the future approach for example; forecasting and back-casting, trend
exploration and morphological analysis.

**How should design be taught?**

The previous section discussed current issues to be considered in the
determination of course content – that is, what should be taught. In this
section I turn attention to process – that is, how to teach. Different
approaches to addressing the question of how teachers should teach the
material often arise from different understandings of the student – their
intrinsic abilities and how they best learn. This section considers how changes
in the understanding of the role of design impact on how to teach, from the
perspective of models of education theory. The role of assessment is analysed
as a particular case in point of how such changes must be operationalised in
the practice of teaching.

**Models of education theory**

Changing views of how to teach can be considered in light of models of
education theory described by Coker. In citing Fox, Coker notes the various
models of general education theory (Coker 2004). She describes these as:

- Transfer theory often depends on lecture style education,
  transferring information from the lecturer to the student
• **Moulding theory** assumes the student needs to be formed into a preconceived image of an ideal professional; this approach is similar to apprenticeship training

• **Growth theory** supports the reflective self-discovery of the learner who directs the outcomes toward self-chosen goals by identifying their own needs

• **Travelling theory** assumes the learner and teacher are co-participants in education, travelling a terrain familiar to the teacher, but their shared experience is unique. (Coker 2004).

These theories of education are evident in various approaches to design education. Historically, design education can be seen to most closely aligned with transfer and moulding theories. Traditional design education practice took a ‘master-apprentice’ approach to the delivery and learning of skills and knowledge related to the practice of the profession. Such models, developed in particular in the Bauhaus methodology, still exist in some form in many educational institutions. These approaches tend to focus on skills acquisition as opposed to theoretical understanding.

Contemporary understandings of design education are shifting towards a closer relationship with growth and travelling theories, in response to changes in understandings of the role of the designer.

The master-apprentice model is linked to earlier understandings of the designer as a single creative genius, operating on innate creativity and flashes of brilliance. Contemporary approaches emphasise the designer’s role as communicator, articulator, and facilitator tend towards a corresponding educative processes emphasising communication and collaboration, along with process skills such as user-centred design approaches.

These issues of skills vs knowledge are often raised in the context of profession orientated design degrees. The question can be asked: does the teaching of design within the context of an applied professional career mean being educated or trained? Cross believes that there is less distinction between
education and training in professional educational contexts such as industrial
design and notes there is ‘a lack of understanding and articulation of the
principles of design education’ (Cross 2007, p. 45). He proposes the
development of new theories and innovative design education based on
experimental research using aspects of theories from education, psychology,
cognitive science and design research. This view represents a recognition that
design education needs to move beyond the traditional models of teaching
design and base these decisions on research that can inform the practice of
teaching design and assessing what students have learnt.

Student-centred learning is becoming more prevalent in the literature. Yang
et al argue for a review of traditional studio based assessable components
158). They also cite Branham stating that ‘student-centred learning will
become the dominant pedagogy in design education in the first quarter of the
21st century’ and that ‘encouraging students to self-direct their own learning
and choose their desired design role as a career would be a better approach to
design education’ (Yang, et al. 2005, p. 176). We are well into the first quarter
of the 21st century and it is worth investigating the implications and or
successes of any such approaches.

Assessment

Assessment can be seen as a yardstick of changing approaches to educative
models. If new ways of teaching are required, a reconsideration of how design
students and their learning are assessed is also needed.

An issue that arises in this process is the extent to which assessment should
privilege process or outcomes of design work. While assessment for design
education usually includes both outcome and process driven components, it
tends to prioritise outcomes (the finished design product) over processes (the
methodologies used to arrive at the product). As Ehmann notes, this may be
due to the fact that teaching staff often find assessing design outcome easier
than assessing design process, and students also seem to prefer this approach.
Likewise a focus on outcomes ‘encourages students to believe that learning is a passive process’, and in this scenario students see outcomes-based assessment as easier to do well by ascertaining what pleases the teaching staff (Ehmann 2004, p. 4).

Coker sees well-designed assessment as a tool to ‘encourage’ learning rather than only the outcome of various tasks (Coker 2004). She identifies the benefits of students coming together at presentations where they are able to compare themselves to others in the class and therefore assess the projects and personal performance at a range of levels. Students may also use journals to allow them to document their progress, process and thoughts.

The journal is seen as a means for a student to record all aspects of a particular project or linked projects within an overall curriculum. Hardy (2004) identifies the range of process skills which the use of journals promote, including the questioning approach needed for problem identification and generation of solutions.

Use of a journal also allows assessors to engage somewhat with how a student went about the learning. Ehmann also discuss the use of a journal to assess student learning via process and outcomes. Concentrating on the process components of the project the author believes will encourage ‘independence, risk taking and discovery’ (Ehmann 2004, p. 4).

The key attribute of assessment is to encourage students to become active learners (Ehmann 2004). This focus on process over outcome is considered an aspect of student centred learning but staff and students need to be informed and understand these methods and reasoning.

**Practice of Teaching**

The previous sections examined both the content and process of design education: that is, what should be taught, and how it should be taught. This
section discusses the concept of the practice of teaching, and how this approach may offer a way forward in improving design education.

Just as teachers need to assess what the students have learnt or provide the means for students to also assess themselves, they must also acquire the methods and motivation to assess their own practice of teaching. I explore the current thinking about the scholarship of teaching below.

Scholarship of teaching

Scholarship of teaching is the need to encourage and improve student learning and understanding across a wider range of types of student learners with a range of abilities, levels of engagement, academic orientation and learning related activity scale (Biggs 2003). By giving this legitimacy to teaching, better teaching can be developed, encouraged and rewarded. As defined by Biggs, ‘good teaching is getting most students to use higher cognitive level processes that the more academic students use spontaneously’ (Biggs 2003, p. 5).

Why is scholarship of teaching seen as important? In Teaching for Quality Learning at University, Biggs describes the scholarship of teaching as a necessary part of legitimising teaching as a scholarly activity (Biggs 2003). In citing Schon, Trigwell, Martin et al note that the ‘practice of teaching must be seen as giving rise to new knowledge’ (Trigwell, et al. 2000, p. 2).

Theories of practice of teaching

Conceptualisations of the scholarship of teaching have been developed over the past two decades. Bass (Bass 1999) and (Trigwell, et al. 2000) discuss the foundations of the movement from initial publication of Boyer’s (1990) Scholarship Reconsidered and other work conducted by the Carnegie project at the Carnegie Foundation for the Advancement of Teaching, and later significant work by Glassick, Huber and Maeroff 1997 ‘Scholarship reassessed’. The recognition and prioritisation of the scholarship of teaching has had some traction in Australian organisations. For example the recently renamed ‘Carrick Institute’ supports innovation in teaching and an increasing focus is
emerging within universities’ centres for learning and teaching, including the International Society for the Scholarship of Teaching and Learning (http://www.issotl.org/) and The Australian Scholarship of Teaching Project. (http://www.itl.usyd.edu.au/projects/scholarshipproject/introduction.htm)

Scholarship of teaching has a process and context comparable to other research paradigms including questions, methods, results and analysis. In citing Shulman, Bass notes this process consists of ‘five elements; vision, design, interactions, outcomes and analysis’ (Bass 1999, p. 2).

Trigwell, et al propose that university lecturers and academic staff not only require a grasp of the literature and associated theory of teaching and learning in their own discipline, they must also ‘be able to collect and present rigorous evidence of their effectiveness, from these perspectives, as teachers. In turn this involves reflection, inquiry, evaluating, documenting and communicating’ (Trigwell, et al. 2000, p. 156). In citing Laurillard, Bass makes a similar point, noting that to be successful, teachers must ground their discipline-specific expertise on sound knowledge of how this material is understood by others, particularly students (Bass 1999). This can limit misinterpretation by students and help contextualise discipline-based information.

Authors also acknowledge that teaching and scholarship of teaching is a process undertaken over a period of time and which is incrementally accrued via practice and experience. There must also be a context: an understanding of the pedagogy of the relevant discipline. This understanding can be categorised as two forms of didactic knowledge (Biggs 2003). The first form is based on knowledge of educational theory drawn from the extensive research-based literature. The second form is based on one’s own experience as a teacher where one forms a personal implicit theory of teaching. The combination of these two forms of knowledge and understanding provides opportunities to improve teaching in a university setting.

Boyer identifies four elements of scholarship within academic practice:
- ‘the scholarship of discovery - close to the old idea of research;
- the scholarship of integration - which involves making connections across the disciplines and placing the specialties in larger context;
- the scholarship of application - which goes beyond the application of research and develops a vital interaction and so informs the other; and
- the scholarship of teaching - which both educates and entices future scholars by communicating the beauty and enlightenment at the heart of significant knowledge’. (Boyer 1990 n. p.)

Boyer sees teaching as a significant and linked component of an academic’s work profile. He suggests that scholarship and on-going learning is not confined to traditional notions of research but is integral to all areas of an academic’s practice (Trigwell, et al. 2000).

In discussing Boyer’s position, Trigwell et al conclude that scholarship of teaching is ‘to make transparent how we make learning possible’ (Trigwell, et al. 2000, p. 1). They link this to Ramsden’s premise that student learning is at the centre of an educational model where ‘the aim of teaching is simple: It is to make student learning possible’ (Trigwell, et al. 2000, p. 1).

Bass contextualises scholarship of teaching by comparing it to an understanding of research: that is, as an issue that requires a problem which drives a process of investigation (Bass 1999). In this approach, the problematisation of teaching or the proposing of problems of teaching is at the core of further developments in the scholarship of teaching. As Bass argues:

*The movement for scholarship of teaching seeks first and foremost to legitimate a new set of questions as intellectual problems. Arriving there, the discourse surrounding the scholarship of teaching can begin to chart what is yet uncharted terrain, a landscape that will feature the convergence of disciplinary knowledge, pedagogical practice, evidence of learning and theories of learning and cognition.*
Ultimately it will be a discourse based on disciplinary protocols of investigative practice calibrated to the idioms of a particular campus and institutional cultures (Bass 1999, p. 8).

Therefore, how is the practice of teaching and the evidence of learning worthy of problem identification and investigation? Also how are these investigations and analyses represented and communicated within the context of one’s professional arena? For one’s work to be considered scholarship of teaching, it must be tested, evaluated, criticised and shared with peers (Shulman, cited in Bass 1999, p. 2) This then allows scholarship of teaching to be acknowledged as adding to the knowledge of a particular discipline or field.

Action research and reflection in action is informed by knowledge of discipline and knowledge of pedagogy of the discipline. Friedman asserts that scholarship of teaching is more than simply reflection on one’s teaching as this alone will not generate significant knowledge (2000). Instead it is the additional aspects of experience, inquiry and theorising that will generate knowledge from such reflection. In discussing Schön and Dewey’s critically reflective pedagogy of discipline, Friedman emphasises that such reflection ‘is not a form of silent meditation on work. In reflective practice, reflection takes the form of bringing unconscious patterns and tacit understandings to conscious understandings through articulation’ (Friedman 2000, p. 13). Like design problems, the process and challenges within a scholarship of teaching context themselves should be identified and investigated, not just solved.

Techniques for drawing out learnings from self-reflective practice have been discussed by a number of authors (Watson and Wilcox 2000; Downton 2003; Tonkinwise 2004). While these techniques have sometimes been developed for purposes such as practice, learning and knowledge creation, they are also applicable to the progression of scholarship of teaching.

Watson and Wilcox (2000) note the relevance of reflection for practitioners, as it supports lifelong learning throughout one’s career, not simply when a student. They explain that ‘reflection is particularly valued in the context of professional life, because of its potential to enhance learning while we are in
In the spirit of hypomnemata, professionals may select and collect in one place, artefacts from their work (handouts, abstracts, letters, proposals, workshop outlines, overheads video clips etc) which represent the daily conventions of their practice, and then, in the hermeneutic tradition, do a close reading (or annotation) of them. This method of reflecting on practice can open up new ways of engaging in practice or lead to a confirmation of current practices. The interruption afforded by the method promotes a deeper understanding of self and meaning inherent in particular practices. (Watson and Wilcox, 2000, p. 64).

In considering reflection in the context of scholarship of teaching Biggs explains that reflection is not what is - as would be the case of viewing yourself in a mirror - but what might be (2003). He also argues that teachers need to have an explicit theory of teaching, not just the theories of their own specific discipline before they can successfully reflect on their own teaching. This reflection can take place as ‘action research’ or action learning where the teaching and learning of the teacher is the focus.

As well as reflective practice, scholarship of teaching can also be informed by qualitative or quantitative research methods drawn from interviews, formative assessment, examination results, student evaluations and peer review (Bass 1999).

**Practice of teaching conclusion**

Theory development and investigation of the practice of teaching is important in this context, as it offers potential to address the disconnect between evolving breadth of practice and the limitations of current course content and
delivery. Practice of teaching approaches, with their emphasis on critical self-reflection and continuous improvement, may be the best way forward in managing and responding to the ambiguities and current state of flux in roles and demarcations of designers. This self-reflection needs to go beyond the confines of the university, where it is often restricted to immediate student feedback. It should also consider the longer term experiences of graduates and the extent to which design courses have equipped them to meet the challenges of an evolving jobs market. This research, which investigates career paths of graduates from the University of Canberra, is a step towards this process. In order to have value, the findings of such investigations should inform ongoing teaching improvements and course redesign, and ultimately contribute to our understanding of the pedagogy of the design discipline.

Conclusion

Discussion in the literature has firstly been examined from the perspective of forming an understanding of what is meant by design. This is a critical foundation, as a shared sense of scope is the first step in moving forward. The major theme in considering how design is interpreted is that of change. A range of authors agree that the parameters, expectations and context for design are all subject to rapid transformation. Design, once confined to subject specific areas such as manufacture, has morphed and diversified over the past two decades.

The literature reflects an increasing recognition that the process of design is equally as important as the outcome. One of the major changes has been the emergence of users as central to the design process, and a consequent evolution in the designer’s role as identifier of problems and interpreter of design opportunities.

As the role of design has expanded, and as its sphere of influence has grown, expectations and responsibilities of design, designers and design educators
have correspondingly increased. For example, as environmental concerns and awareness of the impact of our consumerist society increase, design has the opportunity to be seen as part of the solution, rather than part of the problem.

Areas of specialised expertise, such as experience design and service design, have arisen and been accorded new names. Are these in fact novel approaches, or are they rather outcomes of amalgamations of pre-existing disciplines of design? In these emerging areas, where skills, technology and knowledge from a number of design areas are blended in new, interdisciplinary ways, the boundaries of ‘what is design?’ are again called into question.

Against this backdrop, identifying the design problems and responsibilities of design practitioners of the future becomes both increasingly urgent and increasingly complex. How then are we to go about developing a design curriculum for the future?

The literature has highlighted and substantiated a wide field of research needs and opportunities required for the renewal and development of the future of design education. Whatever the answers, it is clear that education methods and approaches must continue to privilege new design paradigms if they are to remain relevant. Universities and academe generally will require a commitment to ongoing research and cycles of continuous improvement if their own methods of teaching are to keep pace with the needs of designers of the future.

In an increasingly fluid environment, possibly the best skill a designer can develop is the ability to adapt to complexity and change, and therefore for their education it is to equip them to be able to ‘learn how to learn’.

The key issues discussed here inform the work set out in later chapters. The current tensions in design demarcation for example informed the a priori category of identity used in the stages of coding of interview data, while the discussions regarding prioritisation of teaching styles and content provided the basis of the models developed to explain past, current and future design practice and education.
The next chapter details the research questions that arose from the content of this chapter and the role I play as a design educator. It also details the approach and method use to explore the questions and the methods of analysis employed.
3. Approach and method
3. Approach and method

Introduction

This chapter sets out the foundations of my research approach, the design and development of the research and the specific methods for data collection and analysis used in the investigation of the rich qualitative data achieved through interviewing graduates. While the context elements of Australian manufacturing are discussed in detail in Chapter 6, I here describe this context briefly in order to provide the rationale for the development of my research questions.

The approach includes the context in which this research project resides, the development of the research questions, my role as the researcher in this qualitative research based investigation and the human ethics approval for conducting this type of work. The design and development of the interviews is also detailed and the Adopter, Adapter, Departer (AAD) model is introduced as the basis for the descriptors and categorisation of post-graduation locals and trajectories.

I then set out how these elements informed the approach I took to the research conducted throughout this thesis, which employed semi-structured in-depth interviews as my primary method for conducting my field work and data collection.
The next section describes the data collection. This includes the method of selecting the number and type of participants, the interview questions and process of conducting the in depth semi structured interviews.

Finally, the analysis processes and methodologies are detailed, along with the development of the various techniques for the iterative processes of data analysis including computer software and more manual non computer based tools for aiding in the coding and analysis of the information rich, interview data. This formed the basis and description of an audit trail of my research process.

**Approach**

**Context**

As discussed in the literature review, industrial design is currently in a state of flux both nationally and internationally. With the significant shift from locally-based to off-shore manufacturing and an increasingly globalised economy, the traditional focus of Australian ‘industrial design’ on design for manufacture is clearly waning. What is less certain is the future: what are the emerging forms of practice which may represent the future ecology of Australian industrial design?

My initial question was: ‘Does industrial design have a future in Australia?’ and my response is that there is and must be such a future. Graduates of Australian industrial design education, whether working here or overseas, are giving rise to new forms of practice through their lived experience. These new forms need to be identified, nurtured, and recognised as a uniquely Australian response to current issues and challenges. Such analysis goes beyond established high profile designers such as Marc Newson – though such role models are important. There are, however, other less obvious models of practice which reflect the breadth of industrial design application. Designers
are applying their skills in a diverse range of settings, such as service design in the public sector; and in novel ways of engaging with new technologies, such as bespoke practitioners.

Australian design has a short history since colonisation and is unsurprisingly a little immature in comparison to the development of design in Europe and America. Industrial design has to respond to a range of forces and reinvent itself to stay relevant and make positive contributions to society beyond just domestic products.

The traditional academic literature presents a mostly international (European and North American focused) view on design and industrial design. The literature review focused on design research and design thinking, including design for economic benefit to business or design and sustainability. However to what extent are such analytic frameworks applicable to the Australian context? What is actually happening in Australian design; how do Australian designers develop their practice; and what is the potential of Australian industrial design?

In reflecting on these issues, my colleagues and I have noted the significant debates regarding the roles and types of practice of industrial design and the blurring of roles between design disciplines (Trathen and Varadarajan 2009). The changing environment means industrial design is in the midst of ‘a major paradigm shift that has resulted from expanding its influence to new subject matter and exploring new ways to think about the modern life’ (Kwon 2007 cited in Trathen and Varadarajan 2009). Within this context, design practitioners, design theorists and design educators are all engaged in international discourse about the role of design education (Friedman 2000; Buchanan 2001; Yang, et al. 2005; Yee, et al. 2007; Zec 2007). While viewpoints differ, there is an acknowledgment that design education requires restructuring to accommodate and reflect changes including those brought about by the changing contexts of the global economy. The role Australian industrial design and design and manufacturing play now and in the future is one of the issues in this mix. However a collective comprehension of the
understandings of industrial design’s new dimensions is yet to develop (Trathen and Varadarajan 2009).

As noted in Chapter 2, defining design, let alone industrial design, is a fraught exercise. The lack of shared terminology is highlighted when designers from different countries come together at international conferences, and debate the evolving definitions of the role and scope of industrial design (Engineering and Product Design Education, UK, 2009). As discussed in more detail in Chapter 5, the underlying lack of consensus on scope, role and terminology is manifested in apparently simple issues, such as: where in the university setting should industrial design be located? It is currently seen alongside architecture, engineering or even more traditional art school areas. Perhaps more importantly, ill-defined parameters make research grants and processes, and employment studies, problematic even a simple enumeration of industrial design jobs in Australia is impossible if the boundaries of the profession are unclear.

Australia has a strong tradition of economic growth and prosperity based on its natural resources above and below ground, and a correspondingly low priority attached to ‘value adding’. Despite this context, and its small numbers compared to more definitive professions of architecture and graphic design, Australian industrial design has maintained a level of standing and status. Industrial design graduates successfully find employment in a range of different creative and economic areas (Higgs P, Cunningham S et al. 2005; Victorian Government 2008). Whether the growth of non-manufacturing applications of industrial design expertise is driven by necessity or desire, the shift away from traditional paradigms is incontrovertible (Trathen and Varadarajan 2009).

**Research questions**

The context outlined above prompted a series of questions about the future of Australian industrial design, and consequently how educators need to influence and adapt to that future. Investigating the real world experience of industrial designers appeared the most effective way of exploring these questions. I
wanted to investigate the extent to which the challenges and experiences of recent industrial design graduates reflected the issues debated in the literature, and how these findings could illuminate possible forthcoming directions for the practice and education of industrial designers into the future.

As both an alumnus and long-term industrial design educator at the University of Canberra, I was uniquely placed to investigate these questions from the perspective of recent industrial design graduates from the University of Canberra. Through investigating and analysing their experiences and practice by in-depth semi-structured interviews, I aimed to address the following research questions:

- What changes are revealed in graduates’ practice as they have moved through their careers?
- How do graduates’ experiences confirm known forms of industrial design practice and illuminate emerging forms of practice?
- What emerging forms of practice may represent the future ecology of Australian industrial design?
- To what extent can these provide guidance to industrial design and design education?

The foundation of the research was drawn from phenomenological approaches. Within phenomenology, researchers aim to find meaning in humans’ perceptions of their own lives. As noted by Liamputtong, ‘phenomenology attempts to generate knowledge about how individuals experience things…in relation to a concept or phenomenon of interest’ (Liamputtong 2009, p. 5) This approach takes a necessarily individual perspective, and strives to share these perspectives. Therefore qualitative methods, in particular in-depth interviews, are effective phenomenological methods of inquiry.
While qualitative approaches are inherently context-specific and broader interpretation or generalisability of findings must be carefully considered (Marchand 2008), the nature of the research questions, which focus on motivations and experiences, dictated such methods. As noted by King and Horrocks, methodological limitations of qualitative methods ‘are mediated by the opportunity to potentially retain original and fresh perspectives that may have been inaccessible within a more standardised approach’ (King and Horrocks 2010, p. 21).

I considered a range of qualitative methods when deciding how best to achieve the research aim of gaining in-depth knowledge of industrial design graduates of the University of Canberra and how they negotiated their practices. I initially considered the idea of an immersive technique of observation within people’s practice and questioning them in that setting. However the diversity of participants’ location (both national and international) made this method unviable. In addition my questions were not primarily focused on issues regarding participants interaction with the built world around them. Instead, the focus was on reflections upon their practice narratives.

Other techniques considered included questionnaires and surveys; however the aim of maximising rich and in-depth data prompted the selection of semi-structured interviews as the most appropriate technique (Laurel 2003). Semi-structured interviews provide a sound approach for more in-depth understandings of people’s lives and experiences. According to Kvale and Brinkman ‘Knowledge is constructed in the interview (Kvale and Brinkmann 2009, p. 2) and:

*It should not be forgotten that interviews are particularly well suited for studying peoples’ understandings of the meanings in their lived world, describing their experiences and self-understanding, clarifying and elaborating their own perspective on their lived world* (Kvale and Brinkmann 2009, p. 116)
Such a semi-structured interview approach lends itself to phenomenological approaches, as it tends ‘to be closer to life…[and] the everyday life situations and experiences’ (Sarantakos 2005, p. 279).

The interviews provided the opportunity to identify and analyse in depth understandings of the various types of practice and the influence they exert on a group of University of Canberra graduates of industrial design.

The effectiveness of semi-structured interviews in gaining meaningful data is closely linked to the extent to which the interviewer succeeds in creating and maintaining affinity and understanding with interview participants. As noted by King and Horrocks, ‘building rapport with your participant is widely seen as a key ingredient in successful qualitative interviewing…rapport is essentially about trust enabling the participant to feel comfortable in opening up to you’ (King and Horrocks 2010, p. 48).

My relationships with industrial design graduates span many years, and have incorporated roles in which I have been advisor, educator, mentor and peer for many of them. Both current and past students have commented upon my approachability, and this has been reflected in relationships which have continued long past graduation. These relationships ensured I was singularly well-placed to make best use of semi-structured interviews with graduates as my primary research methodology. As noted by Sarantakos ‘Interviewers who are similar in background to the respondents not only makes (sic) entry into the respondents world easier but also promotes (sic) trust, mutual understanding and therefore reduces (sic) bias and distortion’ (Sarantakos. 2005, p. 291).

**The role of the researcher**

An important aspect of such qualitative research methodologies is the acknowledgment and explanation of the role of the researcher. As noted by King and Horrocks ‘the researcher is required to communicate the perspective from which they approach their work’ (King and Horrocks 2010, p 21).
As an industrial design academic at the University of Canberra who gained my industrial design qualifications from this institution in the 1980’s, I have a long affiliation with the institution. I spent 12 years as a practising industrial designer outside Canberra and before entering academia. This knowledge and history of industrial design at University of Canberra gave me a unique perspective to conduct this research. In addition my ongoing rapport with students and graduates enabled a methodology dependent on strong communication links.

My role is documented throughout the process via a ‘thick descriptive and audit trail’ of what I did and how this aimed to produce the highest quality of analysis (King and Horrocks 2010, p. 158). My approach to the research was an iterative process of refinement and reflection of research questions: it is through this process that subsequent possible meanings were generated.

**Ethics**

Ethics approval for the research was gained through standard RMIT ethics approval processes. Introduction of participants to the project was by email. Standardised information about the research was provided to all prospective participants and informed consent to participate was obtained on that basis of plain language statement and informed consent forms. The signed consent forms were received as part of the consent of each participant agreeing to be interviewed.

**Designing the interviews**

The data collection phase of this thesis constituted investigation of a group of University of Canberra industrial design graduates. Participants were invited to take part in an audio only recorded semi-structured interview. Several lines of inquiry were investigated to elicit information regarding their entry into the industrial design course and their work history since graduation. These
included questions on their choice of industrial design as an undergraduate degree, additional qualifications since graduation, career moves, views about industrial design and its future and aspects of current or past practice.

This section details the qualitative design approach, research methods and processes used in this data collection phase and the variety of tools and techniques employed, their selection and justification. Details of the method of recruitment and selection of participants are also included.

Why interview graduates?

The project aimed to explore the development of the University of Canberra graduate industrial designer in a period of significant change where there is much discussion about the current and future role of industrial design. The project investigated the narratives of these graduates as developed through semi-structured interviews, providing the opportunity to identify and analyse the application of industrial design and industrial design education to the range of possible employment and professional sectors of practice.

The results from this investigation and analysis contribute to the knowledge base of industrial design practice. The research has implications and benefits for both Australia design practice and design education.

The AAD model

Prior to conducting the interviews, I developed a categorisation of post-graduation descriptors to explain and explore the career trajectories of industrial design graduates. I needed a model to explain the various categories and a finite number of three was determined to be the most suitable in describing this situation.

These categories were based on the combination of my previous research (Trathen, et al. 2007; Trathen and Varadarajan 2009), my on-going analysis of current debates in both the literature and in vivo discussions at for example, design conferences (Futureground Melbourne 2004, DesignX Toronto 2005, ICSID conferences San Francisco 2007 and Singapore 2009, ConnectEd
Sydney 2007 and 2010, Cumulus 38° South 2009, Engineering and Product Design Education Brighton 2009) and my on-going connection with students and alumni of the University of Canberra industrial design course. The three categories developed by means of this process were:

- **Industrial design Adopters:** Those graduates that take on traditional industrial design practice which has a focus on Design for Manufacture (DFM). This includes roles as an in-house industrial designer, employment by a consultant industrial design firm, and working as sole practitioner for the design and manufacture of mass manufactured products.

- **Industrial design Adapters:** Those graduates that have been required to adapt to changing circumstances and who have successfully modified their practice or developed new forms of practice beyond DFM in response to changed environments.

- **Industrial design Departers:** Those graduates that have left the field entirely after working at some stage in industrial design related employment post-graduation

I drew participants from all three categories to ensure I gained input from ‘people with different vantage points’ (Rubin 2005, p. 67).

Figure 3.1: Adopter-Adapter-Departer model represents the model of ‘Adopters’, ‘Adapters’ and ‘Departers’ in diagrammatic form. In this model, the horizontal (X axis) represents the passage of time from pre-university, through an industrial design education and then post-graduation and the development of each career, including one each of an Adopter, Adapter and Departer. The vertical (Y axis) represents the relative distance from adoptive, or traditional, forms of practice. Dark gray represents Adopter, orange: Adapter and light blue: Departer. The model represents a simplified version of three individuals, represented by three gray ellipses on the left. These three individuals almost merge as they go through their industrial design education.
with an adoptive DFM focus. Then upon graduation, their practices begin to diverge. Some, the Adopters, continue on with a DFM practice; others, the Adapters, modify their practice and start to move away from traditional DFM approaches; finally the Departers leave the profession completely.

![Diagram of Adopter-Adapter-Departer model](image)

**Figure 3.1: Adopter-Adapter-Departer model**

## Method

### Selection of participants

The selection of participants was an important component of the interview based research method. The participants were selected using purposive, or strategic, sampling techniques (Mason 2002, p. 123; Sarantakos. 2005; Stern and Poor 2011). In this process, selection was not random but was instead
based on careful consideration of desired attributes. As noted by Rubin, selection of participants must enable all relevant perspectives to be considered:

_You need to select interviewees who collectively present an overall view of your topic, while at the same time choosing them with sufficiently different backgrounds to provide convincing evidence for the theory you are trying to build’_ (Rubin 2005, p. 70)

On this basis, I developed a set of required perspectives and attributes and used these to develop an interviewee selection matrix. Elements considered in the selection of participants comprised:

- conformity with research parameters
- knowledge of subject area
- diversity of perspective.

**Conformity with research parameters**

This research project was not an exploration of the career trajectories of all graduates of the University of Canberra industrial design course. Rather it specifically aimed to investigate the post-graduation Australian-based industrial design practice of graduates of the University of Canberra four-year industrial design bachelor’s degree between 1996 and 2006. The majority of Australian Industrial design degrees were 4 years duration during this time. A period of comparative staff and core course stability at the University of Canberra. Approximately 285 students graduated in this period. I had begun employment at the University of Canberra in 1993 and therefore my knowledge of the potential participants was established.

The selected time period therefore met the criteria of the potential interviewees being knowledgeable about the area of topic. (Rubin 2005). Further refinement of the selection involved the range and length of experience in their working life to bring their first-hand experience to the interview and be able to discuss the issues. The 2006 graduates had at least 5 years’ experience at time of the interviews.
In addition the investigation focused on certain categories of graduates (Adopter, Adapter, Departer) to distil experiences and narratives that could lead to a better understanding of Australian industrial design.

This time period provided a sufficiently diverse group of potential participants to cover the three identified categories (adopter, adapter and departer) with appropriate career experience and/or professional practice.

The following categories of industrial design graduates were excluded:

- Those with nil post-graduation industrial design employment. This group was considered out of scope for this research as they had not participated in industrial design practice.
- Teachers. A number of graduates of University of Canberra industrial design proceed to complete a graduate diploma in education and gain employment in secondary schools with design and technology education. Although they represent an important component of design education and industrial design education has informed their teaching practice, members of this group were excluded from the potential interviewee list as they do not fit the scope of this study.
- International students. International students that graduated from the University of Canberra but subsequently returned to their native country after graduation were not included in the study as they have made minimal contribution to the practice of industrial design in Australia.

**Knowledgeable**

All graduates who conformed to the research parameters were potentially eligible interview participants. The next consideration was the extent to which potential participants were knowledgeable about the issues I wished to investigate. This consideration was of primary importance: as noted by Rubin, ‘Finding interviewees with first-hand experience is critical in making your results convincing’ (Rubin 2005, p. 65). The validity of research findings is fundamentally linked to the relevant knowledge of participants who become the essential data sources for subsequent investigation. This point was
highlighted by Rubin ‘Interviews gain credibility when your conversational partners are experienced and have knowledge about the research problem’ (Rubin 2005, p. 64). In the process of participant selection, I considered the range and length of experience in candidates’ working lives, in order to ensure they were equipped to bring their first-hand experience to the interview and to discuss the issues under investigation.

Diversity

The selection of interviewees was designed to ensure that a variety of perspectives could be explored. Rubin stated that:

> Credibility is enhanced when you have interviewed individuals who reflect a variety of perspectives. The philosophy of responsive interviewing suggests that reality is complex; to accurately portray that complexity, you need to gather contradictory or overlapping perceptions and nuanced understandings that different individuals hold (Rubin 2005, p. 67).

It is only when a diversity of views is included that more complete understandings can be developed, as it is ‘combined views from different areas of practice or backgrounds [that] present a balanced perspective and overall picture’ (Rubin 2005, p. 64).

In this case, diversity of views and understandings of industrial design and practice were needed. This included consideration of participants’ type and length of work experience, geographical location, further education or other forms of exposure to changing environments of industrial design practice. For example, I wanted to include perspectives of graduates working in local, national and international settings; and to include three areas of practice: private sector, public sector and self-employed. Information regarding type of employment is omitted in order to protect the identities of participants. A further important consideration was to find participants with appropriate career experience and/or professional practice from each of the three identified categories, Adopter, Adapter and Departer. Gender was also a consideration. In the time period under investigation, women comprised
approximately 20% of graduates. In order to reflect this overall composition, four of the twelve participants selected were female.

**Process**

I used my networks and personal knowledge of the alumni of the industrial design graduates University of Canberra during the time of my employment. All participants were my students at some time and often during their degree studies. Potential participants drawn from the considerations above were initially approached by email and all alumni invited to participate agreed to do so.

**Respondents interviewed**

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Gender</th>
<th>Location</th>
<th>Original descriptor</th>
<th>Year of graduation range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charles</td>
<td>M</td>
<td>Local</td>
<td>Adapter</td>
<td>1995-1998</td>
</tr>
<tr>
<td>Kim</td>
<td>F</td>
<td>Local</td>
<td>Adapter</td>
<td>2003-2006</td>
</tr>
<tr>
<td>Fiona</td>
<td>F</td>
<td>National</td>
<td>Adapter</td>
<td>1999-2002</td>
</tr>
<tr>
<td>Jane</td>
<td>F</td>
<td>International</td>
<td>Adapter</td>
<td>1999-2002</td>
</tr>
<tr>
<td>Aiden</td>
<td>M</td>
<td>International</td>
<td>Adopter</td>
<td>1995-1998</td>
</tr>
<tr>
<td>Ted</td>
<td>M</td>
<td>International</td>
<td>Adopter</td>
<td>2003-2006</td>
</tr>
<tr>
<td>Lucy</td>
<td>F</td>
<td>National</td>
<td>Adopter</td>
<td>2003-2006</td>
</tr>
<tr>
<td>Paul</td>
<td>M</td>
<td>Local</td>
<td>Adopter</td>
<td>1999-2002</td>
</tr>
<tr>
<td>Nigel</td>
<td>M</td>
<td>National</td>
<td>Adopter</td>
<td>1999-2002</td>
</tr>
<tr>
<td>Todd</td>
<td>M</td>
<td>Local</td>
<td>Departer</td>
<td>1995-1998</td>
</tr>
<tr>
<td>Geoff</td>
<td>M</td>
<td>National</td>
<td>Departer</td>
<td>1995-1998</td>
</tr>
</tbody>
</table>

*Table 3.1 Table of respondent attributes*
**Pseudonyms and avatars**

Each interviewee was allocated a pseudonym for the reasons of ethical considerations of anonymity (King and Horrocks 2010). They were also allocated an avatar (untrue image) to represent them, help bring them to life and assist in the visualisation of various aspects of the analysis. The photostock images are approved for use by FreeDigitalPhotos.net

![Allocated pseudonyms and avatars](image-url)
Number of participants and data saturation

The target number of interviewees was initially set at around 9–12 as common qualitative interview studies are around 5–25 participants (Kvale and Brinkmann 2009). This target indicated an estimated 3–4 people from each of the category headings of ‘Adopter’ ‘Adapter’ and ‘Departer’. This also allowed for a cross section of geographical locations and experiences to cover the three areas of local, national and international. Local respondents were working in Canberra, national respondents were located in an Australian state capital city, and international respondents were living and working overseas. I also selected participants from the range of graduating years of relevance to this study (1995 to 2006). This number also allowed for the three areas of practice: private sector, public sector or operating their own business to be considered a selection criterion. The list of attributes of each respondent is shown in Table 3.1. Year of graduation is spread across four years to prevent possible identification of interview participants.

The literature indicates the importance of avoiding over-sampling, and ensuring that sufficient time is allocated to analysis of findings in comparison to data collection. As noted by Kvale and Brinkman, some research studies ‘would have benefited from having fewer interviews ... and instead having taken more time to prepare the interviews and analyse them’ (Kvale and Brinkmann 2009, p. 113).

The issue of the ideal number of participants also relates to data saturation: the point at which no new information is obtained from further interviews. Rubin notes that greater numbers are not necessarily of primary importance; rather it is gathering sufficient diversity of input that is most critical.

You do not need vast number of interviewees to increase the credibility of your findings; instead you have to be able to convince readers that you have interviewed sufficient to obtain different points of views and that when brought together these understandings provide a complete picture. You might want to double check certain key conclusions, but once your double checking verifies your initial findings, you can stop (Rubin 2005, p. 68).
Question design
As noted above, semi-structured open-ended interview questions were most appropriate for my research. This technique encouraged participants to provide narrative responses to the general list of questions and themes that had been established prior to the interview. It also provided sufficient flexibility to respond to the answers and circumstances of the interviewee. I could probe further if required to add depth to the interview through elaboration, clarification and completion (King and Horrocks 2010).

Development of interview questions was based on predetermined themes (via template analysis) developed from the review of literature and linked to the participant’s role in relation to the model of Adopter, Adapter or Departer, and were designed to address the research questions around the identified themes. The questions were developed to:

- investigate projections about future roles for design professions
- confirm existing known forms of industrial design practice and discover new forms of practice
- develop a better understanding of the contribution industrial design makes to national and global society and industry
- provide possible guidance to the development of industrial design and design education
- understand the implications for Australian industrial design practice in a global economy and for the development of the education of industrial designers.

The key themes for interview discussions included: entry pathways into industrial design, practice trajectories post-graduation, current modes of practice, potential futures of industrial design, the contribution of industrial design and industrial design education. A interview guide is included (see Appendix 1).
The interview process

Once the questions and areas of investigation were refined, I developed a check list or interview guide to ensure all aspects were covered in each interview. The interview guide had a general structure, but the semi-structured approach used meant the order was not strictly adhered to as I wanted the conversation to flow as freely as possible. I encouraged a narrative style when it suited the interviewee (King and Horrocks 2010). I found that interviewees would often cover certain questions’ content in their answers to other questions, so some questions did not need to be specifically asked. At other times I was also able to explore further a particular avenue of enquiry.

This flexibility allowed me to respond to topics expressed at any given time and pursue lines of conversation as necessary. To ensure all topics were covered at some point throughout the interview, I checked off the question topics on a new printed question guide I had for each interview.

I began each interview with an introduction designed to build rapport and relax the participant. In this introduction I thanked participants for agreeing to participate and verified informed consent forms. I also talked about the recording equipment and technique as a starting point. The first question was then covered, allowing respondents to speak freely about their entry pathway into industrial design from their first thoughts about studying industrial design to their graduation. As outlined above, subsequent ordering of questions was flexible.

Conduct of the interviews

I conducted a face-to-face pilot interview to review the protocols, questions, style, recording equipment and transcription service. The pilot interview was successful and little change was made to the final interview structure and questions. I also received positive feedback regarding the interview style and questions.
Due to the varied geographical locations of the interviewees three interview techniques were allowed for; face-to-face interviews where convenient for those based in Canberra; by video and audio Skype for those based outside Canberra; or by phone if required. Of the 12 interviews conducted, one was by phone, four were face to face and seven were conducted by video Skype. This last technique proved a very acceptable method mimicking many of the positive aspects of a face-to-face interview. Such technology enables the researcher ‘to hold an intimate conversation with someone the other side of the world’ (King and Horrocks 2010, p. 84). When using video Skype I used desk top mounted speakers to obtain the best sound quality required for later transcription and review.

**Recording equipment**

All audio of interviews was recorded. I used two pieces of recording equipment during the interviews, a one gigabyte Livescribe Pulse pen (a hand held device which records and links both audio and hand-written notations and sketches) and an Ipod digital recorder. The Ipod was a backup recording device for the pulse pen in case of equipment failure. These both provided good quality recordings for necessary later transcription (King and Horrocks 2010). The backup device was required in one interview and proved invaluable as the pulse pen recording device was accidently turned off during the interview and I therefore made use of the backup recording. This equipment and recording methods were fully explained to the interviewees.

**Analysis**

The data generated from the 12 interviews consisted of:

- pulse pen notations made during the interview (as noted above the Pulse pen was also used to audio-record the interview)
- interview summaries written immediately after the completion of each interview
- audio recordings and transcriptions
- journal of on-going reflective observations.

There are various views on how best to consider the interview material. Some authors, such as Liamputtong, view a verbatim transcript of the material as a necessary preparatory step to enable data analysis (Liamputtong 2009). Others, however, suggest that, given the time and expense involved, full transcriptions are not necessary – working directly with the audio is sufficient (Kvale and Brinkmann 2009). I decided upon a combined method: that is, I obtained and used a full verbatim transcript, and I also immersed myself in the audio being facilitated by the use of the pulse pen software. This approach allowed for a more flexible and informative process.

**Pulse pen notations**

I made notes during the interview using the pulse pen: I marked key words or themes and noted questions for further investigation in a mind map (see Figure 3.3: example of a mind map generated during interview). The pulse pen technology was of great benefit (www.livescribe.com). It links written notations, key words and visual representations of relationships recorded on the pulse pen paper with the audio recording made by the pulse pen. Post interview, this allowed me to touch the pulse pen to the relevant term or notation on the page and immediately access the linked point in time of the audio recording. I often found this useful to review and reconsider thoughts and reflections, and check this back in comparison with the audio. The portability and easy access of the pulse pen meant that I could do this at any time, even if I did not have immediate access to a computer.
Interview summary

On completion of each interview, I prepared one-to two-page summaries. These summaries included the time, location and format of the interview, as well as key thoughts that arose from the interview, main points made by the interviewee and my initial reactions to them, as well as ideas for future consideration.
**Audio recordings and transcriptions**

While some authors recommend that investigators should undertake the process of transcription themselves in order to best immerse themselves in the data (Liamputtong 2009), others consider the significant time involved in transcriptions should be balanced with competing priorities for the researcher (King and Horrocks 2010).

I decided to have the audio files of the 12 interviews transcribed by a professional transcription service. This enabled me to spend more time on re-reading and re-listening to the content to fully familiarise myself with this data. I liaised with the transcription service to ensure the transcript produced was fully verbatim, including non-verbal content such as laughter, as this is all important material (Liamputtong 2009). The presentation of the transcript included time codes allocated to each new page, providing quick reference back to the original digital audio files. I reviewed the transcriptions for accuracy and added or clarified missing text after re-listening to the audio. The links by means of time codes and the pulse pen also enabled me to return easily to the audio to check or verify the context, tone or nuance of the conversation.

**Journal**

I kept a working journal of my daily insights, altered understandings and reflections on the research process, in order to maximise research outcomes (Kvale and Brinkmann 2009). This journal took a number of forms over the period of research but in essence it was a recording of ideas, thoughts and visualisations as I worked through the project. When conducting and reviewing the interview content, the journal became a way of recording and developing my ideas while also ‘providing the research with a frame for understanding and reflecting on the process and changes in knowledge production throughout an interview enquiry’ (Kvale and Brinkmann 2009, p. 113).
Data analysis processes

This section provides an audit trail documenting the development of my thinking throughout the research as part of a rich descriptive method. It describes both:

- the theoretical basis for the methodologies I used in analysing the data
- how I applied these methodologies in practice.

Theoretical basis for data analysis methodology

My data analysis processes were based on established processes for analysing findings from qualitative research techniques (Bazeley 2007; King and Horrocks 2010). I followed a three-phase process of qualitative analysis which was undertaken iteratively rather than sequentially. These comprised descriptive coding, interpretive coding and the development of overarching themes.

The development of themes was based on mixed methods or styles of approach to the thematic analysis, including some top down as well as bottom up generation of groupings and using a combination of thematic, a priori, matrix and template approaches (King and Horrocks 2010).

King and Horrocks describe template analysis as allowing ‘the researcher to define some themes in advance of the analysis process – referred to as a priori themes’ (King and Horrocks 2010, p. 168). I was also aware of the danger posed by developing too many a priori themes, as this can lead to a blinkered approach to themes emerging from the data. Instead, my approach used some a priori themes, while also then adding and removing others throughout the iterative process of reflection and refinement.

The technique of identifying some themes in advance of the interview analysis ‘is well suited to studies which have particular theoretical or applied concerns that need to be incorporated into the analysis’ (King and Horrocks 2010,
This fits well as, in my research; the research questions have both theoretical and applied applications.

This template analysis method, with its mix of both top down and bottom up processes, recognised that descriptive and interpretive coding are not entirely separate entities. The coding structure themes developed prior to the interviews were initially added to during the first phases of coding and then refined during the iterative analysis process of reflection and refinement, before reaching a point where it could ‘serve as a basis for building an account of the findings’ (King and Horrocks 2010, p. 166).

Additionally, template analysis approaches are highly effective for the analysis of interviews of an hour’s duration, with a sample of 10–25 respondents (King and Horrocks 2010). They are also recommended for situations where respondents are grouped into two or more categories. In my case, I identified these groups under the established headings of Adapter, Adopter, Departer.

My analysis represents an explorative process, with each new step dependent on the results of the previous iterative step of analysis. My understandings and application of these steps in the context of my research is set out below.

**Application of data analysis methodology**

**Development of a priori codes**

My role as an industrial design educator, my immersion in the field of industrial design practice and my investigation of the literature around industrial design enabled me to develop tentative themes that I considered in framing interview questions. These themes were then used to establish initial descriptive coding of interview responses. Such a priori themes were added to as others arose in on-going analysis and reflection. For example, my personal summaries of interviews and the notes and mind maps made during the interviews assisted in the development of descriptive coding of the interviews. My iterative research
approach enabled, and required, a process of analysing the content of the interviews and comparing and contrasting these data with aspects highlighted in the literature and likewise with my experience in the practice of Canberra educated industrial designers.

**Techniques for data analysis**

I used a range of techniques in first immersing myself in, and secondly making sense of, the data. These were both software and non-software based. I explored various approaches and returned to them from different perspectives over time as I coded and recoded the data, grouped and regrouped emerging issues and gradually moved towards an understanding of the key themes emerging.

The process was exploratory, investigative and iterative, rather than sequential or once only. Throughout the process, I continually developed and referred back to my journal. The techniques included:

- mind mapping
- affinity diagrams
- tag clouds
- NVivo ‘tree’ and matrices.

**Mind mapping**

As noted above, I used the pulse pen to produce initial mind maps during each interview. Mind maps enable the representation of key elements and relationships between them (see Figure 3.3: example of a mind map generated during interview). These early stage mind maps helped to navigate the data and to return to review specific elements of the audio as needed.
Affinity diagrams

Affinity diagrams are a simple method of ordering and re-ordering ideas or pieces of data. This approach records single pieces of information on separate cards, thereby enabling them to be arranged and rearranged to reflect different understandings of how the information should be interpreted. I applied the affinity diagram approach by recording ideas and data items on separate re-adhesive Post-It notes and attaching them to a large white board. This low-technology approach had several benefits: it was a tangible and easily navigable representation of my emerging thoughts from the data, it allowed new ideas and data items to be added quickly, and it facilitated moving and re-grouping individual Post-It notes, enabling me to investigate different patterns, categories and relationships over time. Using the affinity diagram board helped with both initial and later stages of coding. For illustrative purposes, an example of one stage of my Post It note affinity diagram is shown below.

Figure 3.4 Initial themes arrived at from first pass of personal notes.
For clarity, the written content of the items included in this affinity diagram are:

Rapid prototyping, professionalism, change practice, no jobs, passion, internships, generic design, future, education, materials and processes, problem solving, the economy, architecture, user focus, off shore, make a difference, Melbourne, lack of manufacturing, CAD, CAD monkey, eco environmental, engineering, policy, interconnected (small and inbred) government, confidence, making, strategic design, service design, business acumen, independent designers, office relationships, interaction, social change, democratization, visualisation, China, teams, identity (European), identity (Australia), furniture, interdisciplinary.

**Tag clouds**

Tag clouds are visual representations of text which show relative priority, occurrence or use by font size or colour. Tag clouds can be used to show frequency and importance of emerging themes, and provide a visual interpretation of the data at a broad brush level. At a glance, we can see what material is emerging as informing potential issues and their relative importance. Tag clouds are helpful to quickly communicate these themes in presentations to others, and as road maps to the researcher, providing a guide without being mired in the detail of numbers. Once I had undertaken initial coding of the data, I was able to put the codes into the form of tag clouds. I prepared a tag cloud for each individual interview and also for the interviews as a group. One example of a tag cloud developed for an individual interview is shown at Figure 3.5.
Early approaches involved development of a ‘tree’ within NVivo: the tree is a representation of categories and subcategories emerging from the data (see Figure 3.6). This development process was based on mind maps generated as part of the ongoing development and exploration of the literature and my thoughts.
After a ‘tree’ was developed, and initial coding was complete, I also produced matrices within the Nvivo software environment. Like tag clouds, matrices are used to show the frequency and importance of themes emerging. However they present data differently from tag clouds in that they show numeric frequencies, thereby providing a greater level of detail and actual numeric values for further analysis. Initially, all component codes were entered into a table against each of the respondents. Matrix tables were developed showing
frequencies of coding instances for each code against each individual. This assisted not only in visualising the patterns of coding within and across the 12 coded individual interviews but also provided easily accessible frequency results. An example matrix is included at Table 3.2.

Table 3.2  Extract of early iteration of matrix descriptive codes for each interview respondent

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
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<tr>
<td>1: DESIGN PRACTICE</td>
<td>10</td>
<td>9</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>14</td>
<td>12</td>
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<td>5</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>1</td>
<td>17</td>
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<td>0</td>
<td>4</td>
<td>4</td>
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<td>9: Office relationships</td>
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<td>10: Passion</td>
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<td>11: Collaboration</td>
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Coding

As noted earlier, I used the techniques described above to immerse myself in the data and begin to explore its meanings. These explorations took place through iterative and layered coding processes. The data suggested a range of descriptive codes, and all relevant data from the transcripts were categorised according to those codes. In addition, the data were considered in comparison to the original a priori themes to discern relationships. The same process was then used to examine and re-examine emerging trends in the codes, and to group them over time to form interpretive codes. Further reflection and analysis led to the discernment of overarching themes.

Descriptive coding

In this phase, the first step was full immersion in the data in order to achieve thorough familiarity. To achieve this, I read the interview transcripts several times and also listened to the audio recordings to detect the intonation, pauses and other cues to meaning which may have been incompletely reflected in the verbatim transcripts. Once I felt fully comfortable with the content of the interview transcripts. I began to highlight and comment upon items of relevance and interest to my investigation of industrial design practice. I used software based tools including NVivo and computer generated tag clouds to both manage and help interpret the data. Within NVivo I initially used a text search option to locate occurrences of words that had been identified as possible recurring patterns or possible descriptive themes. These word selections were derived from the initial broad brush affinity diagram approach based on the notes taken during the interview and from summaries I drafted immediately after the completion of each interview. I applied the search function to a range of text including the interview transcripts and my mind maps and notes, as well as my analysis of the literature review components.
Descriptive codes were formed by:

- grouping similar responses together, observing repetition and patterns emerging from the data, and searching for material relevant to the research questions
- checking for content which may have been related to the a priori themes: which may have either supported or suggested refinements to those.

I then applied these codes to the data to enable further manipulation by means of tag clouds and matrices.

**Interpretive coding**

The interpretive coding phase involved the ongoing iterative process of grouping and interpreting the meanings of the descriptive codes that were revealed to have common attributes and relationships. This process also involved the reflection and application of my knowledge of the discipline area and then returning to the interview transcripts to clarify content, context and meaning.

**Overarching themes**

The final stage of analysis involved the development, definition and refinement of overarching themes. The themes were developed through both top down testing and application of a priori themes postulated before the analysis began, and by a bottom up process of development based on interview data. The iterative process of developing the themes and analysing their constituent elements highlighted overlaps of content where certain interpretive codes were shared across areas within other major themes, requiring categorisation and re-categorisation as new links and relationships were explored. These were refined and re-interpreted over time and were eventually crystallised into six overarching themes. The relationship between both the component codes and the overall themes is discussed in the next chapter.
Conclusion

This chapter described the overall approach of the research project and the methods used in obtaining and analysing the data. This chapter is significant because it is important to understand the approach, reasoning, iterative process and techniques employed throughout the research project. It provided the evidence and basis for the thick descriptive audit trail mentioned above of what process I used and how I went about this process.

It began by outlining both the research questions and the context in which they were developed. Ethics processes and the role I played as researcher were also outlined. How the research questions and research approach guided my selection of in-depth, semi-structured interviews of graduates as the most appropriate investigatory technique was explained.

This chapter introduced the significant and first knowledge contribution; the model of Adopter, Adapter and Departer as helping to explain the observed categories of industrial design graduates, and outlined how these categories were used in the selection of interview participants. Question design and the conduct of the interviews were described in detail, before I gave a theoretical background to the analytical methods employed. I then described how I applied these methods to the data analysis process, and how iterative and layered approaches eventually distilled overarching themes.

The next chapter details the findings of these approaches, and in particular describes the six overarching themes developed from these processes. It goes on to explain the development of the Thematic Map of Australian Industrial Design Practice which conceptualises the relationship between the themes and their application to industrial design practice.
4. Navigating design: the themes in design practice
4. Navigating design: the themes in design practice

Introduction

This chapter reports the field work findings obtained from the methods described in Chapter 3. As described there, these methods were iterative and interactive, gradually building up and refining categories and analysis of the data (King and Horrocks 2010). These methods were used to analyse the interview transcripts in order to generate, apply and modify descriptive codes.

The chapter works through the development of each of the six themes that emerged from listening to and interpreting the graduate’s responses to the semi-structured interviews. Each of these themes represented my categorisation of what I heard, interpreted and understood from what was being said in the career stories of the graduates. The links between the earlier reviewed literature, the new literature referred to and the interview data are also used to augment and support the development and explanation of each theme.

The themes came from the iterative analysis of the emerging categories and the subsequent unifying concepts within the data, as detailed in the previous chapter. Where there were significant similarities, these descriptive codes were amalgamated into interpretive codes, and finally the interpretive codes were...
grouped into overarching themes. I used themes and diagrammatic representation as a justified way to describe the content of the material I was hearing. In qualitative analysis, the use of themes represent a sound and well founded way to interpret and present the information that I was privileged to hear. (Bazeley 2007, King and Horrocks 2010, Hurberman and Miles 2002, Crotty 1998) The Thematic Map of Australian Industrial Design Practice, as show in Figure 4.1 below, was the diagrammatic and conceptual outcome of this process. This model shows the descriptive and interpretive codes which constitute themes, and the relationships between themes. Within the model the following styles and formats are used:

- Interpretive codes are shown in lower case bold.
- Themes are in upper case.
- The proximity and location of themes in relation to other themes indicates different relationships.

Through a thorough description of these themes I will show how the graduates have found their way through their design practices and careers, where these themes emerge and become apparent during this process of navigation, and how the concept of a resilient adaptive practice begins to take shape.

The themes and component codes are visualised in Thematic Map of Australian Industrial Design Practice to allow for easier communication and understanding of the individual elements and their relationship with each other.

Each categorisation is supported by selected rich and illustrative quotes from the transcribed interview content. The collection of interview data is the primary data source under analysis in this chapter. As such, the illustrative quotes from interview transcripts provide examples of the rich and informative basis for the development of interpretive codes and themes, and for my subsequent development and application of models in Chapters 5 and 6. Some quotes include material which was categorised into only one interpretive code,
while others contain material which can be grouped into a number of interpretive codes. The lengthy responses many interviewees provided demonstrate the relaxed and information-rich environment created for the interviews.

Points to note regarding interview data are these:

- The full text transcriptions are available.
- Names or references to companies and employers in interview responses have been removed to maintain anonymity.
- Omitted text is shown by the symbol [...], inaudible text is shown as [?].

The overarching themes and interpretive codes are:

- Communicator Theme: based on the interpretive codes of Computer Aided Design (CAD), sketching, visualisation and making
- Approach Thinking Theme: based on the interpretive codes of problem identification and solving and user centred design.
- Social Conscience Theme: based on the interpretive codes of environmental change practice and make a difference.
- Facilitator Theme: based on the interpretive codes of innovation, interdisciplinary and teams.
- Mobility Theme: based on the interpretive codes internal and external influences.
- Identity Theme: based on the interpretive codes of profession, personal and Australian.
Graduate journeys

In addition to the description of codes and themes, the data were also used to compile Graduate Journeys. The Graduate Journeys, included at Appendix 2, are narratives encapsulating the personal trajectory of each interview participant. Initiation into industrial design, immediate post-graduation decisions and subsequent career turning points are examined. These narratives offer important insights into how individuals navigate their practice and the AAD model developed in the previous chapter.
The Six Themes

Theme 1 – Communicator Theme

Communicator theme: discussion

The communicator theme describes some of the most important elements of design practice. A fundamental part of the designer’s role is the ability to communicate across a range of modes, to a range of audiences and across different disciplines with varied levels of access to shared language (Caplan 2006). Industrial designers communicate verbally, but perhaps even more important is their non-verbal communication. Pictures, models, diagrams, sketches and prototypes are all potential communication pathways for designers. The skills to produce such pathways form essential elements in the designers’ ‘toolkit’.

The role of the communicator theme is clearly reflected in the interview data. It is evident that the various forms of industrial design communication play an important part within the respondents’ world of practice. Be it in traditional design for manufacture (Adopter), in the transitional roles which cross traditional boundaries (Adapter) or within seemingly unrelated fields beyond design (Departer), the skills of visualisation are applied in a range of diverse situations.

Industrial designers are educated and trained to think, work and communicate in both two and three dimensions including the outcomes of perspective sketches, 3D CAD and the making of models and prototypes as part of a design process or as a final outcome. Two dimensional technical engineering drawings are still used in some aspects of the design development and documentation process. However, many objects are developed in virtual 3D environments as either surface models or as fully parametric files that can be used for rapid prototyping or for the development of tools for mass
production manufacturing. This range of communication skills was evident in the interviews as an important aspect of industrial design practice. The same skills are recognised as essential attributes within the profession of industrial design (Carson and Cameron 1998; Lewis and Bonollo 2002; Yang, et al. 2005).

The communicator theme has links to the themes of both Facilitator and Approach Thinking. The communicator theme highlights the importance of the range of visualisation and making skills which can facilitate information sharing and collaboration across teams: such communication underpins the facilitation role which is later described within the Facilitator theme. In the same way, communication skills are often key to a design thinking approach. The making and visualisation skills of a designer are exemplified by and integral to the problem identification and solving skills which constitute the Approach Thinking theme. For example the act of making or sketching ideas and concepts and developing quick prototypes is a key component of approach thinking. This visualisation helps communicate concepts to others and to one’s self as part of the iterative design process.

The communication theme is comprised of a number of interpretive codes that were applied and later amalgamated to form the overall theme. As shown in Figure 4.2, the communicator theme includes the interpretive codes of making, sketching, visualisation, 3D, CAD and rapid prototyping. Each of these interpretive codes is described below.
Interpretive code (a) i: CAD

Computer Aided Design (CAD) is a fundamental component of many industrial design practices and education programs. I have included it as a component of the communicator theme as it constitutes the most common tool for articulating and sharing design development processes between designers and other disciplines.

CAD is a fundamental communication skill for DFM industrial designers, and generally centres on three-dimensional computer modelling. Different tertiary institutions both in Australia and overseas approach CAD, and its priority relative to other subject areas, in a variety of ways. The University of Canberra industrial design course includes a heavy emphasis on CAD. The learning outcomes involve required knowledge of the application of three-dimensional parametric computer modelling with direct links to mass production manufacturing techniques. The approach taken encompasses CAD both as an in-depth skill and as a particular approach to design and detailing. As taught at the University of Canberra, CAD training has undoubtedly equipped students with a solid grounding in this skill-set, and has provided pathways for students to obtain employment while studying and also after graduation.
Of the twelve interview respondents, 10 raised CAD as an issue within their interviews and all of these described it in relation to industrial design practice and attainment of employment opportunities. Though the link to employment opportunities was consistent, some had positive views while input from others suggested negative connotations about CAD.

Respondents described the role of ‘CAD monkeys’, those people who are hired to work on CAD almost exclusively and who detail either 3D or 2D drawings, in a way similar to a traditional draftsperson. In these roles, most work involves detailing others’ ideas, rather than generating one’s own. Such jobs prompted mixed views from participants. Some graduates were cautious of being pigeon holed in this relatively narrow role, or resented it as it allows only limited scope for demonstrating their full design potential. Others viewed the role as an important entry point into design employment, and valued their skills in CAD as giving them ‘an edge’ in a competitive jobs market.

There were several instances where participants described how their CAD skills had helped them secure design employment. Nigel, Todd, Lucy and Scott reported they had gained employment in industrial design practice based on their abilities in the communications skills of CAD and or sketching. Nigel believed his employment soon after graduating was due to his skills and knowledge of a specific CAD software program; Pro Engineer (Pro E).

Nigel

But the main reason was that I could use Pro-E, … and their university graduates only used Solid Works. So for me that was the main reason I got offered that job was for Pro-E and nothing else, so I was just a good graduate who used Pro-E.

Todd also saw his CAD skills, along with his skills at conceptualising, as being an important contributing factor to his practice soon after graduating.

Todd

..., working with the models and we had to get rapid prototypes done. And so a lot of the things that I got to do, my computer skills were in high demand at this place because at the time CAD CAM was becoming more pervasive.
Certainly they had Pro Engineer where I was, although that wasn’t what I was, and ever was really used to do. I was used mainly for conceptual work.

Aiden agreed that CAD and sketching skills were of paramount importance in gaining an entry level design position. His lack of confidence in these areas impeded him seeking employment in design immediately after graduation.

Aiden

...the way I remember we were taught was if you want to get a job with a design consultancy, you have to be – you have to have skills that they can sell. And what they want is someone who can sketch and someone who can use CAD basically and I didn’t really feel that either of my skills in those areas were(sic) strong enough. But I mean, I’ll come back, that first design job I had, that was a huge steep learning curve. I hadn’t touched computers, really, in 4 years, since I was at uni and it’s always nice in hindsight, but had I known what I was capable of then, I probably would have pushed harder for a design job straight out of uni. I probably would have looked at other alternatives. Maybe even doing what I’m doing now.

Scott entered his first post-graduation job due to his CAD skills but noted he was surprised at the lack of interest in the other aspects of his abilities.

Scott

... I can’t remember whether I applied through an advertisement or anything like that but it was a pretty, in retrospect it was a pretty easy job to get, basically they were looking for someone with Pro-Engineer CAD skills. So I turned up for the interview and the guy that was interviewing basically said here’s a seat, here’s Pro-E, show us what you can do and so that was it, there were hardly any sort of meaningful questions about my capabilities. It was just show us some CAD, so I did that and pretty much on the spot they said great, when can you start?

Lucy also acknowledged the importance of CAD skills in finding work, and used the term ‘CAD monkey’ to describe roles primarily using CAD. For Lucy, a CAD monkey position represented a useful entry level position.

Lucy

Well I had I think three days off since I finished uni before I started work. So I got the job at[…] a couple of months before I finished uni. So pretty much based on the work experience that I’d done there and then just calling them up and saying I’m almost finished, is there any jobs coming? And they
eventually said yes you can have a job as a CAD monkey, so yeah I think I pretty much had three days off, moved down to […] and started working there. And so started off as a CAD monkey, got thrown in the deep end doing some sheet metal.

On the other hand there were some who also actively rejected this aspect and saw ‘CAD monkey’ as a derogatory term: with the role being akin to a slave or at least performing very menial tasks. The term ‘CAD Jockey’ was used by Nigel to describe the same role. In his eyes this referred to a position where one worked under instruction and had limited creative or intellectual input into the design process. He made a connection with CAD being seen as only a component skill of industrial design practice: if other aspects of the industrial design job were removed then the industrial designer became merely a ‘CAD jockey’.

Nigel

... I guess with industrial designers a lot of people think that they're number one thing is to make the form and to really get piece of paper and work on the visual. And if you take that away from a lot of industrial designers, you feel a little bit like you’ve become a CAD jockey or something.

Likewise Kim revealed her concerns about entering a traditional DFM industrial design position. If her other skills and knowledge were not going to be used, she feared being pigeon holed and serving time as a CAD monkey.

Kim

But I think that’s why I didn’t necessarily pursue a design career because I didn’t want to spend five years slaving away at that sort of CAD monkey stage to maybe when I’m 50 get to a point where I can be doing conceptual, you know, that sort of higher level thinking about not necessarily products but using design as a problem-solving tool to address issues.

The discussions regarding CAD and its appropriate place in a design role highlight varying understandings between graduates, and between graduates and employers, about what work, or balance of different types of work, constitutes ‘real’ design work. This type of discussion informed my
development of the Identity theme, and the perceived capabilities of industrial designers.

**Interpretive code (a)ii: sketching**

Although the days of finished colour rendering may be gone, freehand sketching (as distinct from computer-generated images) is still seen as important and valuable as part of a design process associated with industrial design (Olofsson 2005; Skaggs 2005). The ability to sketch provides another important non-verbal communication technique for designers to share ideas, describe details and map out alternatives. Sketching not only assists in communicating with others, it facilitates the design process itself by externalising and articulating the conceptual process with which the designer is engaged.

Eight of the twelve respondents explicitly discussed sketching as a relevant skill and component of design practice. The examples below, drawn from the interviews with Paul, Aiden and Jane, highlight the relevance and application of sketching. Paul noted the persistence of sketching despite the importance of CAD.

*Paul*

*For the sort of things I'm doing less than others, but sketching is still, I don't think a computer will ever replace sketching, basic sketching. Visualisations, renderings, different kettle of fish but basic sketching, yeah, that's something we didn't do enough of. I still do basic sketches today and that's important.*

Aiden referred to the benefits of being able to sketch ideas and details in group situations where he needed to be able to communicate with others.

*Aiden*

*And it's fun in a way, because you often, I often find myself in contractors’ meetings, project meetings, on site and someone will question whether or not you can do what our designing team is and I'm able to stand up and sketch a section of the sign or sketch a footing detail – that I don’t think a graphic designer or an architect would necessarily be able to do.*
Jane spoke of the importance she places on using sketching as part of her practice and design process. She identified sketching as the foremost skill she learnt at university that she uses most in her current role.

Jane

Yeah. I think it's [the skill I learnt at university I use most in my job] definitely sketching. Like sketching and being confident with sketching is like a really good thing because like, that's the most immediate way of getting your ideas on to a piece of paper and being able to visualize it

**Interpretive code (a) iii: Visualisation**

Visualisation is the ability to conceive and understand problems in a visual way. It provides a mode of thinking and communicating, and, like sketching, both helps designers communicate with others and facilitates the design process itself. Sketching is an example of visualisation techniques but there are many others. These include the visualisation of systems, information and other more complex ideas via diagrammatic representations, flow charts, and conceptual models. The development of the Thematic Map of Australian Industrial Design Practice, and other models used in this thesis, are examples of visualisation. The impact of how visualisation can translate complex and specialised knowledge to meaningful information for a wide and varied audience is perhaps epitomised by the work of Hans Rosling (Rosling 2012). Professor Rosling’s presentations of complex demographic data in compelling and accessible visual formats have become a benchmark for visual communication.

Six of the twelve interview participants discussed various aspects of visualisation and design. As noted in the quote from Jane previously, the link between sketching and visualisation is strong and its importance in the design process is central.

Jane

sketching is… the most immediate way of getting your ideas on to a piece of paper and being able to visualise it
Designers are increasingly making use of the variety of software programs designed to facilitate visualisation. These include some graphic design software and mind mapping applications. Kim, for example, referred to other visualisation tools and software she used in her practice.

*Kim*

The things that I have consistently returned to, like being able to use Photoshop, InDesign and Illustrator…

Todd as a ‘departer’ identified the strong links between visualisation, communication and the design process. In discussing his transition into a ‘departer’, he reported that while he was undertaking a new and seemingly unrelated educational qualification he was applying his visualisation techniques and abilities.

*Todd*

And I would model that as flow diagrams and when I went into my exams, I would have about three or four sheets of paper for an open book exam and they would be diagrammatic. And I would have the right bits in the end and I would fly through these things...

The same approach was reported as applicable to his current practice.

Absolutely, it came in left, right and centre because having a reality check on how things really are made, gives you a way of approaching problem solving. I would say that the strongest thing I ever learnt from industrial design was to think outside the box and solve problems. And I have applied the exact same problem solving methodology to any other form of problem. I use it in policy work in the government department that I work now, because I have always been visual in the way that I conceive models and in the way things, even with information and I used it through […] school.

**Interpretive code (a)iv: making**

Making is the production of physical representations of design thought and is a fundamental component of industrial design practice and design thinking. It can include the making of models and prototypes by hand and also by CAD
through the use of a range of additive and subtractive rapid prototyping techniques. Like sketching and CAD, making is a process of visualising concepts and solutions which aids designers themselves, as well as facilitating the communication and testing of ideas with others (Kelly 2001). For this reason, the interpretive code of making is interconnected with the Approach Thinking theme and the concept of ‘make to think’ (W. Burnett, ‘d’ school, personal communication 16th October 2007). This concept articulates the importance of producing made objects in order to develop and apply design thinking. Five graduates referred to making in the context of industrial design either as part of their practice or in the context of industrial design education.

Charles and Nigel used making as part of the design process within the comparatively large design and manufacture firms they worked within. In their experience, the hands-on exploration involved in making is an integral part of the practice of industrial design.

Charles outlined the joy involved in the making aspects of design practice, and noted the importance of being able to hold, view and test a physical artifact as part of the design development process.

Charles

I worked at […] for almost four years, I think it was, which I thoroughly enjoyed as well because of the research and development component. I love that messy stage of design, where you try something and see if it works at all or how well it works and, you know, in that sort of physical context and then reflect on that and modify it, in a design sense, and then go back and make another prototype and check that. You know, that cyclical, intuitive process of design, yeah, that’s really enjoyable for me,..

Nigel referred to the making process used to test and verify concepts and solutions before they were put into production. This hands-on making approach is compared to a theoretical approach that may be employed by engineers in a similar situation.

Nigel

So you become way more of a like, you do most of the engineering yourself like in terms of – and we just do it all by testing, not by FEA [Finite Element Analysis], not by like actually pencilling it down and working it out
engineering wise... We’d make 70 prototypes, test them all and that one works and so that’s how we kind of did it.

Some interview respondents noted the importance of making in their choice of industrial design as an undergraduate course. Jane and Kim for example saw the connection with the tangible aspects of making and the intellectual approach of problem solving. They enjoyed the hands-on aspects of design and Kim articulated the attraction of the combination of physical aspects of making with intellectual thinking approaches.

Kim

I felt like I wanted to combine those two things and make use of a brain that can ... conceptualise and do all that sort of stuff as well as being able to get dirty and make things and all that sort of hoo-ha.

Yeah, yeah I had fully anticipated that, and growing up on a farm it was that sort of engineering, ingenuity, let’s see how we can get this to work with only these three small things, and that problem-solving side of it. It was always very compelling.

Jane

I think there was some kind of fascination with making stuff and like being involved in stuff that was being made, and something really like real and tangible.
Theme 2: Thinking Approach

The Thinking Approach theme comprises a number of discrete interpretive codes identified in the interview data and subsequently brought under the theme heading. As shown in Figure 4.3, the Thinking Approach theme includes the interpretive codes of problem identification, problem solving, design process, design thinking and user centred design; all of which were used in coding the interviews. These interpretive codes were often used to code the same sections of interview due to similarities and crossovers within the text and were therefore readily merged under the theme ‘thinking approach’.

Thinking Approach items were discussed by eleven of the twelve interview participants, and were evident across the range of Adapters, Adopters and Departers. As noted above, the Communicator Theme elements of sketching, visualisation and making are linked to Approach Thinking, as these skills are used as a part of a process of design thinking.

The analysis of respondents’ transcripts revealed that many understood ‘Thinking Approach’ as a major part of the industrial designer’s role. This self-recognition is an important attribute in understanding industrial design’s current and potential role in helping solve emerging problems.

The Thinking Approach theme is an amalgamation of the multiple aspects and skills that make up what is commonly referred to in the literature as ‘design thinking’ (Archer 2007; Yee et al 2007). I understand this term to refer to the context-free kernel of design: the bare bones of design process and tools which can be applied in problem identification and solution both within, and beyond, the traditional confines of design for manufacture. As investigated by this research, Approach Thinking is a major factor in the ecology of industrial design. As shown by its proximity to Social Conscience theme in the Thematic Map of Australian Design Practice (see Figure 4.1), Approach Thinking is closely related to the theme Social Conscience.
Design thinking terminology not only appears in the design-oriented literature but also has more recently been migrated to non-standard applications. There has been a relatively recent proliferation of proponents suggesting that design thinking be applied in a variety of areas (Mau 2004; Berger 2009; Brunner and Emery 2009; Faust 2009; Koria, Karjalainen et al. 2009).

Mau expounded his manifesto of a design-oriented approach with the aim of making the world a better place (Mau 2004). In building on Mau’s work, Berger discussed the various aspects of design thinking approaches and applications to a variety of ‘creative problem solving, social, personal and business concerns’ (Berger 2009). Brunner and Emery identified Approach Thinking as a fundamental component of building a successful business (Brunner and Emery 2009). They saw Approach Thinking as not only applicable to the design of objects but to the overall method of developing successful and perhaps innovative products, services and experiences. They cited the benefits of this approach as exampled by Steve Jobs’ employment of industrial designers in Apple as the turning point for the then ailing company, and its subsequent and well-documented success.

This design approach is also evident in the development of business schools based on design approach thinking (Faust 2009; Koria, et al. 2009).

The international company IDEO encapsulates the shift from DFM to an application of design thinking beyond the bounds of traditional design. IDEO marketed and applied Approach Thinking to its endeavours including and beyond the development of manufactured products and into more socially oriented pursuits. Their freely available publications Design for Social Impact seek to explain and disseminate design approaches to designers and non-designers alike, and to promote design thinking in non-traditional design based fields (IDEO 2008.1; IDEO 2008.2; IDEO 2010).

Approach Thinking includes a research for design philosophy that focuses on aspects of user centred design and human factors (Laurel 2003; Visocky-O’Grady 2009). It also includes design ethnography, where methods such as
ethnographic observation are borrowed from social science in order to better understand how people interact with built environments, products and services.

**Figure 4.3 Approach Thinking theme and interpretive codes**

**Interpretive code (b)i : Problem identification and problem solving**

Problem identification and problem solving are seen as two points on a continuum of the design development process. Both are necessary components in developing appropriate and informed design solutions.

Industrial design’s strength in design thinking, problem identification and problem solving were reinforced by the interview respondents. The interview transcripts of five respondents included codes mapped to problem identification and problem solving.

For example, Charles passionately articulated the steps involved in being a designer and the continuum of design process including problem identification, design thinking and problem solutions. He makes a distinction between the different skills required for problem identification and those used for developing solutions.
Well, to be able to identify problems through your understanding of being able to identify problems as a designer and to be able to address those problems through divergent thinking. Yeah, I think, you know, it’s really about identifying and solving those problems, isn’t it? So, you know, design training allows you this amazing ability to be able to really, perhaps, sometimes efficiently, but very effectively, find the problem, which IDEO does, to bark back to them. And then it directs it, you know, two different sides of the same coin, I think. One is about finding the problem, that you use different techniques for. And one is about addressing that problem and using techniques and use, again, a different set of skills. And as designers, you’re equipped with those skills, just by virtue of being designers.

Scott also referred to both problem identification and problem solution. He explained how research, whether outsourced to consultants or conducted in house, helps to develop an understanding of the user and how this is linked to the problem identification phase.

Scott

Yeah so a fair bit of what I do is around problem solving and the process that we use, and like examples are like where we get our inputs for the design problem from, like do we really understand our customers and if we don’t, how do we go about doing that. So we do a bit of research and you know what’s the best way to do the research, you know we’ve pulled consultants in but we also do some of it ourselves. So a fair bit of the role is about trying to find the right people help us do what we do.

Some respondents were consciously aware of the ability to apply design principles and approaches in other, non-design-related, areas. For example, Kim articulated the portability and breadth of application of her undergraduate training.

Kim

Yeah….in my own mind going, ‘Okay, I can see that I’m learning a process and I’m learning the ability to grab things from a whole heap of different places and I’m getting a really good background in a whole heap of, I guess it’s ideals like working, like an ideal for working so you establish a background in something and then you might come up with a whole range of different solutions, and then you test those solutions and then you come up with an alternate winner.’ Like that was always the process from right the way through, that we were being taught, just happened to be different things that we were working towards.

Interpretive code (b)ii : User centred design
User centred design (UCD) or human centred design is a significant component of industrial design as well as of design thinking and design research in general. It is a component of a design process that has links with the development of innovative concepts and solution including the human factors and usability considerations within the design development process (Kelly 2001).

The analysis of interview transcripts identified that eight respondents referred to aspects of UCD. The respondents’ input reflected recognition of UCD as a component of design thinking, as well as a research approach applied within the design process.

Kim outlined UCD and its links to ergonomics as part of the learning of design and design approaches that became clear in her developing understandings of industrial design process and design thinking.

*Kim*

*it was all very based on design principles and ergonomics and all that sort of stuff: that’s one subject that really sticks in my mind because that gave you an opportunity to think about a product beyond where a designer would typically stop. So you’ve made a product, and then we had an opportunity to user-test it, and then we had the opportunity to refine it, and then we spoke about things like, ‘What happens to this product when it’s no longer useful, or when it’s no longer desired and all that type of thing?’*

In their interviews, Charles, Ted and Scott identified a focus on the user as an important attribute of industrial design. They saw industrial design as having both the commitment and methodologies to understand the user, including the ergonomic and emotional components, in order to develop better design solutions. This user-focused research is a critical component of design thinking and design process in the profession of industrial design.

*Charles*

*....I think industrial designers can take ideas and make them feasible and create a better society. I mean, it really is as simple as that. Through an understanding of your user, in all of those various ways that you can understand your user, you know, ergonomically, from an emotional perspective,*
from all of those different understandings of how people interact with their day-to-day lives, industrial designers can develop understandings of that, using different research techniques and create better products that are both better for the user, by virtue of them being better for the environment.

Ted

I would like to push the user research side of things, like at my current job I do quite a lot of I would say quick and dirty usability testing but that’s, I would like to obviously it’s, if you think about the user-end design, it’s a 20 year course just to study what you do, it’s an immense thing but it’s something I would like to learn more of the techniques and get better at them and find ways in which to really translate qualitative data into really sort of medical designs and with a more, I mean I guess the nature of qualitative work, it’s so much up to interpretation but yeah more consistency and more well consistently applied tools.

Scott, who works closely with both industrial designers and engineers, made a distinction between the two regarding the UCD research approach of the industrial design graduates. He viewed industrial design graduates as having stronger research skills in UCD, reflecting a clear focus on the aspect of human-product interaction in design.

Scott

Yeah yeah. But going back to your question, I’ve been really impressed with some of the students and their ability to do good quality research, that’s something that’s changed a lot. So I guess I’d like to see that continue and maybe it’s not happening across the board but like some of the industrial design grads distinguish themselves from the mecheng ones through that demonstration of how they’ve gone about solving you know, say their major project and final year project. Some of the research that they’ve done, you know like observational research, interviewing people and observing them and trying to make sense of latent themes and all this sort of stuff, like when we see that we love it, like we – I mean we don’t hire them based on that but it’s a pretty big tick.
Theme 3: Social Conscience

The role of the Social Conscience theme is reflected in both the literature and the interview data. As shown in Figure 5.4, the social conscience theme includes the interpretive codes of change practice, make a difference, sustainability, eco environment and social responsibility. Earlier coding iterations of social responsibility, and sub-codes of environmental concerns, eco design, industrial design’s ability to contribute positively to society and making a difference to individuals and society, were amalgamated within this theme. Likewise, instances of respondents describing attempts to change a practice from within the organisation or as a reason to change their own practice were also included in the social conscience theme.

There is evidence within the interview transcripts of tension in this theme. There was a recurrent concern to address environmental issues in manufacturing. However in many cases industrial designers may not be employed at a level within a company to influence some of these factors. In these cases, graduates are faced with the necessity to still design a product within those parameters, or decide to seek other employment where they have the opportunity to address the environmental concerns.

The respondents demonstrated a clear desire to develop meaning in their practice and to use their influence to bring about change. Interestingly Evans and Sommerville saw the need for design education to ‘develop long term strategies that enable designers to not only be aware of but also pay a major participatory role in shaping change’ (Evans and Sommerville 2007 p. 5).

Social conscience, where participants discussed ethical, environmental or social justice concerns, was a recurrent theme in the data. This level of social awareness and of the impact of a consumerist/capitalist economy is laudable, and highly relevant to the issues facing contemporary society. However respondents reported examples of a mismatch between such social conscience issues and the limitations currently experienced in their practice. There was a
strong sense that those entering industrial design do so with a desire to make a positive contribution to society, and often find aspects of the market-orientated traditional industrial design incongruent with those goals.

The designer’s role is inherently in conflict: on one hand, design benefits from and assists the consumption of mass produced goods, and on the other, design takes a holistic, life cycle approach to product design which logically drives an awareness of our finite resources and the impact of unchecked disposability. These inner tensions are reflected both in the interview responses and in the writings of authors such as Papanek (Papanek 1985; Papanek 1995). Papanek considered the particular responsibilities of the designer in a consumerist world, and recommended the idea of minimising the impact of consumer driven products.

The social conscience theme that emerged from the interview data suggests interview participants have a well-developed understanding of the positive contribution industrial design does and can play in society. While there was an understanding of the consumerist aspects of industrial design production there was also a strong desire to contribute to the better future of the world, and of a desire to be part of the solution rather than the problem.

What is particularly encouraging is that this understanding appears to have developed in respondents both during and after their education as an industrial designer. These issues did not have to be a prescriptive component of the education for these concerns to be understood, unlike some prescriptive skills and knowledge acquisitions such as ‘CAD’ or materials. Respondents recognised that there is both a responsibility and a set of skills and knowledge that allow them to consider this contribution in a professional realm.

There are links between the themes of social conscience and approach thinking. As designers consider how best to use their skills for the good of humanity and the planet, more potential applications of design thinking beyond the standard DFM emerge. Recently approach thinking aspects of design practice have been explored and used in areas relevant to social
conscience such as health care (Philips Corporation presentation at ICSID conference 2009), IDEO’s Design for Social Impact (IDEO 2008) and Bruce Mau’s manifesto in Massive Change (Mau 2004).

The focus on social conscience approaches is widespread in the literature (Heller and Vienne 2003; Fuad-Luke 2009; Pilloton 2009). For example the argument has been made that design must aspire to be ‘a medium for developing ideas that benefit society’ and that should ‘in many cases…serve a social function’ (Reid, et al. 2009, p. 1). Others have advocated a paradigm shift that puts design-with-a-conscience at the heart of the process and ‘moves design from primarily focusing on pragmatic considerations of utility and style for the profit ensuing from the product, to considerations of the principles and ideals that decide the impact the design will have on the lives of the people who come in contact with it’ (Gideon 2009, p. 1).

Social values and concerns are increasingly being acknowledged as important elements of industrial design education. Cheng and Liao noted that future roles of industrial designers would be increasingly engaged with the changing needs of society (Cheng and Liao 2001). They identified four concepts relevant to embedding these future roles within industrial design education: social structure, social change, social problems and social process. Talbot and Ward also discussed the increasing importance of ‘responding to human and social needs’ in design practice and the need to ensure this is incorporated within industrial design education (Talbot and Ward 2004, p. 224).

Perhaps most significant is the development of concepts such as redirective practice and ontological designing (Willis 1999; Fry 2005; Fry 2009). In these paradigms, design is seen as a potential vehicle to redirect business practices from within, on the basis of a realisation that design has consequences which place corresponding responsibilities on designers’ shoulders. In Fry’s understanding, designers often respond to a brief by a third party without understanding whether the outcomes of the work adds or detracts to the world, as economic imperatives take precedence over pursuing the greater good. Design has increasingly become a service which develops instructions
for others to take action rather than design taking the original direct action of
making (Fry 2009 p. 26). He states that:

To understand this situation is to grasp that design practice cannot simply
add ‘sustainable’ onto its already flawed foundations. Rather, the nature of
design practice has to fundamentally change - it has to be redesigned

These debates in the literature were reflected in the interview data.
Respondents recognised, acknowledged and promoted the need for change but
were limited in what they could do to modify the organisation for which they
worked. Especially noteworthy was the widespread understanding of the
significant consequences of design, and that these consequences could be both
positive and negative.

What the data says about ‘social conscience’

Material coded to the theme of social conscience was widespread throughout
the interviews. Nine of the twelve interview respondents discussed various
aspects of social conscience design activities in their responses. Further
examination of this material revealed a number of separate, but related,
elements. Original descriptive codes used in categorising the interview data
included social responsibility, wanting to make a difference, environmental and
sustainability issues and demonstrations of attempting to change one’s practice
or one’s employer’s practice to reflect these concerns. These descriptive were
eventually amalgamated into two interpretive codes: environmental change practice
and make a difference. These are detailed below.
Interpretive code (c)i: Environmental change practice

Environmental change practice refers to situations where participants reported efforts to modify existing processes to improve environmental outcomes from their positions within an employing organisation or company.

Four interview participants spoke specifically of attempting to change an employer’s practice in regard to environmental concerns. Lucy related her experiences in a relatively small design practice where she endeavoured to source materials and processes that reflected a more conscious effort to acknowledge environmental concerns. This included life cycle analysis for products and packaging for which her employing company was responsible. Although the management of the organisation was willing to explore some of the ideas there were limitations based on the cost of implementation.

Lucy

And so you know I got to go to a couple of you know talks and things like that to sort of try and find out bits and pieces when there was something that might be relevant and so yeah they were quite happy to do it, it was just when it came to a big cost difference then it wasn’t going to win, but as much as it was something we could do alongside everything else then yeah they were quite happy for us to go ahead with it.

Both Nigel and Scott discussed their experiences within comparatively larger Australian design and manufacture companies. Nigel related the reasons for his decision to leave a particular company after his attempts to change practices and approaches to environmental concerns were unsuccessful. His capacity to influence change was ultimately limited by the corporate structure and his position within the organisation. He realised he was unable to reconcile his principles with this environment and left this employer.

Nigel

Okay, yeah well so once again it was one of those things where there was just time, I got a bit complacent and I got a bit – I got over working for them in terms of the corporate […] cos I felt sort of like I was, I couldn’t make a change, I couldn’t do what you know … there was two things. […] wasn’t heading in the direction I wanted to kind of see a company head down, so environmentally and just the processes weren’t put in place and the fact that
designing products, we could’ve made great innovations in terms of how it was assembled and things, and often as a more senior decision that was turned down because of a small cost increase.

So I got really disheartened there and one project I worked on where it was a matter of putting in a fuse which was kind of like a defining moment, was a matter of putting in a fuse and the fuse, it was a re-settable fuse so it meant that this [appliance] that we were developing would last you know 50 years probably, so as soon as it overheats the fuse sets itself off. And cool it down and off you go so it doesn’t stress the motor, things just last way longer, something else would’ve gone off but — and it was a dollar. And it was rejected by the [?] for costs, like and cos like that whole world was like, and it changes but cos it was so cost-sensitive a project, they just made them and so you put it in something that’s a bit thick and it blows up [?] you know so that really got to me, and it actually started to affect me in terms of what I was doing in terms of — [name of company omitted] good in terms of we get to see all the returns and the mountains of returns, and as a company it’ll change, I know it will but just at the moment they’re just not on top of it. Their big innovation this year was like trying to get rid of polyfoam packaging, like that was it and we were already like as a design team, we’d already pretty much done that anyway you know.

Scott discussed the situation in his employment with a design and manufacture firm, where there were both positive and negative aspects in relation to environmental issues. He was proud of the artefacts the company made as they aligned with his belief that products should be developed to make a positive contribution to people’s lives. The products were not designed to have a short life span with the aim of driving increased turnover and profits. The company therefore avoided the pitfalls of designing products which ‘end up on the tip’. However he felt that some practises within the company were wasteful and that decisions were made based on the cost to manufacture and profits, rather than having environmental concerns as a key priority.

Scott

it’s ironic that you know we are quite a wasteful company here at [...] We’ve just started to get out heads around where we’ve got an environmental policy now, we’ve got a few programs aimed at reducing energy use and waste in what we do here in the office, but our CEO doesn’t walk around saying we’ve got to make these boxes out of hemp or recycled cardboard or you know, he wouldn’t really encourage that sort of stuff unless it was having a direct impact on the bottom line. So there’s a few fringe people here that are closet greenies sort
of pushing programs here and there that if they can demonstrate a bottom line impact then it’ll get done, which is great and I’d say I didn’t want to become involved in products that end up on the tip and it’s not ideal what we’re doing here cos we create a lot of silicone and polycarbonate and it’s not all you know recyclable. But it’s offset by the huge positives that we’re doing you know in people’s lives, so I guess I’m comfortable with that. I’d love to see a more environmentally responsible ultimately, and we’ll probably be forced to in the end by external forces, but at the moment they’re not really that strong.

**Interpretive code (c)ii : Make a difference**

The ‘make a difference’ interpretive code categorises interview responses which indicated the ways in which respondents understood the potential positive influence which the profession of industrial design could have on society.

Three respondents, Kim, Paul and Scott, discussed such issues using references such as making a difference, a positive contribution to society, and being part of the solution not part of the problem.

Kim for example referred to early ideas of what industrial design could do.

*Kim*

I really liked the idea of being able to make things that made the world better. I think it was the altruistic goal, getting into it. [laughs]

Later in the interview she discussed her design for manufacture experiences with industrial design at university and the negative links with ‘making stuff’ rather than being part of a positive contribution. Throughout the interview, Kim referred to her belief that industrial design could make a positive contribution but was not aware of where such opportunities exist in Australia.

*Kim*

And I guess another part of it was I had by that point had some sort of environmental, I guess ideals that I didn’t necessarily feel were going to be satisfied by making more ‘stuff’. [laughs] And so I wasn’t sure if I wanted to be involved in the industry where their business is to make ‘stuff’. It’d be more than overjoyed if I ended up in a firm, like one of those magical boutique agencies that you hear about every now and then that has an opportunity to do something that’s really good for humanity. You know, they make ‘stuff’ for humanity, that would be great; or they come up with a solution based on their
ability to solve problems that just makes things better. It doesn’t have to be huge, like it could be, you know…

Paul referred to similar concerns when he articulated his personal view regarding being involved in design that can benefit people.

Paul

Yeah, I’m most interested in designing things that help people to live. And not in a stupid way, to make them healthier, so they can’t hurt themselves as much, make their life easier so they get more done for less effort. I think you’ve got to try and interact with the natural environment more, you know, heal some of those, we are natural beings.

Scott referred to the positive contributions he believed he made via the firm he worked for at the time of the interview and the difference this could make to people’s lives.

Scott

I really enjoy what I’m doing, so you know the people here are great and the problems that we’re trying to solve are really challenging and rewarding, doing something positive for people
Theme 4: Facilitator Interpreter

The facilitator interpreter theme reflects the important role played by industrial design practitioners in enhancing collaboration within work teams. Many such teams incorporate individuals from disparate professional backgrounds and the industrial designer often contributes to team cohesion and shared understanding of work goals by bridging such disparities. The same applies to communication with clients and members of the public. Industrial designers have skills in oral and visual communication and representation; skills which are very useful in building shared understandings when limited shared language and terminology makes written communication difficult. The facilitator interpreter theme therefore has strong links to the communicator theme, and, given its centrality to the role of industrial design, to the identity theme as well. Reflecting these relationships, the facilitator interpreter theme is placed in the Thematic Map of Australian Industrial Design Practice between the themes of identity and communicator.

The theme of facilitator interpreter emerged from reviewing the transcripts of graduate interviews. The data indicated a strong sense of the role industrial designers play in acting as both a facilitator and interpreter, with all twelve respondents making references to the component or related categories. When coding the data, all references to collaboration, innovation, team work and interdisciplinary were assigned to this category. These were later amalgamated to the interpretive codes of interpreter, innovation, interdisciplinary and teams described in this section.

These categories are unsurprising as interdisciplinary and team work are fundamental components of Australian industrial design practice. The facilitator/interpreter uses the knowledge and skills obtained through industrial design education and practice to act as the facilitator in team work situations. As noted by Julier and Moor:
‘Studying the individuals responsible for crafting and conveying knowledge about specific groups of people to others in the design world reveals that contemporary product design is truly collaborative, interdisciplinary practice.’ (Julier and Moor 2009, p. 140)

The importance of designers’ role in collaborative and interdisciplinary work in teams has been recognised in the literature regarding design practice and education (Davis 2008; Dykes, et al. 2009; Winters 2009). For example (Davis 2008) calls for a curriculum that reflects the importance of working in interdisciplinary teams and with human-centred experts. She noted the importance of the ability to relinquish sole control, and suggested the proportion of curriculum resources devoted to collaboration needs to be significantly increased.

Input from the interview respondents reflected that this team approach was already a reality - at least for some designers. As graduates of the University of Canberra’s industrial design degree course, participants had significant exposure to the human centred design methods, philosophy and team work embedded in the UC curriculum. They had also made the successful transition to applying these skills in their workplaces, where they worked successfully in teams to reach common goals, collaborating to facilitate collective project outcomes. The interview data revealed the role of facilitator/interpreter that respondents played across various types teams.

As noted by Nitzan Waisberg, in (Julier and Moor 2009) the component aspects of facilitator interpreter and the blurring of the roles of traditional design disciplines demonstrate the adaptability of the industrial design graduate in contributing to the team and project at hand. Part of this adaptability is based on the industrial designer’s understanding of other disciplines. This thinking has been conceptualised as the T-shaped designer, where depth of discipline knowledge in one’s own field (the vertical element of the T) is ideally matched by a broader and more generalised grasp of the fundamentals of other disciplines (the horizontal element of the T) (Kelly 2001). Similar concepts have been applied in the consideration of design education (Crisp, Dale et al. 2009).
The role of facilitator-interpreter has been given priority in the development of new courses that address new modes of practice, business and innovation. Examples of such courses include the ‘d’ school at Stanford University and Aalto University in Finland (Koria, et al. 2009)

![Facilitator Interpreter theme and component codes](image)

**Figure 4.5 Facilitator Interpreter theme and component codes**

**Interpretive code (d)i : Interpreter**

As I read and re-read the interviews transcripts it became apparent that the interview respondents played significant roles as interpreters in their team and collaborative practice. There were several examples described by the interviewees that highlight this role.

For example, Kim outlined how her organisational role entailed presenting and explaining information from engineers to graphic designers so the information could be presented in a form understandable by the general public. In this case, as an industrial designer her knowledge of both parties was sufficient to be able to successfully operate in this role.

*Kim*

Yeah I think, especially on big infrastructure projects there’s going to be people that come from a whole heap of different places: so last year for example, I was working for [...] and producing a strategy report. So that was based on a whole heap of input from engineers that don’t like talking to anyone, and then
trying to get all of that into a format that the community could read through a graphic designer that has no idea what the content is about. [laughs] So being that go-between and having a bit of an understanding, like how a graphic design firm operates, having a little bit of understanding about the process of an engineer: I've no idea about what they're talking about normally. But I guess being an intermediary because you have been involved in a whole lot of different things, because I think industrial design is a little bit like that: it gives you a lot of broad skills, like doing the graphics is really important. I think that's very handy; photography is good, but mostly just because it's interesting.

Paul also described an aspect of his business where he interpreted information or ideas from an architect and provided detailed specifications to a manufacturer in order to supply particular components to a builder or construction contractor. Again the industrial designer has the knowledge and also the communication and documentation skills to convey the necessary information.

Paul

We fit in generally with helping with the more technical aspects. Architects often come up short with technical details. Manufacturers come up short with being able to design things so that's a bit of a gap where we have done a bit of work ....

Architects don't really give a shit about detail. They want to get their fee, they want to do the basic concepts and move on. So they just throw it over the fence to some extent, I'm generalising, but throw it over the fence, someone else's problem to deal with the detail. So it's more a case of who needs help with the details? And so we do some work for architects but it's mainly for manufacturers and that can fall into builders as well.

Geoff noted his role in a non-industrial design advisory capacity included discussing decisions and options with clients and colleagues. He emphasised that even though he was not working in industrial design, he continued to apply his design process knowledge and skills. While expressed in different circumstances to the two examples above, he employed similar facilitation and communication techniques. For example, he reported that he visualised the options and scenarios for his clients and asked for multiple options from his staff before committing to any single idea.
Geoff

I meet with clients, look and I can see it clear, I can see it clear as day, with all my I guess, all the people that are doing the same job as me, because they haven’t been trained in the same way that I have [...] whereas because we learnt at uni to you know, there’s more than one way to skin a cat, to really just flesh out all the potential ways that something can be done, that’s then what I take to my current job that when I sit down with a client as opposed to I guess how many of my colleagues approach a client which is oh you’re Mrs A, B or C and this is what we do for you, I really, you know that’s probably one of my most favourite parts of the job is then I, I do get on a whiteboard after I’ve met with a client and just say well, you know and go through it myself and just structure things in different possible ways, so money can go here and da-dada-da and yeah..........

Interpretive code (d)ii: Innovation

In this context I used the interpretive code innovation to include not only novel approaches to problem solving but the process of ensuring new ideas are put into practice. Innovation is a core concept for business and innovative practice is a design activity in which industrial designers can play a significant role (Kelly 2001; Howard 2008; Berger 2009). Industrial designers can create innovative solutions throughout the design and development process.

The currency of the concept of innovation is reflected in the interviews. Five respondents raised aspects of innovation within their discussions.

One aspect of the discourse related to innovation was the extent to which the Australian context encouraged this attribute. Some respondents saw the traditional nostalgic notion of improvisation through necessity as still applicable today. Others felt that Australian design was not innovative in comparison to international companies and that local product development was more incremental in nature.

For example Aiden, who is based in North America, articulated a traditional cultural perspective of Australians being innovative and resourceful through necessity driven by geographical remoteness. He felt Australia was rare in its ‘do it yourself’ approach and therefore perhaps offered a different method of innovation.
Aiden

Yeah, I do, because unlike my British colleagues in Dubai, I think we do have a different sense of design and innovation. Without sounding nostalgic or but we’ve always had that ability to knock something up. Our parents do it all the time. As a kid, if the lawnmower’s broke, you fix it yourself type thing and I don’t know if that’s the same everywhere, but I suspect it’s not. I don’t think many other cultures have the — societies have a culture of do-it-yourself to the same degree that we do and because we’re so small, we’re always outward looking.

On the other hand, Nigel referred to his perception that Australia lacked a developmental culture that allowed for innovation to occur in comparison to some international settings.

Nigel

Yeah I don’t really know how to put a perspective on that, I just feel like I see a lot more styling, innovation and blue sky innovation coming from international designers rather than Australian designers but it’s a whole culture, I feel like we don’t have that design competition culture I think, you know there’s people doing all this work for design competitions and there’s a lot of people that just doing all sorts of things that just aren’t … that aren’t I guess practical in terms of, they’re just innovation kind of development.

Other interview data described innovation in terms of the migration of design thinking beyond traditional boundaries. Charles for instance reflected upon the international rise of design and links to innovation and industrial design via the application of design thinking. He identified this as being put into practice by companies such as IDEO which had successfully built a business model linking design to innovative practice and solutions applied to a range of broadly-defined problems.

Charles

Industrial design, these days, also involves attitudes to system design, IDEO’s making headway in that field. People, you know, big businesses are approaching them to design their business model better, rather than just a product. So it’s that design thinking is coming to the fore a little more. And then you look at all sorts of things, like innovation and design, which IDEO, again, has made headway in, or innovation as a concept. And interaction design, and all these sorts of things, which are little fields. There are all these little fields popping up and they’re fields in their right. But they’re also linked with industrial design.
Another issue discussed in the interview data is that of shifting terminology and concepts. Scott for example reflected that while his undergraduate industrial design education did not use the term innovation, the design process he was taught was integrally linked with innovative practice. As his awareness and understanding of innovation has developed, Scott reported his perception that non-designers increasingly recognise and value this attribute within design thinking. They wish to learn about innovative practice and apply it as part of a method leading to innovative outcomes.

*Scott*

*And I think we were doing innovation but we weren’t really calling it that, and I don’t know how that’s sort of, yeah whether that was just a perspective at uni and it was different out in the real world but now innovation is like one of the core things that resonates, and probably any company would say that too, like yeah we’re all about innovation. If you don’t innovate you die or you can’t really compete in your industry very effectively, so at the moment I’ve like been exposed to a fair bit of external stuff where you know members of these groups that get together and share I guess wisdom around innovation and learning, like non-competing companies that you know want to get ahead by helping each other. I’m seeing you know other businesses like banks and like non-manufacturing type companies cottoning on and wanting to learn from you know designers and innovators and how they can apply it in their own businesses. So I’m seeing innovation becoming like more of a well-known and like an applied sort of activity, I guess.*

Both Scott and Nigel raised relevant aspects of their practice and collaboration in the context of approaching problems in a more innovative fashion. They linked innovation to a desire to move beyond the more individual and inward-focussed design approaches that are generally conceived in many competitive business situations. Both saw this type of collaborative approach as facilitating and enhancing innovation as a theme which emerged throughout the interviews.

Scott described collaboration and cooperation at the corporate level. He outlined the practice and benefits which emerged from different types of businesses coming together to share experiences and learn aspects of innovative practice for the good of all.
Scott

...I think they were buying into the concept of don’t try and do it on your own. Yeah so this group that we’re a member of is, its mantra is — I’m trying to think of what it is — it’s about bringing non-competing companies together to learn from each other. And one of the core principles of innovation is about that you innovate through connections with others, you know like innovating at the water bubbler, you know you go and make a cup of coffee and you strike up a conversation with someone and it might give you that critical connection that solves a problem for you that you wouldn’t have found it if you’d just gone and sat in a room on your own with some peace and quiet trying to work it out.

So there’s that concept of yeah companies coming together and sharing lessons, contacts, their problems, helping others solve problems for them, or working on them together. It’s that big network I guess, reaping the benefit of that network. And part of it also is that the group is sort of run by a company that’s, what they do is they provide stimulants for these companies where they have regular workshops and events where they get experts or sort of speakers to come in and share knowledge on a particular topic. And so the topics might be more relevant to some companies than others, so yeah you might have a presenter speaking about a particular topic and we’ll be there but there’ll also be someone from you know a bank as well, so we’ll be taking different things from the material.

Nigel described his experience of independent designers coming together to collaborate and help each other at an individual level. He saw this as a support network that prioritised collective benefits above individual secrecy or ownership. While Nigel recognised the benefits of this type of collaborative practice for innovation, he also noted the risks involved.

Embracing the advice from everyone, so I feel like I’ve just learnt so much more. So with everything I think we’re shifting to be a bit more open about what we’re doing and less secretive and just trying to be the people that just do, we’re just doing this.[...]

Nigel (later)

Before that like the collaboration thing is probably, gets me more excited than anything at the moment in terms of just taking away some of the – I’m lucky, at the moment I’ve got a wife that works, so with this collaboration stuff’s also been less need to actually go you need to bank your wage today, so as a kind of a bit of a resolve that we’ve been able to collaborate and say well let’s have a go at doing this and see what happens. So we’ve been lucky in terms of all three of us are kind of in a similar situation so
that we can, we’re a bit more flexible than what we ever were. And we’ve all come from big companies to do smaller more independent style of work.

**Interpretive code (d)iii: Interdisciplinary and teams**

The interpretive code of Interdisciplinary and teams refers to industrial designers participating in teams as part of design practice: whether such teams were discipline specific, interdisciplinary and/or multidisciplinary teams. The increasing importance of interdisciplinarity is discussed in the literature (Budd, et al. 1999; Kelly 2001; Yang, et al. 2005; Devlin and Davies 2008), as well as being prominent in the interview data. Five of the respondents referred to the positive aspects of the interdisciplinary nature of industrial design practice and how this can contribute to successful and innovative project outcomes.

For example, Todd discussed aspects of interdisciplinary team practice and possible considerations for design education where the designer needs to have their own informed voice to be able to contribute meaningfully.

*Todd*

... I think that’s yeah, when I was talking about interdisciplinarianism, I was never envisioning turning it into grey because I think you’re right, I think you have to have some sort of core skills and those core skills build the foundation because otherwise if you just speak the language of the other team members, you risk just being a conduit and not becoming anything other than that. And that's fine in some ways because there are some people who need to be like that. They are probably in marketing and sales, but I think, I do think you need to inject some of this understanding of the language of business and the way that that works and I think that needs to be injected at a lower level. In terms of masters degrees and things like that, I suspect that encouraging people to think about the things that they might like to knit together, so that they start to do say computing and things like that, still has to be done earlier and then encourage the masters, obviously to refine that process.

Ted also discussed industrial designers’ ability to transfer their skills and contribute meaningfully to teams including those with a multidisciplinary makeup. The industrial designer can facilitate and aid the team in reaching its desired project outcomes.
Ted

I don’t know but industrial designers can transfer their skills better than any other designer. You don’t see graphic designers doing brilliant spatial design or like rarely. You don’t see architects, well they try but like architects rarely succeed as excellent product designers or graphic designers. Of course there’s really famous exceptions to the rule, so you can’t paint them completely with the same brush but it seems somehow, I think industrial designers get a taste of everything in their degree and it just gives you a really good knack of transferring a basic creative skill set to different applications and one of the other biggest things that the more and more I work, the more I realise is that industrial designers somehow have an excellent ability to work well in teams and to function well in a multidisciplinary environment, better than just about anyone else.

And that I don’t really know why but somehow you’re working with I mean, graphic designers or architects or anything and quite often they just don’t function that well in a team. Well maybe graphic designers are a bad example but certainly architects and interior designers and stuff like that, well marketing people or anyone who you work with, somehow like in my current job for example there are like 20 people that I work with on a routine basis and with all kinds of different backgrounds. But there is one other industrial designer there and it is just incredible, you can just spot when we’re doing some team exercise just like how well this other industrial designer supports the work and helps the project move forward. When everyone else is just complaining about one thing or another, yeah somehow …

Scott referred to the careful consideration of the makeup of teams and the role industrial designers played in his organisation.

Scott

We try to create a team that’s got a diversity of levels of experience and particular skills, so you need to have someone who’s good at CAD, you need to have someone who’s a doer, who gets through stuff really effectively. Because not everyone’s like that, some people just naturally churn through lots of stuff and others are effective but they might be really good at you know being given one task and being really good at that. We try and mix the industrial designers with the mecheng people, with a view to giving the ID people more of the user interaction type stuff and the mechings more of the technical you know physics and maths and fundamental type challenges.
And personalities as well, like you know some projects will, like you’ve got the project development life cycle of starting with the fluffy, poorly defined front-end stuff through to the back-end, almost in the market and then actually in the market and following up, where it’s much more well defined and people know what needs to be done, they just need to get in and do it. And different personalities suit those different scenarios, so my team, we’re at the front-end poorly defined end of that spectrum.

**Theme 5: Mobility**

The mobility theme comprises both external and internal influences that influence an industrial designer’s career path: the pressures which industrial design graduates experience in relation to gaining, retaining and changing their employment situations. These pressures influence how industrial designers negotiate their individual career journeys and play an important role in developing their practice. Unsurprisingly a time of economic downturn can lead to a reduction industrial design jobs and thus people move away from industrial design during a downturn and may not return. Their perceived standing in any given cohort of graduating students also influenced where respondents had attempted to find work and in which fields. Such perceptions and experiences are highly subjective. For some, a lost job opportunity will be seen as a small set back, while others will experience the same incident as a major confidence blow. In all cases, perceived lack of opportunity affects the long term career aspirations in industrial design and correspondingly the perceived need to move beyond this field.

The elements considered in compiling this theme were grouped into two interpretive codes: factors external to the designer and factors internal to the designer. The descriptive codes underlying these are:

- external influences: economy, lack of jobs and office relationships.
- internal influences: passion, resilience, beliefs and confidence.
As shown in Figure 4.6, the mobility theme includes the interpretive codes of passion, beliefs, resilience, confidence, office relationships, economy and lack of jobs.

Interpretive code (e)i: External influences

External influences are those which are beyond any individual person’s control. Descriptive codes which were compiled in this category comprise the economy, lack of jobs and office relations. The first two codes, relating to the economy and job opportunities, are closely related.

(e)i.i: The economy

The state of the economy at any particular time has a major influence on obtaining employment within an industrial design environment, either as a contracted service provider to industry or as an in-house designer within design and manufacturing firms. As considered in later discussion chapters, situations where the economy is stagnant or low-performing lead to a lack of jobs. The low number of job opportunities was a recurring theme within the interviews. Six of the respondents included material coded as having raised ‘economy’ within their interview.
Kim referred to a friend made redundant during the recent economic downturn. She noted that industrial design can be seen as a superficial extra, and therefore expedient in tough economic times. Where industrial designers only contribute to the visual aesthetics of a product they are vulnerable to being considered as dispensable.

Kim

I think my current understanding of industrial design, as in bread and butter industrial design is still that product design stuff. And depending on how far up the food chain you are depends on what work you do: so if you’re a pond dweller, you’re doing CAD, that’s your role and I’ve experienced, because I’m still in contact with people from uni so I speak with […] for example, and I notice that in him. He didn’t necessarily get an opportunity to design anything: he took someone else’s designs and he made them a computer model. And I think there’s also, I don’t know if this is a GFC type thing, but there also seemed to be a bit of a mentality out there that designers are very dispensable, like they’re a bit of an added extra: they’re not necessary; they make things, for a very cynical view, they make things look pretty; they don’t necessarily make things work and therefore when things get tight maybe that’s the one thing we start cutting away from. And he was made redundant…..

Scott discussed his work in an Australian based information technology/engineering oriented manufacturing firm when the ‘dot com’ crash of 2000 had a major impact on the economies of countries such as Australia, including the subsequent layoff of staff.

Scott

Yeah so the company was growing incredibly quickly and we couldn’t really keep up with the pace of the growth and it then became an unsustainable thing, like we were a listed company, we became American owned, we were taken over by an American company. And ultimately yeah we had the dot com crash, and they had to do mass layoffs and redundancies, so I was one of the last ones to go but we ended up with I think about two or three engineers left in the end, and out of I think there were probably 30 or so.
(e)ii: Lack of jobs in industrial design

Lack of industrial design jobs was a recurring issue that emerged from the interview data. Eight of the twelve respondents discussed the lack of perceived employment opportunities for graduates of industrial design. This was attributed either to actual economic conditions at the time of graduation or a general feeling of a lack of jobs specific to the type of education they had received.

For example Kim described her perceptions at the time of completing her degree regarding a lack of available industrial design jobs. This concern was intensified as Kim felt she came from a relatively large graduating year: she felt this increased competition would further impede people's ability to find work.

Kim

... it was more, especially towards the final years going, ‘Okay, well what are our other options for employment?’ Basically because the statistics are one in four of us might get a design job; what other options do we have and what sort of interests do we have, because not everyone in that course wants to sit there and design kettles [laughs], for example. They might be pretty excited that they get that opportunity but some, that might not be their goal, and so what things is course teaching us that are making us better people, and making us able to contribute to a broad range of employment?

Fiona and Todd expressed the view that industrial design jobs were in short supply and they were therefore willing to consider employment opportunities in other locations, whether further afield domestically or internationally.

Fiona

Everyone wants to be a designer. **There are no jobs.**

So I finished, there was no jobs. I went to the UK thinking that was part of my journey as well, it was like I needed to get out of Canberra, I just needed to escape. So there were no jobs and so I went great, UK.

Todd

well it was just prior to leaving here, I had had an interview with [...] and at the time we were coming out of the recession that we had to have, so I was actually quite impressed to have a job offer at that time and I was ready to go up to Sydney. Although it was fascinating, because for a boy who said, ‘I
don't want to go anywhere near Sydney!' suddenly, my eyes were open here and going up to there. And so I went to go and work for [...] think at that time there weren't too many of us getting jobs first off the bat in the first month or so out of graduation, I'm sure that got absorbed quickly, but it was a tough economic environment for sure and so I was ready to bite into anything.

(e)i.iii: Office relationships

Office relationships emerged as a necessary descriptive code to reflect respondents views regarding the instability in work opportunities due to the destabilising aspects of internal office relationships. These were described as being either with other individuals or the management structure of the organisation.

I used the term ‘office relationships’ to code instances of six respondents having personal or management conflict that they considered to have affected their level of job satisfaction leading to a possible change in employment. These instances covered a range of concerns of varying levels of gravity. Some instances were as simple as a personality difference, while others were more significant. Issues tended to be exacerbated in situations with smaller staff numbers, as is commonplace in Australian design studios and practices. Underlying differences in beliefs or work practices were also potential sources of tension. The playing out of office relationships, either between colleagues or with management, have a significant role in the decision to stay with an employer or move on thus reflecting the link to the theme of mobility.

As an example, Fiona left a very small design firm due to a personality clash and lack of respect for her employer.

Fiona

That was just a shit hole of a place to work, so after three months I went bugger you, I'm not working for you, you drunken whatever. And left and started you know, doing my own things and that’s when I started doing jewellery and then tried to, did that for a year and a half or so and then decided I needed to get a full time job and so I ended up getting the job at the design department at [...]}

Todd, employed in a comparatively larger design consultancy, also had issues with personalities and management.
Todd

So I moved up to […] and I started work there and I had the introduction to what a design studio was like and at the same time and introduction to small businesses and the personality dynamics which are part of a small business, which you don’t see in a larger organisation, which are moderated in a larger organisation.

Todd continues

I didn’t enjoy it as much because of the personalities there. I didn’t enjoy the head of the company or his design ethos or his personality or his vision of where he felt that I fitted into his profit plan.

Lucy left her job for similar reasons. Within the limits of confidentiality, she explained her departure in response to issues of management processes and personalities. She identified the small size of the organisation as intensifying negative issues in interpersonal work relationships. The Australian context has many of these smaller practices: in addition the overall field is small and very interconnected.

Lucy

Yeah, I think maybe management style’s a little bit of it but in terms of you know with a smaller company you know what’s going on and it’s more of a personal relationship. Whereas when something’s bigger, you know if it’s a big big company and you don’t know the big bosses and they do something you don’t like, you can just whinge about them but you know if it’s sort of a bit of a grey area between the two then you know it sort of becomes a bit trickier.

So I think you know in terms of yeah, how difficult situations are handled and you know staff comings and goings are handled. If there’s something like that, there’s a policy in place and you’re like okay well if something goes bad I know that that’s what’s going to happen, you can sort of deal with it. But if it’s sort of you know you expect something to go one way and then out of nowhere something else happens, you’re like woah and so I guess that is part of it. They’re not […] but you know also as much just how the process works and you know some places just have not much set up in terms of procedures and like in terms of the design process as well, not just in terms of things going bad and which can make it a lot easier to just jump in and get stuff done I guess.
Internal Influences

Internal influences included in the mobility theme are those which over which people may have control. Descriptive codes which were compiled in this category comprise passion, resilience, beliefs and confidence. The coding categories of passion and beliefs are closely connected with the theme of social conscience. A person’s passion and beliefs can influence their choice to, for example, stay with or leave an employer, and can also be a link to development of a social conscience.

Interpretive code (e)iv: Passion

Passion was identified as a person’s level of enthusiasm, zeal and engagement with design. It emerged from the data as a contributing factor in gaining and maintaining employment in industrial design practice. Without this passion for design, graduates are less likely to pursue industrial design as a career over time.

Respondents discussed passion, or ‘love’ for industrial design and the design process in five of the interviews. Some described passion as a necessary component of being a designer, while others reflected on how a perceived lack of passion in some industrial design students affected their abilities.

The element of passion has been described as essential for design. Grudin (2010) notes that ‘Design achievements, great or small, result from episodes of focused passion’ (Grudin 2010, p. 82). Passion can in many ways be more important than natural aptitudes for particular skills, as passionate students will work hard to overcome any shortcomings they may have, while sometimes gifted students may tend to ‘coast’. Skaggs concluded that students with certain aptitudes, that he described under the titles of visual, creative and flexible thinking for industrial design, will be passionate about industrial design (Skaggs 2005). From my experience as a design educator, students and cohorts of students are characterised by differing levels of passion. I see the interests and potential they may have within industrial design and design generally as largely predicated on this intangible but important attribute.
Students are also aware of the importance of passion. In reflecting on her experiences as an industrial design student, Kim explained she felt there was a proportion of her peers who were not sufficiently enthusiastic about industrial design, and were in the area almost by accident.

*Kim*

*And there was also, like I think in any group as horrible as it is to say, there’s always going to be for want of a better term ‘dead weight’: there’s people that are there and they’re just going through the motions. They don’t necessarily have a passion to strive to get a career in that industry, or they might lack a better plan, like they might have just stumbled into industrial design and gone, ‘Oh yeah, I like making stuff.’*

Charles also saw the need to be passionate about industrial design in order to succeed in the field. Throughout his interview Charles expressed his passion for industrial design and believed that if others were to successfully engage in the profession they needed to share this passion.

*Charles*

“*That’s another thing. I keep saying this but industrial designers, I think, need to love design. Yeah, you’ve got to just love it.*”

Although no longer employed in a design role, Geoff voiced strong links to his industrial design background. He found, and valued, the inventive and innovative parts of his work, and thereby maintained a connection with these design elements. He remained passionate about the creative aspects of design and how these were applied in his new profession.

*Geoff*

*And look I love that creative aspect of my job and if I didn’t have the creative aspect you know it wouldn’t be something I’d be doing.*

**Interpretive code (e)v: Resilience**

By resilience I mean the ability to adapt to changing circumstances, take on new challenges and see opportunity in new situations. Each of the interviewed respondents articulated a strong level of resilience. Their lived experience reflects a breadth of abilities and approaches to a variety of situations. Several
respondents had faced a redundancy and had responded in a reflective and adaptive manner, taking the opportunity to try a new path.

Aiden for example, initially lacked confidence but is now a successful internationally based designer.

Aiden

At uni, I didn’t end up at the end of the degree with a whole lot of confidence about actually working in industrial design and I didn’t really feel informed about where else I could fit in. I’ll touch on that later, but I guess, I had a fairly negative outlook by the time I left about working for one of those consultancies. And I think I may have applied for a few jobs, but really only half-heartedly and then fell away from it completely. I mean, not long after I left uni, I didn’t think that I would ever have a design career, because I mean, at that time, it was recession. There were only a couple of students there probably, I don’t know, probably left the course with the skills that at the time I thought you would need to get a job in industrial design, who I felt were better than me, so I had this attitude, ‘Why try it?’ I know that’s a really negative thing to say, but—and it’s probably got a lot to do about my own self belief at the time as opposed to the structure of the course. So I just did what was easy, which was to chef, which I’d been doing to pay my way through university. So initially I did that. I moved from—I just moved with the same hotel company back to Sydney and then thought I should try and keep my hand in, so I think I approached [another company]. I ended up getting a job as an architectural model maker for about 6 months and continued to work as a chef on the weekends. I swapped it around, but that was a pretty hellish occupation.

Scott described his move from Canberra as a result of a forced redundancy. This led him to change cities and secure a more desirable job in another workplace. His current role allowed him to develop and apply a greater variety of his skills, knowledge and beliefs when compared to his previous position.

Scott

Yeah so I found myself out of a job (after a redundancy) and started applying for jobs in Sydney. I applied in Canberra as well, but I found it pretty difficult, like there wasn’t a lot to choose from and I cast a pretty broad net, like I was looking at you know some of those furniture places in [...], the office fit-out places. There’s an engineering one, place in [...] as well that does defence-related stuff which yeah that was bit of a slow moving one. I had an interview with them when I was actually up in Sydney and that didn’t go anywhere. And then yeah so I ended up just applied for this role at [...] through an ad in the paper, came up for a couple of interviews, got the job and started as a design
engineer, and that was pretty daunting at the start, even the job interview was pretty daunting. It felt a lot different to the company I’d just come from, ...

Geoff reported that after he was made redundant, he faced the challenge with entrepreneurial flair. He described how the redundancy provided the opportunity and needed impetus to pursue an original idea he had previously generated but not developed.

Geoff

Yeah well I actually, it was kind of good they were downsizing and because I was kind of last in the marketing I got made redundant which was perfect because in that period of time before that I was kind of writing a business plan because in marketing, which was, it was good, in marketing and sales which was good I guess something I’ve always wanted to develop is a consumer consumable, a product that is a consumer product because you’re pitching to the emotions, as opposed to business to business kind of product, that it’s a more you know financial decision so I’ve always wanted a consumer product and I’ve always wanted a consumable and that is actually why I didn’t then go into my own furniture design business.

Jane’s experience of job change also had a positive effect on her work trajectory and marked a significant change in direction into fashion and trend forecasting. Leading up to this quote Jane details her international working experience and how her various job changes have influenced her career direction.

Jane

And it was like a really, it felt like a really amazing opportunity so I took the job, and it was a bit, that was my hardest decision, was going from, going to factories and working with product and actually designing stuff to go in to a job which I’m doing now where I’m not actually designing stuff. I am designing it to a point, to like the drawing stage and describing and like researching and doing all that stuff, but I’m not actually going to factories or anything like that.

Interpretive code (e)ví: Beliefs

I used the term beliefs to refer to strong personal philosophies or views which impacted on the respondents’ individual practice of industrial design. Beliefs are relevant to mobility, as people will consider modifying practice or changing jobs if core concerns are challenged or unmet by the prevailing conditions.
Such beliefs included anti-consumerism and anti-marketing views. Respondents’ input indicates that some beliefs were evident early in their work trajectories while others developed over time and exposure to different work environments. The subcategory of beliefs was linked to issues such as Social Conscience, social responsibility and environmental concerns; and respondents described these from the perspective of how their individual practice and that of their employer impacts on these issues. Respondents reported examples of how they modified their own practice and or endeavoured to modify the practice of others in response to these concerns.

**Anti-consumerism**

An anti-consumerism stance was evident within the respondents' narratives about their beliefs and experiences. This view was linked to concerns about the environmental effects of consumerism and the consumer driven economy, and the potential for manufactured products to be quickly superseded and create waste. As a component of the theme ‘beliefs’, anti-consumerism was present or developed while studying industrial design and in subsequent professional roles. Some respondents described their realisation during their undergraduate study that traditional industrial design, with its focus on DFM, had the potential for negative consequences. One such attribute was that industrial design was a part of the product design and development process which was responsible for the mass production of artefacts. Scott described it as a course where he ‘was learning a trade in how to create junk’.

*Scott*

... One thing that I do recall is that I quite quickly worked out that I wasn’t too keen on becoming someone that just pumped out high volume, fast moving consumer goods and things that end up on the rubbish tip. I was resigned by sort of mid to the end of second year that I didn’t care if I didn’t actually become an industrial designer, I know that sounds probably a bit why didn’t I go and do something else. I didn’t know what I was going to do but I loved the course and so I kept on doing it, and I guess I was hoping that I’d somehow find some sort of niche that was meaningful and not going against the grain I guess of what I was thinking at the time.
Kim detailed her negative sentiments regarding the consumer society and the related aspects of manufacturing and industrial design practice. She highlighted her connection of beliefs with a socially responsible society and the link with the theme of social conscience. Her comments reflect that although designers could be part of the problem, they could also be part of the solution. This suggested a hope that perhaps they could be involved in creating products that make a positive connotation or contribute more meaningfully to society.

Kim

...and so design has a real responsibility in that they, and this is again very unlikely to happen given that we have such a consumer driven economy: but design should be playing a role in limiting the use of resources. So whether that is designing for disassembly or just cutting out design redundancy, or whether it is something, even like producer pollution controls: so the producer becomes responsible for the good that is then thrown in landfill. Like if the designer or if a design process can be found to deal with that issue, so ‘We’re going to have to throw this thing away at some point: what solutions do we have for dealing with it? Can we take it apart and reuse it? Can we send it back to the person that made it in the first place and have some sort of protocol in place that, because of the way this thing’s designed that it can then be turned into the next version?’ So whether it’s just putting a new façade on it, because I’m assuming the internal workings of an iPod probably haven’t changed that much since they first came out, and they’ve had eight generations of them...

Anti-marketing

Interview participants articulated negative connotations of marketing practices that indicated a negative view of practice within larger design and manufacture firms. This anti-marketing component was seen as competing with the designer’s ability to contribute meaningfully to the design development process. The issue is linked to the concept of identity and the perceptions of those in other professional fields involved in developing consumable products. For example Charles felt employers undervalued designers’ user centred design approaches in comparison to the input of the company’s marketing section.
Charles

But, no, certainly, in terms of the user centredness, or an emotional understanding of the user, when I was working at [...] for those years, that was not mentioned. We would get kind of aesthetic direction from marketing seminars: little workshops with marketing people, which I found to be, yeah, I have issues with certain marketing attitudes to what a design can be. So, yeah, I think, you know, and I relied on my understanding that I learned from university, at university. You know, I relied on my knowledge built at university, to develop products that were user friendly, i.e., [...] ...But there were things, you know, marketing, which I can’t remember now. But I remember coming away from some of those meetings with a really bad taste in my mouth about directions that were given.

Todd echoed these concerns regarding the power of the marketing areas of the companies he was dealing with as a then practising industrial designer employed by a large design consultancy. The influence wielded by the marketing area concerned him, as their beliefs did not match his own but they could not be challenged as they were providing the design consultancy with work.

Ted

... or any of these things that drove me to distraction. And I think the other thing was also realising the degree to which the marketing managers in a lot of these larger companies, the major client was [...] at the time and the marketing managers regardless of, I mean I had to respect their expertise, but I still felt they were really short sighted and they had an incredible level of control over the process and really there had to be a [?] word] because you needed to keep these people on side otherwise it was game over.

As part of Ted’s further study he was exposed to related marketing education but was very blunt about his negative experiences.

Ted

And then there was a little bit of marketing and branding and brand strategy stuff which I absolutely hated and decided I never wanted to spend a second in that world.
Interpretive code (e)vii: Confidence

I used the term confidence to refer to self-belief: in ones’ own efficacy and competence as a designer. Confidence emerged as an important personal attribute in the mobility theme that influenced career trajectories and practice development. Interview data indicated that confidence had a significant role to play in respondents transiting through aspects of their practice. Some overtly mentioned confidence or the lack thereof, as determining factors in certain decisions they made during the negotiating of the work trajectories. Others demonstrated a certain level of confidence in the way they negotiated their developing practice.

Nine respondents referred to attributes coded as confidence within the interviews, with several respondents revealing their lack of confidence after graduating. For example, Aiden described his diffidence in pursuing work as an industrial designer after graduating. This lack of confidence influenced his attitude to finding design related employment and his initial steps into a career in design.

Aiden

...At uni, I didn’t end up at the end of the degree with a whole lot of confidence about actually working in industrial design and I didn’t really feel informed about where else I could fit in. I’ll touch on that later, but I guess, I had a fairly negative outlook by the time I left about working for one of those consultancies. And I think I may have applied for a few jobs, but really only half-heartedly and then fell away from it completely. I mean, not long after I left uni, I didn’t think that I would ever have a design career, because I mean, at that time, it was recession. There were only a couple of students there probably, I don’t know, probably left the course with the skills that at the time I thought you would need to get a job in industrial design, who I felt were better than me, so I had this attitude, ‘Why try it?’ I know that’s a really negative thing to say, but — and it’s probably got a lot to do about my own self belief at the time as opposed to the structure of the course.[...]

Charles also referred to confidence-building in the role of designer as an important part of his first industrial design position post-graduation, and how this enabled him to make a contribution to his employing firm. It is evident that his confidence grew regarding the role of industrial design.
Charles

Yeah, I think so. I mean, yeah. It’s also a confidence thing, too. You’ve got to remember, I was fresh out of uni, in these things, and they’re bigwigs that have been in their careers for a long time and really know what they want. You know, I built that confidence while I was there but, certainly, in the preliminary ones, you kind of sit and listen to what’s happening and offer your two cents worth, you know, when you can. But you would, I mean, you’re the designer so, you know, you put your mark on the design. So in that sense, you still rely on yourself to come up with something that may align with their thoughts of what the product might be. But also can be responsible in terms of what your attitudes to what the products should be, in a more kind of, I think, egalitarian is too strong a word but, you know, user perceptions and understandings and the fact that people are using your product, so it should perform well.

Ted, a participant based in Europe, discussed his experiences and his view that Australians have a higher level of confidence in their abilities. He referred to Australian industrial designers having a level of social confidence that allows them to perform well in international environments.

Ted

I think Australians are generally very hard workers in the global scale of things and of course some have an inbred, innate sense of social confidence that perhaps other people with other backgrounds have different skills, different strengths. But certainly there’s something about industrial designers that are just generally work so well in a team and can really transfer their skills to different tasks well.

The lack of confidence revealed by some of the respondents in the immediate post-graduation stages of their career may be natural. Factors which may promote or inhibit confidence could include the prevailing economic climate at the time of graduation, or their perceived standing within the graduating cohort.
Theme 6: Identity

Identity as a theme relates to how the identity of industrial design is understood or recognised by individuals both inside and outside the field. The lack of clarity of the definition and scope of industrial design discussed in Chapter 2 is reflected in my own practice and experiences. On this basis, I developed the broad issue of industrial design identity as an a priori descriptive code.

Analysis of the interview data led me to identify three sub-categories of interpretive codes, each examining different groups of people’s perceptions and understandings of the profession of industrial design. As shown in Figure 4.7, the identity theme comprises:

**Profession identity:** What do people outside industrial design understand about the profession of industrial design? This category includes the general public and employers.

**Personal identity:** What do people within industrial design understand about the profession of industrial design? This category includes industrial design graduates and practitioners.

**Australian identity:** What do people outside Australia understand about the profession of Australian industrial design? This category includes international employers and international industrial designers.
As discussed in Chapter 2, the definitions and parameters of industrial design are contested, ambiguous and often misunderstood. There is a lack of agreed language to delineate and describe the field, and a corresponding lack of agreement on the scope, meaning and roles attributed to the terminology. This confusion is multi-faceted: it is reflected in the literature and is a recurrent theme of discussion at national and international conferences.

This continued blurring of discipline boundaries, and the consequent problems in defining industrial design, impedes analysis and standardisation in education, employment and practice settings.

The implications of these issues for the identity of the profession have been addressed by Gadi Amit, on a Core 77 web article, where he addressed the definitional problems of industrial design and the corresponding identity issues of the profession (Amit 2011). He noted that:

\begin{quote}
Now, why deal with the definition of industrial design at all? Because despite the upswing in its popularity ID is still one of the least understood professions in corporate America.
\end{quote}

He later stated:

\begin{quote}
... to make things worse, even within the ID community: there exists no strong, crystallised definition.
\end{quote}

Amit described industrial design as moving between two polarised positions of innovation or art and self expression. The fact that both poles can be included
in the scope of industrial design was, as he wrote, where the misunderstandings of industrial design reside. His proposed solution was a reaffirmation of industrial design on the basis of *that which is industrial*, noting that ‘our fragile profession might do well to stand on the two legs it was born with’ (Amit 2011).

Analysis of the nature of industrial design, its parameters and application has also been conceptualised as a pyramid (Ashby 2010) where different layers represent different aspects of design focus. This diagram represents the majority of work in the field as technical design, with a smaller part being seen as industrial design. However, Ashby argued these should not be seen as separate activities but as part of an integrated whole, and noted ‘It is better to think of all three tiers as part of a single process that we shall call product design’ (Ashby 2010. Slide 5.) This approach promoted a difference between product design and industrial design, with industrial design understood as the lesser stylistic sibling of product design (personal communication EPDE conference September 2009).

Other authors have also proposed a distinction between product design and industrial design, but diverge from Ashby’s position. For example, Brunner and Emery consider industrial design not as a subset of product design, but as a separate and independent design element (Brunner and Emery 2009). This approach categorised industrial design within the confines of mass produced physical objects, and saw more broad ranging applications of design thinking as outside these categories. From their understanding, ‘Industrial design is essentially the development of objects for mass production, typically three dimensional, physical objects or the interaction with them’, and product design ‘occupies a gray area between industrial design and software design and the development of interaction design’ (Brunner and Emery 2009 p. 24).

Both perspectives described above are in direct contrast to the widely-held Australian view. In Australia, it is generally accepted that the whole gamut of relevant activities should be brought under the one umbrella of industrial design, with product design seen as one component of the overall field. In
domestic terminology the entire pyramid is considered industrial, rather than product, design. Correspondingly, Australian industrial designers have a reputation for possessing a wide range of skills (Trathen and Varadarajan 2009).

The lack of shared nomenclature across international boundaries reinforces the confusion surrounding the role and identity of industrial design. This is reflected even in the professional international peak body ICSID, where industrial design is defined in this way:

*Design concerns products, services and systems conceived with tools, organisations and logic introduced by industrialisation - not just when produced by serial processes. The adjective "industrial" put to design must be related to the term industry or in its meaning of sector of production or in its ancient meaning of "industrious activity". Thus, design is an activity involving a wide spectrum of professions in which products, services, graphics, interiors and architecture all take part. Together, these activities should further enhance - in a choral way with other related professions - the value of life. Therefore, the term designer refers to an individual who practices an intellectual profession, and not simply a trade or a service for enterprises.*

The link between the title of industrial design and the term *industrious* used in the definition is significant, and the concept is potentially applicable to a much broader range of contexts than its historical links with manufacture. However these issues are the subject of on-going debate as exemplified by conversation and presentations at international conferences such as the 2009 Engineering and Product Design Education (EPDE) conference and the 2007 and 2009 International Societies of Industrial Design (ICSID) conferences.

The international debates are reflected within Australia and the ramifications of uncertainties about definitions and roles are wide reaching.

While generally tertiary education courses in the field are entitled industrial design, some use the ‘product design’ label. In the same way, departments educating industrial designers may be located in a number of areas of Australian universities. Courses may be situated in areas of design alongside architecture or graphic design, as with the University of Canberra, or with engineering or even more traditional Art school areas.
Likewise the permeable boundaries of the profession are reflected in the employment market. The range of jobs in which graduates obtain employment is wide. This can be seen either as a reflection of the breadth of application of the field, or the realities of the lack of manufacturing opportunities in Australia which require graduates to find work in non-traditional areas (Trathen and Varadarajan 2009). These issues also have implications for the identification and enumeration of industrial design careers and job opportunities. For example, the Australian Government classifies areas of research and employment for a range of purposes, including research funding and employment tracking and analysis (ABS Standard Research Classification 2008). These classifications are problematic for industrial design because they often inadequately describe and define work roles applicable to the field. This has significant implications for research undertaken regarding the profession: for example, one study aiming to investigate post-graduation employment for industrial design graduates found existing data unhelpful. Researchers resorted to using the yellow pages to help locate possible employers that identified with industrial design practice (Higgs P, Cunningham S et al. 2005). Similar definitional challenges confront all studies in which industrial design practice and employment is included (Victorian Government 2008).

By contrast architects, who are registered with an accrediting professional body, can be identified: they are called architects, see themselves as architects, and are employed by architectural firms in roles referred as architects. In industrial design however, many graduates do not seem to work in industrial design roles or identify with being an industrial designer.

Interestingly in Australian mainstream popular culture, the term design has increasing currency. For example, ubiquitous reality TV shows featuring home renovations or the development of new ideas for marketing often include design references and frequently profile designers. However the term ‘industrial design’ is rarely used or promoted. This ‘TV test’ highlights the low public profile of industrial design, which is evident both in the general community and within the secondary education system.
The ambiguities of the role definition are played out in lack of clarity of identity at personal, professional and Australian levels. Interview respondents reported how these issues are experienced from a personal perspective: in fact aspects of industrial design identity were discussed in every interview. Identity issues raised were wide-ranging. There were mixed responses about being an Australian educated or based industrial designer, as opposed to designers from other countries. Respondents indicated the lack of a clear Australian industrial design identity in a national and international context. The lack of personal identity, with people not knowing what industrial design is, was also articulated.

**Interpretive code (f)i: Profession**

The interpretive code of Profession identity is concerned with the understandings of industrial design among people outside industrial design. This category includes the general public and employers. Interview respondents articulated the ongoing issue of identity of industrial design as a recognised profession by the general public.

When considering options for university study, prospective student’s choices are influenced by their existing perceptions about various fields of study. In the case of industrial design students, it appears that few have clear understandings about the profession before beginning the course.

Only some interview respondents had selected or even heard of industrial design prior to their ultimate decision to pursue industrial design education at university. Instead their knowledge was often confined to an awareness of the professional fields of architecture and engineering; contact with industrial design was in these cases more or less accidental once course options were being explored.

The respondents interviewed commenced industrial design at the University of Canberra during approximately the 10-year period 1993-2003. However in
respect of the profile of industrial design, little change is evident between their school-leaving environment and the current situation. Even today, many students enrolling in the industrial design course have done so almost by chance, with little guidance or knowledge about the profession.

Aiden for example explained he had never heard of industrial design during his schooling until a Year 10 work experience opportunity exposed him to the profession.

_Aiden_

*Well, to be honest, I hadn’t heard of industrial design until I looked at the, I don’t even remember what the book was called now, but the book you get that tells you what courses are available and what you’ll get with your TER.*

*I’d never heard of industrial design and no one had ever spoken about it until work experience in Year 10. Oh, actually, I was exposed to it in work experience in Year 10 when I did work experience and they had – oh, I did graphic design with them, but they had a small team of industrial designers…*

Lucy likewise was not aware of industrial design until late in her schooling. This highlights the lack of recognition in the general public and the school system about the profession of industrial design.

_Lucy_

*Yeah I guess, cos I’d always been into art and like making things and whatever and so I’d originally been thinking about architecture. And we had a family friend who was an architect and he was trying to convince me not to go into architecture because of how it fluctuates so much as an industry and you know that kind of thing. And so I was sort of looking at other options as well, I was still sort of thinking about it and just happened to come across industrial design in like a course guide book when I was at school, and read through it and it sounded like all the stuff that I like doing, so I thought yeah that sounds pretty good, I’ll do that. So that’s pretty much how I came across it, it was just I came across it by accident I guess but it was all the things that I enjoy, so.*

Paul also referred to the lack of awareness in his school days about industrial design: he knew the areas in which he was interested but was not aware that industrial design could be an avenue to explore and achieve these.
Paul

Funnily enough . . . I hated art at school even though I like art now. I never liked that because I never had to, you’re sort of forced to create or something like that but I did technical drawing which was interesting, I really liked that. **But there was no real knowledge growing up in the bush about**, well, you sort of know what architects are but most of the teachers there, there was no real awareness of that sort of thing.

I can’t say I had a great knowledge of what industrial design was. I think it takes a few years to really sort of appreciate what it is and what industrial designers do but I thought, and that was probably a bit of a mystery in some ways because I was interested in how can you also handle detail design and all the technical aspects but also handle just some broad-based stuff. I thought that’s such a broad range of knowledge and skills and I really didn’t know how that would be just that I was interested in it, just something to move towards. So what did I think I may be doing? I don’t know. Designing things somehow.

Geoff felt industrial design was under-appreciated in comparison to art. Art, he thought, was better understood due to availability, accessibility, understanding and education, whereas the important contribution made to society by industrial design was under-recognised and under-valued.

**Geoff**

All this kind of stuff right, but I mean it’s just funny that that is not available or you know, that that’s not around for industrial design because you know in some ways, I mean yeah I agree I do feel that what industrial designers do is more I guess important to society than what an artist does, they’re both very important but you know there’s no understanding there which is crazy. And so I mean that [?] again that’s a difficult thing to kind of create and develop because yeah people have to go to an art expo because they understand it and they want a picture on the wall but industrial design, firstly [?] common I guess lack of understanding, in society as to what industrial designers actually do,....

Charles acknowledged he did not know much about industrial design earlier in his education but felt recognition is occurring.

**Charles**

I think you’re probably aware that industrial design has only recently come into its own, in terms of a widespread understanding of what industrial design
actually is. And prior to my actually kind of investigating it formally, before
doing it, I was not hugely aware of the field of industrial design, in terms of the
understanding that I possibly should have had. Because, you know, it’s been
around since decades and decades. Yeah.

Jane, who is based in Europe, referred to herself as a product designer rather
than an industrial designer, and raised the issue of lack of a universal
understanding of the profession.

Jane

Yeah. I say product design not industrial design ’cause it kind of, even though
most people like my age would know what it is but like some other people
don’t really know. But mostly I refer to that I studied design because that’s
what people care about, that you’ve got a design degree.

Interpretive code (f)ii: Personal

The interpretive code of personal identity is concerned with the
understandings of industrial design among people within industrial design.
This category includes industrial design graduates and practitioners.

The lack of professional identity discussed in this interpretive code above has
corresponding implications for personal identity. Interview respondents
reported personal perspectives on their lived experiences as industrial
designers.

Scott explained how the two dimensions intersect and gave an insight of how
that can be experienced at a personal level. In this excerpt, Scott described his
personal identity as an industrial designer and explained the dilemma faced by
many who have studied industrial design. The general public does not have a
good grasp of what an industrial designer does in comparison to other design
related professions such as architecture or graphic design.

Scott

………. one thing I’ve always struggled with is who am I, what do I call
myself, like at a party someone says hi what do you do? And I always have
this split second, shit what do I do – do I say I’m an industrial designer, am I
a manager in a company that manufactures parts. Or am I a design engineer,
like it’s how do I quickly convey something that they’ll get straight away. Cos I
used to find, it always drew a blank face when I said I’m an industrial
designer, and maybe because of that I tended to say well yeah I still say I’m an industrial designer but I quickly follow it up with a more detailed explanation of what I do. Maybe cos I’ve been conditioned that people still don’t know what we do, yeah.

The exchange with Fiona excerpted below covers a number of the identity issues related to industrial design where she referred to the broad application of industrial design and the identity of the profession and herself. Again the implications at a personal level are described, where Fiona noted she felt ‘a lost sense of identity’.

Fiona

I guess because I haven’t worked in an agency and I haven’t done this and I haven’t done, you know, I know that everyone that studied my course have pretty much said, will say the same thing, who’s designing, you know. I guess what we studied at uni was a bit more specific and we’ve all sort of branched off and done other things. And as you say, it is still a part of industrial design.

Interviewer: Yeah.
Fiona
And that’s the problem with industrial design, it’s so bloody broad.
Interviewer
Okay that’s good, yeah.
Fiona
It’s not like architecture.
Interviewer
And that causes problems, I mean is that a good thing or a bad thing?
Fiona
I think it does cause problems defining yourself.
Interviewer
Yes, so sense of identity?
Fiona
Yeah I have got a lost sense of identity, for sure. That’s the thing, when people ask me what I do, you know I go, I develop product or I design product or I design stuff. I don’t know.
Interviewer:
Yeah.
Fiona
What do I do, I don’t know? Identity that’s right, a lost sense of identity.
Interviewer
But it’s also very broad in its, it seems to be broad in its applications?
Fiona
Yeah.

Interpretive code (f)iii: Australian
The interpretive code of Australian identity is concerned with the understandings of people outside Australia about the profession of Australian industrial design. In this study, I examined the respondents’ experiences of how international colleagues viewed Australian industrial design. The respondents with international experience generally had views on this issue.

In considering overseas perceptions of Australian design, Jane concluded she was not aware of any Australian product design brands that have an international reputation.

Jane
But actual Australian design. I don’t know. Like I don’t really, I think it should be kind of seamless. I don’t really think there should be an actual Australian signature look or how it’s perceived. I think that it would be good if it was up there like, but you don’t really hear about it, it’s not a key thing. Like you hear about Australian film, an Australian film is like a really international, is on an international level, and then a few fashion brands are coming up, of Australian brands that are starting to do really well. So I think, I’m just trying to think of any brands of, Australian brands that involve product design that have an international reputation. I can’t really think of any. Now you can give me some clues.

Ted, who was also based in Europe, discussed the range of Australian design culture and identified Melbourne as an Australian city recognised for design.

Ted
...everyone knows there’s a lot happening in particular in Melbourne, there’s a lot of really kind of popular music coming out of Australia, there’s popular designers, fashion designers, architects and Australians I think generally just have a reputation of being hard workers, so it’s quite interesting, it really is the last couple of years, it’s on the tip of just about everyone’s tongue and I had a meeting just a couple of days ago with one of the I would say most talented designers I went to school with, and he was asking about moving to Australia. He’s from Slovenia but runs his own company at the moment. And yeah he’s just heard there’s a lot going on there and so he’s through the, quite interested in heading down to Melbourne and he’s looking at getting into kind of branding, brand development sort of position. And I think there’s definitely that work available in Australia.

It is worth noting that three graduates mentioned Melbourne in their conversation about Australian identity. There is recognition evident about the success of Melbourne’s developing identity with a design perspective. No other Australian city was specifically mentioned in this context of the perception of Australian design. This perception of Melbourne is interesting to note after the Australian State of Victoria has made a deliberate and strategic plan to associate Melbourne with design and has carried out investigations of the impact of various aspects of design such as the ‘Five years on; Victoria’s Design Sector 2003-2008’ (Victorian Government 2008). Kim for example described Melbourne as a city that offered potential opportunities that suited her view and ideals of design.

*Kim*

*And then probably going to a slightly larger city, and I see that city being probably Melbourne: I think it probably has a lot of those ideals that I was talking about. There seems to be a much greater opportunity there for niche-type agencies to exist that provide very specific services, like, ‘How can we design the flow of people through these doors,’ or something. Because of the number of people there and the demand, I think there’s a lot of companies there and they need some sort of comparative advantage which creates a demand for boutique niche-type agencies to service that. And they’re also very forward in their planning approach. I’m not really considering a long-term career in planning, but I see it as a very similar thing to design in terms of finding solutions to things.*
The Thematic Map of Australian Industrial Design Practice

The Thematic Map of Australian Industrial Design Practice, as shown in Figure 4.8 below, conceptualises the relationships between the themes explored above. The model represents the themes (shown in upper case), each grouped with its interpretive codes (shown in lower case bold). It is the overall interaction between the themes which produces the flexibility and broad application of industrial design practice which was a key finding from the interview data: shown in the centre of the diagram as the themes of industrial design practice.

There are multiple layers of interaction between all elements of the model, and all are integrally linked. However the strongest connections between themes are reflected in their location within the schematic representation of the model.

For example the Communicator theme is located in the model between the themes of Facilitator and Approach Thinking, as there are strong links between these three. Effective communication skills are essential to undertaking the facilitation role often associated with industrial design practice. In a similar fashion, core communication skills constitute the ‘tool-kit’ upon which the design method (shown as Approach Thinking) is operationalised. Correspondingly, the strong association between the Social Conscience theme and Approach Thinking theme is reflected by their adjacent placement in the Thematic Map of Australian Industrial Design Practice. While potentially a prime collaborator in unsustainable global patterns of consumption, the designer may also hold the key to future design for life approaches.
Conclusion

This chapter described the findings derived from the application of methods discussed in Chapter 3. Iterative layers of analysis of the interview transcripts were undertaken with each step defining and refining the interpretations and directions supported by the data. The links between the literature and the interview data are also described.

The themes which emerged from this process were:

**Communicator theme:** this theme highlights the importance of the role of verbal and non-verbal methods of exchanging information and reaching shared understandings

**Approach Thinking theme:** this theme recognises the philosophy underpinning the design thinking methodology and application
Social Conscience theme: this theme reflects the participants’ strong focus on ideals of environmental sustainability and social responsibility in their practice

Facilitator theme: this theme indicates the thread of the industrial designer as a point of connection across multi-disciplinary groups

Mobility theme: this theme draws together the diverse factors influencing the employment opportunities in an industrial design career

Identity theme: this theme underscores the impact of the loose definitions and scope demarcation of the industrial design profession.

Taken together, the six themes help us to understand interview participants’ lived experiences and how these relate to the evolving ecology of the industrial design profession. The relationships between the themes were conceptualised by means of the illustrative Thematic Map of Australian Industrial Design Practice, which visually highlights the intrinsic links between them.

This chapter content is significant as it takes the interpretation of the lived experiences of recent graduates to be able to understand the range and significance of the practices of design graduates. This demonstrates that the graduates reflect and review the professional challenges of their careers post industrial design qualifications as they negotiate their way forward and develop and demonstrate resilient and adaptive practices. This is richer and more informative, with regard to what is actually happening in the arena of graduates of industrial design. This is in contrast to for example, a research approach that is limited by only exploring design practice through the view of employers and employer representative bodies.

The next chapter describes the use and design of diagrammatic models to visualise abstract concepts and build a theoretical understanding. It provides an overview of how I used models to communicate the concepts I am covering in this study and their importance.
5. Modelling design practice
5. Modelling design practice

Introduction

This chapter deals with the application of the diagrammatic models discussed in the previous chapter that are used to visualise abstract concepts, systems and relationships. I then detail the specifics of each of the models developed, how they applied in this part of the study and how they assist in explaining the range of issues relevant to industrial design. These models are important in the visualisation and thus communication of the theoretical concepts I have used to describe the various aspects of industrial design practice and education.

Each model description makes reference to additional supporting literature where relevant and in addition to the literature referred to in chapter 2. In the case of the archetypes, illustrative quotes from the interviewed graduates are also used to augment the model description.

Four model types are described: The Triple Axes Model, the Design Development Wave, the Australian Industrial Design Ecology Framework and the Five Archetypes.

The Triple Axes Model, which shows the competing priority continuums along which various forms of design practice and education are situated.
The Design Development Wave, which shows the relationship between the front end and back end aspects of design development and process.

The Australian Industrial Design Ecology Framework, which draws upon the categorisations of Adopter–Adapter–Departer (AAD) developed in earlier chapters to map the breadth of design practice.

The Archetypes, which describe the development and location of the individual archetypes within the Australian Industrial Design Ecology Framework. I outline the purpose and role of these archetypes as conceptual constructs and their use as an aid in explaining the various influences of industrial design graduates. I then describe each archetype: The Visual Creative, The Technical Product Designer, The Digital Maker, The Design Deviser and The Dissident Designer.

**Models and their role in this research**

Before describing the models developed and applied in this study, this section explains the purpose of models and how they can assist in formulating and conveying abstract concepts.

**What are models?**

Models have been described as a display of systems showing relationships between elements or concepts, providing ‘abstract representations of ideas and idea structures’ (Ware 2008, p. 164). As noted by (Orona 2002), models provide a means of seeing and understanding abstract concepts and relationships in a quickly accessible way. Such models can take a variety of visualisation forms, all with the common theme of seeking to aid the development, understanding and communication of complex information. While models often use shapes, forms and spatial placement as integral elements, text is also an important attribute.
Why use models?

The link between the development of external models and the development of internal thinking is well-recognised: the process of articulating our thoughts in visual representations assists in those thought processes. As noted by Ware:

*Although we can, to some extent, form mental images in our heads, we do much better when those images are out in the world, on paper or computer screen. Diagrams, maps, web pages, information graphics, visual instructions, and technical illustrations all help us to solve problems through the process of visual thinking.* (Ware 2008, p. ix)

The same importance is emphasised by Miles and Huberman, 1994, (cited in Bazeley 2007, p. 34) who stressed that ‘you know what you display’. Even more fundamentally, as referred to in the previous chapter, Bill Burnett suggested that it is only through developing models, sketches and other visual representations that designers can fully develop their design approaches (W. Burnett, ‘d’ school, personal communication 16 October 2007). This process is equally important internally and externally. Internally, it assists in self-reflection and refinement of ideas in an iterative design process. Externally it helps in communicating ideas and concepts to others.

The production of models is used across various disciplines, including the sciences. While for some investigators in other disciplines, the approach may be novel, for designers, turning ideas into visual representations is second nature. Whether using technology such as CAD or simply pen and paper, the designer’s instinct is to communicate visually.

Models in this research

This conceptual background coupled with my own design approach and skills made the use of models an integral part of both the process and the outcomes of this research. As described in Chapter 3, I used a range of visualisation methods including initial sketch models and mind-mapping software from the outset of the investigation to allow me to think and work visually. I found this approach the most effective in exploring a variety of ways of displaying, reflecting and understanding the information I was formulating. The models
were essential to dealing with data by trialling theories and developing concepts in the investigatory phases of my research. The models I constructed including the earlier explorations and the final Triple Axes Model, the Design Development Wave, the Australian Industrial Design Ecology Framework, the Five Archetypes and the Thematic Map of Australian Industrial Design Practice, constitute both a significant part of the new knowledge products generated by this research and a key communication mechanism in explaining these to the reader.

**How I developed these models**

I found Maxwell’s advice, that ‘creating early concept maps help clarify the conceptual framework or theoretical underpinning of a study’ (Bazeley 2007, p. 34), to be highly relevant in my case. With this in mind, and as noted above, the beginnings of the final models produced can be traced back to the outset of my research.

Initial concept sketches, notes and freehand diagrams from interviews, affinity boards on which possible codes and themes were grouped and regrouped – all fed into the visualisation and creation of conceptual structures which helped to understand, theorise and articulate my research as my ideas developed. As these progressed, the need for specific models to be developed became clearer. Initial sketch models on paper progressed through representations with computer software, as I engaged in iterative reflection and refinement of the visual representations vis a vis the information and thoughts being revealed from my data analysis. All models developed followed a similar pathway: as shown in Figure 5.1, I made many early freehand concept sketches to explore ideas and possible relationships between them. As illustrated by Figure 5.2, I then progressed to translating these sketches into software-generated representations. This enabled many different versions to be trialled, as I searched for the most effective way to show the complexities and interconnectedness between the concepts I was generating, before achieving the final versions of the models described in the next section.
Figure 5.1 Early concept sketches of proto-models

Figure 5.2 Trialling alternative model representations
Overview of models

The models developed through this phase of the research comprise:

- The Triple Axes Model, which shows the competing priority continuums along which various forms of design practice and education are situated
- The Design Development Wave, which shows the relationship between the front end and back end aspects of design
- The Australian Industrial Design Ecology Framework, showing the breadth of design practice mapped to axes of what designers do and how designers work
- The Archetypes, which describe the development and location of design archetypes and their location within the Australian Industrial Design Ecology Framework.

Each is detailed below and the implications discussed.

Industrial design: the Triple Axes Model

I have developed a visual conceptualisation, as a propositional model based on reflections of my own educational practice, observation in continuous curriculum review and discussions with colleagues. In this visualisation, I show the competing priorities which influence the changing role of the industrial designer as continuums set on three axes. Once we understand these continuums at the level of professional role identification, we can consider the implications of the model for design education.

As set out at Figure 5.3: triple axis model of industrial design education, this model maps the approach along three axes, or continuums, of priorities developed from topics developed from my reflective practice, observation and discussions with my peers:
While specific course content is variable, the mix and proportion of each of these six broad terms, and the point on the continuum chosen, helps to describe and analyse the various styles of industrial design education around the world. Importantly, all paired concepts are continuums, not dichotomies. For example, the issue is not skills OR knowledge, but what should be the appropriate mix of both?

In educational terms, all six elements are necessary elements of industrial design education for the student to graduate as an industrial designer. Trying to cover all equally results in student confusion: the challenge lies in finding an
appropriate blend and emphasis of each, within the time constraints of the
given course of study. I discuss each of the continuums below.

**Process–Outcomes axis**

The Process–Outcomes axis refers to the continuum between privileging *process* (the deliberative, exploratory and investigatory pathways we have traversed) versus privileging *outcomes* (the final destination, end point or product which results from these processes).

Process driven projects place emphasis on how a student went about the project and examined the range of tools and approaches potentially available to develop new products and solutions. Process tends to be given higher priority than outcomes in projects dealing with User Centred Design (UCD) or design thinking and in sketch models. A focus on process can reward aspects of risk taking behaviour, as it recognises and values ‘trying out ideas’ even if the ideas ultimately do not result in a resolved outcome. Process-valuing styles can incorporate other aspects of design research that help inform both the design problem identification along with design solutions.

At the other end of the continuum, a focus on outcomes gives priority to the final result, regardless of the processes from which it arose. Projects which privilege outcomes tend to suit students with innate flair or creativity, able to produce an appealing outcome, even though they may have ‘leap-frogged’ valid processes along the way. Such projects tend to also prioritise skills in outcomes production, such as model-making, CAD or rendering.

How educators site design teaching and learning objectives on this continuum can affect their graduates’ strengths and weaknesses. Curricula focussing too strongly on *outcomes* do not promote risk taking or innovative approaches and possible outcomes, whereas those more strongly oriented to *process* can devalue actually achieving desired results.
Skills–Knowledge axis

The Skills–Knowledge axis refers to the continuum between a focus on skills (the capacity and competence to undertake learned techniques) and a focus on knowledge (theoretical understandings of concepts, strategies or histories).

Traditional industrial design was largely based on the acquisition and mastery of skills. Techniques such as drawing, sketching and model-making were the backbone of the field. Today, these are more likely to be applied in CAD, but similar approaches apply.

Skills such as these remain an important component of the contemporary industrial designer’s toolkit. Designers must have the ability to communicate ideas and solutions to others: to peers and colleagues, to clients and to manufacturers. In some ways their skills in a design language beyond the verbal and written word are even more central in the trans-national and multi-lingual environment of global economies and manufacturing.

The concept of knowledge forms the corresponding pair for skills on this axis. While some forms of knowledge, such as manufacturing materials and processes, are long-standing aspects of design curricula, traditionally skill development was given greater priority than gaining theoretical knowledge. While these conventional areas of knowledge remain, an important focus is on building students’ ability to find and apply knowledge, rather than simply acquiring a series of ‘facts’. The explosion in knowledge makes it impossible for anyone to ‘know everything’, even about very specific subjects. More important is the fundamental approach of how to locate the relevant knowledge: where to look, how to research, how to interpret and how to apply this knowledge, all are paramount. For example, regarding materials, rather than retaining specific lists or attributes (which may change) of many materials, it is probably more important for students to know that there are a great deal of these choices available and for them to have processes for determining the most appropriate choices.
Risk–Safety axis

The Risk–Safety axis refers to the continuum between risk (innovation and the corresponding chance of failure) and safety (conventional approaches which can stifle creativity) linking to the topics of risk and play discussed in chapter 2.

Risk is an inescapable part of developing innovative approaches to problem solutions. As IDEO thinkers have explained, risk taking is necessary to break out of safe and potentially boring and un-innovative design solutions.

From an educational perspective risk taking can be hard to promote to students with requirements to pass a subject. Finding ways to reward risk taking is possible within an educational environment, but less so within the constraints of many business models. It is noteworthy that companies such as Apple or Google which typify innovative practice have recognised risk taking and mistake making as part of good practice.

The opposite of risk taking is the safe approach. Taking known approaches to achieve what is known to be valued – by teaching staff or by the public – can lead to a convergence of style and design solutions. This gravitation to the mean can promote ‘sameness’ and lack of individuality.

The triple axis model is significant in visualising and understanding competing tensions within industrial design education and the elements of the three continuums are used in the development of next model: The Design Development Wave.

Design development wave

The Design Development Wave was developed to provide a diagrammatic representation of design process, design education and the relationship between the two.

If we take a helicopter view, the design process can be understood as a process moving from idea exploration to tangible product development (see Figure 5.4:...
Design development continuum. In this schematic, the process begins with initial phases of problem identification, design research and design opportunity analysis. These phases, represented here as the left hand end of the timeline, are sometimes seen as the ‘soft’ aspect of the process. Design processes then develop to more detailed stages, with the right hand end representing the detailed manufacture, ‘hard’ or back end of the process (Ulrich and Eppinger 2008).

These elements are reflected in design education. While students are given an overview of the entire design process, the time limitations of an undergraduate degree preclude in-depth coverage of all aspects of the design development continuum. Design curriculums therefore tend to focus either on the soft front end or the hard back end aspects. By reflecting on my own practice as an industry based industrial designer and subsequent time imbedded in design education I have found that in Australia, where traditional design for manufacture (DFM) has predominated, industrial design curriculums have generally been biased towards back end processes. These different emphases are represented by Figure 5.5 Curriculum comparison via the continuum, where the Australian focus on the back end is shown by the blue curve and the overseas focus on front end is shown by the orange curve.
The Design Development Wave shows how choices in design education reflect the compromises and tensions outlined in the Triple-Axes Model (Figure 5.3). The Triple Axes Model explains how different understandings of the role of industrial design, and consequent course structures, reflect positioning along three continuums of twinned variables:

- **Process – outcomes**: indicating the relative importance attached to the application of sound processes and the final product;
- **Knowledge – skills**: indicating the weighting given to theoretical, intellectual approaches as opposed to traditional skills in, for example, sketching and drawing;
- **Risk (unknown) – Safe (known)**: signifying the balance between tried and true methods compared with innovation and consequent chance of failure.

The relationship between the Design Development Wave and the Triple Axes Model is shown in Figure 5.6. A focus on the back end, DFM aspects of design (blue: right hand side dominant in the Design Development Wave) coincides with more traditional biases on the Triple Axes Model: biases towards...
outcomes over processes, skills over knowledge and safe approaches over risk taking. Likewise, a focus on the front end, softer aspects (orange: left hand side dominant in the Design Development Wave) aligns with the opposite, emerging patterns on the Triple Axes Model, where processes are prioritised over outcomes, knowledge over skills and innovation over safe approaches.

Figure 5.6 Relationship between the Design Development Wave and the Triple Axes Model

The diagram below is a clearer representation of what currently happens in industrial design education – not either/or, but different emphasis on the material.

Figure 5.7 Relationship between the Design Development Wave and the Triple Axes Model in current education

The Design Development Wave combined with the elements of the Triple Axis Model is significant in helping to convey and understand the complexities and relationships of industrial design practice and education to those both
within and external to these two linked identities. The next model conceptualises the framework of the Australian industrial design ecology.

The Australian industrial design ecology framework

This section describes and explains the Australian Industrial Design Ecology Framework, another model developed to describe the various aspects and understandings of Australian industrial design practice.

The Australian Industrial Design Ecology Framework shown at Figure 5.8 uses the X and Y axes to represent two pairs of attributes, preferences or styles. The X axis is used to represent the continuum of preferences or tendencies among industrial designers regarding what they do, with the polar endpoints described as Art and Technical. In this model, the attribute of Art represents the aesthetic, form-giving and human component of industrial design where the technical is the functional and engineering orientated end of this continuum.

The Y axis is used to represent the continuum of preferences or tendencies among industrial designers regarding how they work, with the endpoints described as Producer centred and Community centred. ‘Producer centred’ reflects the traditional understandings and application of specialist industrial design to the design of manufactured products. In this approach, the emphasis is placed on the word industrial, as in ‘INDUSTRIAL design’. ‘Community centred’ reflects the newer aspects of the application of industrial design generalist thinking to problems and issues associated with the design of services for example. In this approach, the emphasis is placed on the word design as in ‘industrial DESIGN’.

In addition to the Art–Technical and Producer centred – Community centred axes, the vertical plane of the Cross Model is divided into three sections: Adopter, Adapter and Departer, as developed in Chapter 3 as part of the AAD model used in the selection of graduate respondents.
The Adopter descriptor is related to the adoption of traditional DFM practice. Moving up the vertical access and further away from DFM the diagram moves into the Adapter area of industrial design practice. The area between producer centred and community centred is located either side of the Art–Technical axis. The next stage in the vertical separation from Adopter and DFM is the Departer section, the furthest away from traditional DFM industrial design practice.

This model is important in visualising the framework for describing the breadth of Australian industrial design practice including the three elements of
Adapter-Adopter-Departer model (AAD). This model and a discussion of its use to locate the Archetypes are developed and explained in the next section.

**The Archetypes**

The section:

- summarises the archetypes including descriptions, derivations and potential applications
- explains each archetype individually, using material from interview data and a web diagram for each showing its unique combination of previously described themes
- positions each archetype in the context of the Australian Industrial Design Ecology Framework to help illustrate various modes of practice from the point of view of individual practitioners.

**Developing the archetypes**

Various models describing the ecosystem of design practice and design education have been developed in this thesis, including the Design Development Wave, the Triple Axes Model and the Australian Industrial Design Ecology Framework. Each explores the tensions, compromises and changes affecting industrial design. As discussed in Chapters 3 and 4, I postulated three typologies of Adopter Adapter Departer in my original analysis and subsequent interview findings resulted in the development six themes:

- **Communicator Theme**: the role of verbal and non-verbal methods of exchanging information and reaching shared understandings
- **Approach Thinking Theme**: the philosophy underpinning the design thinking methodology and application
• **Social Conscience Theme**: ideals of environmental sustainability and social responsibility in industrial design practice
• **Facilitator Theme**: the industrial designer as a point of connection across multi-disciplinary groups
• **Mobility Theme**: factors influencing the employment opportunities in an industrial design career
• **Identity Theme**: how the profession industrial design is understood both within and outside the sector.

In order to further investigate the applications of the models and interaction with the themes, ‘archetypes’, or model typologies, were developed. The archetypes were based on further analysis of the themes and the Thematic Map of Australian Industrial Design Practice, which conceptualises the relationships between the themes. My construction of the archetypes was also informed by my unique ‘insider’s perspective’, developed over more than a decade and half of experience within the development, delivery and assessment of the UC industrial design course. My networks with alumni, with industry and with national and international colleagues are coupled with my grasp of emerging employment patterns and extensive experience with curriculum development. This is not research done from afar but by a stakeholder embedded within the community.

**What are the archetypes?**

The five archetypes developed comprise:

1: The Visual Creative
2: The Technical Product Designer
3: The Digital Maker
4: The Design Deviser
5: The Dissident Designer
Purpose and role of the archetypes

The archetypes are conceptual constructs, and do not replicate the exact experiences of any one individual. However, they do reflect patterns of lived experience and help explain how shifts in the profession impact at the individual level. The archetypes demonstrate the breadth and depth of influence of Australian educated industrial design graduates working in Australia and internationally. Not only do graduates play a significant role in the traditional manufacturing and service orientated economy, they also contribute in less known and up and till now, less-articulated ways. This research articulates and demonstrates the unspoken knowledge that exists in the design community, providing a means for the community to see and understand itself, essential to the reflective process as outlined in chapter 2.

The archetypes reflect different emphases of two aspects – the context in which a practice is conducted and the approach which individuals take to their role. Interview respondents indicated elements of these archetypes in both current practice or during their career development, and illustrative quotes are used to support aspects of the archetypes’ descriptions. In the same way the descriptors Adapter Adopter and Departer, individuals cannot be fully described by the archetype characterisations, and also are not confined to a single category: individuals move between styles and roles. The five described archetypes are distinct but in reality there could be overlaps between them depending on both the location within the AAD headings and the mix of themes attributed to each.

Web diagrams for the archetypes

To aid in the visualisation of the individual archetypes, a spider web graphic was developed to plot the varying priority attached to the six identified themes of Social Conscience (S), Approach Thinking (A) Communicator (C), Facilitator (F), Identity (I) and Mobility (M) – see Figure 5.9. The spider web graphic allows a dot to be placed indicating the relative priority of each of them. The higher the value, or priority attached to a theme, the further from
the centre of the web the dot will be placed. Note the values attached to each theme are qualitative indicators, not numerical or quantitative measures. They are used here to illustrate particular aspects of each of the archetypes described.

Figure 5.9 Spider web graphic showing six themes
Individual explanations of each Archetype

Archetype 1: The Visual Creative

The Visual Creative Archetype is represented by the spider web graphic at Figure 5.10, showing that, for this archetype, the themes of Social Conscience (S), Approach Thinking (A) and Facilitator (F) have a lower priority, with the themes of Communicator (C), Identity (I) and Mobility (M) having higher priority. The Visual Creative Archetype does not place a great emphasis on social conscience, which is often limited due to the work environment in which they reside. Their approach thinking is of a more traditional problem solving type. While they work in teams, Visual Creatives are not usually in a position to influence facilitation across different technical disciplines, as they can lack necessary interdisciplinary or technical engineering orientation skills to do so.

Identity and mobility themes are at a higher priority, with the Communicator theme strongest overall. This Archetype has above average visual communication skills, using a combination of hand-generated sketching and/or form-giving CAD (surface modelling) or two dimensional illustration software programs. However, Visual Creative types tend to do little technical engineering orientated and detail work. The Visual Creative Archetype plays a strong role in the development of consumer products.
The Visual Creative Archetype interview data

Respondents who have privileged this form of practice at some time in their careers, and who therefore provide insights into this Archetype, were Nigel, Todd and Jane. Interview data from these participants reflect the strong emphasis on Communicator roles within this Archetype.

Nigel, for example, not only talks of his own experience working in this archetype model but also his observations of others. His employing company changed from outsourcing the ‘front end’ conceptual designs to a more in-house approach, and Nigel described his experience:

*Nigel*

> So we did the front end and it was me and a couple of other guys, but we did the front-end kind of thing. But once again it was kind of different, cos we were kind of did a lot of it in CAD rather than you know, this is the sketch and this is what we want to do. It was more either an illustrator kind of half-CAD, half-rendered image or it was a 3D CAD model.
Nigel highlights that in many situations the front end form design is completely separated from the technical back end product development aspects:

Nigel

Yeah yeah, industrial designers, it's a different – it's more of a 2D visualisation world than like it's completely different to the way I work but it's much more illustrator, 2D, this is how I want it to look, this is kind of the texture swatches that I want it to go with. I see that a lot more, the styling side of things where it's more blue sky-ish like I don't really care about how you assemble those two parts together for that, this is how I want it to look.

He notes that sometimes a focus on the front end can lead to a 'disconnection from the manufacturing side of things' and refers to these roles as 'fashion kind of industrial designers'. However, in his experience, such single-focus roles are uncommon in Australia:

Nigel

I don't think you meet too many industrial designers in Australia that oh yeah I'm a car stylist or I just design watches or I just do this. Like you meet them a bit but you don't see it – I don't see it as much.

Nigel perceives this styling front end type of role as more common overseas:

Nigel

we get lots of people coming in from Panasonic or Phillips, all these people, and all they've got is just front end, beautiful phones or watches or whatever and there's not many people that I know of who are doing that.

This type of front end work that Nigel refers to is also supported by Jane whose industrial design career has moved into the fashion orientated end of design practice. Jane's move to sports luggage design was a transition to the fashion aspects, which then laid a foundation for a subsequent move to fashion and trend forecasting. She notes this transition has shifted her focus from back end technical aspects to front end styling:

Jane

And it was like a really, it felt like a really amazing opportunity so I took the job, and it was a bit, that was my hardest decision, was going from, going to factories and working with product and actually designing stuff to go in to a job which I'm doing now where I'm not actually designing stuff. I am designing it
Nigel reflected on the links between pure fashion and the styling aspects encompassed within traditional industrial design, and describes his unease with how this relationship works and what it might mean for industrial design:

Nigel

... I feel like it’s more of a fashion, I don’t know why I think that but I feel like it’s more fashion design, it's that real cross for industrial designers and fashion kind of get brought together. And it’s even down to like the wetsuit guys, they’re all industrial designers but they’re much more fashion-based I think, like it’s performance fashion or something, I don’t know. It doesn’t make me feel like it’s industrial design in terms of the traditional plastic moulded you know, consumer products I guess is maybe what I think.

I see a lot of fashion kind of industrial designers that do that more, like I’ve got quite a lot of friends and colleagues that work for surf companies or Rip Curls and things where they’re much more in tune with the look and the fashion and much less – but saying that I think they’ve got a disconnection from the manufacturing side of things, where a lot of that is ob we’ll send off that drawing. Like the people that I meet ... a good friend of mine [...] she was an industrial designer but she got employed for Rip Curl and just did sketches, sent it to Taiwan, Hong Kong I think it was and it’d just come back, you know but it was rare. I didn’t see much of that, I saw it more – I call it the fashion industry but it’s more bags, shoes, you know.

Nigel reflected that form-giving aspects of work are of high priority to many industrial designers:

Nigel

I guess with industrial designers a lot of people think that their number one thing is to make the form and to really get piece of paper and work on the visual. And if you take that away from a lot of industrial designers, you feel a little bit like you’ve become a CAD jockey or something.

Another area demonstrating the emphasis on, and potential capacities of, the Communicator theme is that of visual effects for movies and gaming. As described by Todd, companies developing special effects realised that industrial designers possessed a skill set that could be applied to the world of visual effects:
Because the reason that I got in there was because they looked at other industrial designers and said, ‘Do you have any mates who can come in here because obviously you guys are really good at this computer modelling and stuff,’ so sure enough, that’s what gets you in there. And these people might have inadvertently stumbled on, but there are an awful lot of industrial designers in that place and so I think they had stumbled onto something where they realised, ah the people we need to make these are these types of people. Now there must be plenty of companies out there that don’t realise that the people they need for their future are these people because they can do this, this, this and this, even though their name doesn’t identify with it as such.

Archetype 2: The Technical Product Designer

The Technical Product Designer Archetype is represented by the spider web graphic at Figure 5.11, showing that, for this archetype, the themes of Identity (I) and Mobility (M) have the lowest relative priority, with Social Conscience (S) slightly higher. Approach Thinking (A) and Facilitator (F) have a higher ranking, with the theme of Communicator (C) having highest overall priority.

The Technical Product Designer Archetype has strong approach thinking capabilities appropriate for manufactured goods including materials and process, and excels in high end communication skills including 3D CAD and rapid prototyping technologies. Reflecting the relatively high ranking for Facilitator themes, these Archetypes are team orientated and collaborate effectively to achieve mutual goals. Though the identity theme spoke ranks low, as a Technical Product Designer Archetypes have well understood roles within the profession. Their mobility is affected by economic conditions but these Archetypes are adaptable to a range of employment opportunities. In general Technical Product Designer Archetypes work for organisations where influencing aspects of broader social agendas are difficult and Social Conscience themes are correspondingly low.
The typical Technical Product Designer Archetype is an industrial design adopter. They are able to understand or generate a design brief, and can conceptualise and visualise ideas using either hand sketching or computer skills. They can also detail production CAD files, materials and processes. Their approach includes a stronger attitude towards the technical issues of the problem and design solution and an engineering orientation inherent in their practice. This archetype is representative of the type referred to by Rob Curedale, in (Trathen and Varadarajan 2009) where he refers to the knowledge base of Australian and UK industrial designers:

*Australian and UK Industrial Designers tend to have a better knowledge of manufacturing, engineering and global design trends than many US Industrial Designers. Overall Australian design schools are seen traditionally to have a greater emphasis on model making, developing CAD projects as rigorously detailed exercises and in quizzing students about their projects for their working out of the process of manufacture.*

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**Figure 5.11 Technical Product Designer Archetype spider web graphic**
The Technical Product Designer Archetype interview data

Three respondents Scott, Nigel and Paul refer to orientations of industrial design practice which highlight aspects of the Technical Product Designer Archetype. Their input confirms their awareness of the spectrum between front end – styling aspects of design versus back end – technical aspects and how this spectrum is both operationalised in the workplace and perceived by others.

Nigel described his current perceptions of his role in comparison to other industrial designers:

Nigel

I consider myself now like more of a design engineer than an industrial designer. I did far less styling and concepting [sic] in terms of stuff like overall concepting and much more like your concepts were more I'm trying to fix this problem or we're working on this new hinge or something and that was what you were styling and that's what you were configuring.

... So that's kind of how I feel industrial designers, they're much more hands on, they're much better at multitasking I feel that they're much broader skilled in terms of they just know like almost all of them are good at doing lots of different things. Good at CAD modelling, good at understanding prototyping, getting things to work. But even down to like workshop prototyping, I think there's a lot of like not rapid prototyping things but there's a lot of hand constructions.

Scott affirms the art–technical spectrum of industrial design practice, and notes his location on that spectrum. He understands this to be towards the technical design engineering end, and refers to those at the art end (like Archetype 1 – Visual Creative) as ‘conceptual fluffy’:

Scott

I started off as a design engineer going in there with about five years’ experience, so initially I was given you know autonomy to own a component, so I'd do the CAD and all the testing, see it through to production with guidance from more senior people ... I found that I was quite comfortable with fairly technical things, like but you know I guess something I'm aware of now is that we look at here at [...] we look at industrial designers on a spectrum. At one end you've got people who are fairly comfortable with engineering concepts versus at the other end really conceptual fluffy, I just want to design cars, you know that kind of person. So I'm sort of at the other end, I'm at the more techie end.
Paul also identifies with the more technical end of the spectrum as incorporated in his archetype, Archetype 2, the Technical Product Designer. He was less interested in

Paul

styling per se, more interested in how things work, not just engineering, but how things work with you and what things do and how you come up with that and does it work well with you or not.

Paul also describes the issues of identity and role demarcations of industrial design:

Paul

I wouldn’t call us a traditional industrial design consultancy for a couple of reasons: one, I’m as much interested in engineering as I am in styling if you like, okay, not just how things look but also how things work and how they’re made.

… What is industrial design? Well, it’s just the process of designing things that are made industrially. That’s very broad. However the term can get hijacked by people and representing something else. Like what is design? Is design, you know, fancy jeans or is it an engineer or something like that? And I do find a lot of arrogance in the design community for people, I don’t find a lot with industrial design there can be a lot of style and fashion based behaviours in terms of attitudes, people being cool, trends, what am I getting to? So, and they tend to mean that is industrial design. And sometimes when I describe what I do and they’re like, ‘Oh, that’s not industrial design.’ And I’m like, ‘Well, that’s pretty narrow thinking.’ That may not be the industrial design you know and what you think a traditional firm is but it can be a very broad topic.
Archetype 3: The Digital Maker

The Digital Maker Archetype is represented by the spider web graphic at Figure 5.12, showing that, for this archetype, the themes of Facilitator (F) and Approach Thinking (A) have the lowest relative priority. Mobility (M) and Social Conscience (S) are mid-range priorities, with Identity (I) next in order and again the theme of Communicator (C) having highest overall priority.

Approach thinking aspects are low, reflecting a more ‘art’ based approach rather than more formalised design processes. The Digital Maker attaches less importance to facilitation roles as they often work as solo practitioners, with lower priority attached to team-based design. This aspect links to the highly-rated theme of Identity, as this Archetype aspires to achieve individual recognition rather than to being an anonymous member of a working group. Mobility and Social Conscience are also important: Mobility reflected in attributes of passion and confidence while social conscience is given greater scope as their often their work in individual roles or solo practice allows them to explore issues free from some of the limitations imposed as an employee. The Communication theme is highest rated, and the Digital Maker exhibits strong digital and hand design communication skills and knowledge.

The Digital Maker Archetype has its roots in the traditional designer maker. These roles are linked to industrial design but at the creative art, form-giving end of the spectrum. Traditionally, the designer maker has focused on hand skills, oriented towards either one off pieces or small-scale production runs. Earlier incarnations of industrial design often facilitated the production of designer makers through an emphasis on hands-on model making still evident in some industrial design schools.

The art and craft fields have acted as both a supply source for budding designer makers and as an outlet for existing industrial designers with this focus, providing niche markets and economic opportunities for their work.
The Digital Maker continues these traditions and is often involved in a more individual pursuit of design, showing a passion for this type of creative exploration. Current examples of such roles are industrial design graduates who have gone on to do further study in more craft-oriented or art education. For example, timber/furniture making, ceramics, glass work and silver smithing provide avenues to expand their skills and knowledge and to apply them in designer-maker ways.

The accessibility of new technology has facilitated an upsurge in the role of the Digital Maker, or ‘new crafts-person’ (Campbell 2010). Rapid Prototyping and new small production run technologies are all now readily available and cost-effective. This design archetype can easily operate from a home office as there is no requirement for significant ‘making facilities’. These individuals bring their passion and creative attitude to their experimental explorations. They are tech savvy, with a set of high end 3D computer skills that maximise the potential of new technologies. As their work is often experimental, the Digital Maker tends to exhibit their products or enter design competitions in a more art/craft oriented way. They may work as sole practitioner, but if employed in another design capacity, they explore their more individual creative side outside their ‘regular’ job.

This archetype seeks and is rewarded with the gratification of their name being associated with their design work, therefore achieving a higher personal and professional identity. This is unlike most industrial design situations in Australia where the designer is often an unnamed member of a team working for a consultancy or manufacturer.

The Digital Maker may sacrifice the stability and financial security of more traditional wage-based employment. However, their role enables them to give free rein to the entire range of skills for which the industrial designer is trained, without being limited by the constraints of particular job requirements.
The Digital Maker Archetype interview data

A number of respondents recognised and described attributes relevant to Archetype 3: The Digital Maker. For example Todd refers to the impact of low-cost rapid prototyping, and how this enabled exploratory work.

Todd

‘using rapid prototyping tools to make things like jewellery or moulds and things for those types of things to try and because I noticed that the cost of that machinery had come right down.’

Fiona also described aspects of her practice which are closely linked to the Digital Maker archetype. She reported her current work in developing a range of products that are flat packed and assembled by the consumer. Fiona doesn’t have a factory but can work from home to design and coordinate the making and distribution of a small product run.
Fiona

And you know I don’t have the funds to you know; to tool up all this product and everything like that. So I’m looking at doing it in a kind of you know, my lights are kind of flat pack, you know, so parts of the component will be done somewhere else, some parts will be done here and then I will pack it together and then it will be a flat pack and then people will build it at home., you know.

So you know, I have got to kind of, I don’t have the space and I don’t have the energy and I don’t have the money to be doing, so I have got sort of a bit of a you know, I can only work you know, in, you know, I can’t work on big, massive projects of big pieces of furniture or you know, go to China or do any of that kind of stuff. So I am working in my home with the things that I have got.

In the same way, Charles’s practice allows him to explore and develop what he refers to as.

Charles

... cheaper making technologies, digitally-controlled making technologies. You’re having the democratisation of industrial design occurring, which kind of occurred, well, it did, it occurred for graphic design, back when PhotoShop and Illustrator became widespread. And then you had everyone becoming graphic designers when, actually, they really weren’t but they could use the software. I don’t know. Maybe there’s something in that field that I don’t really know what it is. But I certainly know that me, as an industrial designer, I am harnessing that stuff, that sort of ability that’s widespread, at the moment, and becoming even more widespread. Using the example of [a rapid prototyping supplier] that’s giving me opportunities that I didn’t have five years ago.

His practice includes competition and exhibition aspects, and Charles explains how he consciously links his design approach to his personal affiliation with environmental concerns.

Charles

Yeah, absolutely. Absolutely, every time I put a competition submission in, I talk about the product and I frame it, I contextualise it in terms of its environmental implications. So I’ll say, you know, it is environmentally sound in terms of blah, blah, blah. You know, socially, sustainably managed forests; recyclable aluminium; designed for disassembly; all of these sorts of things. So I make that abundantly aware and when I’m talking about my products at, let’s say, the openings of the exhibitions or with people that have been in touch,
I’ll talk about that. Yeah, I think you can increase people’s understandings by practicing your attitudes to, well, the world, I think. It’s as big as that. Lots and lots of little designers all across the world, if they all have the same attitude that is responsible then it’ll make a big difference.

Archetype 4: The Design Deviser

The Design Deviser Archetype is represented by the spider web graphic at Figure 5.13, showing that, for this archetype, the Identity (I) theme is low, reflecting the relatively low understanding of this role outside their own professional own work environment. Unlike Archetypes 1, 2 and 3, the Communicator (C) also has a low priority, as Design Devisers do not often use their communicator component skills and knowledge. This archetype is associated with high priority attachments to all other themes. Mobility (M) aspects are high, as they demonstrate significant levels of passion, resilience, beliefs and confidence. They have a highly developed understanding of Approach Thinking (A), and apply these understandings and design approaches in non-traditional settings and through innovative means. Their facilitation abilities are also highly prioritised as they work well in collaborative teams and have good understandings of other disciplines. This archetype also has high Social Conscience (S) priority and Design Devisers see their design knowledge and skills as properly being applied to Social Conscience issues outside the confines of traditional manufacturing.

This archetype is evident in the literature and in the respondents’ interviews. In the context of industrial design, Design Devisers lie in the realm of the Departer, where the key elements of design thinking are applied beyond traditional, manufacturing-focused areas of practice. Designers of this archetype use their industrial design background and design approach to address new problems in diverse settings which may have no connection with tangible product development.
For example, service design, experience design and interaction design are fields in which the Design Deviser may adapt and apply their skills and knowledge. Designers of this type may build on their core industrial design education, and marry this with additional education and experiences. This combination of disciplines has become more formalised with for example, business courses specialising in the application of design thinking in a more service-orientated economy. This aspect of design is stronger internationally than in Australia, but even in this country the shift of design thinking towards links to business and engineering has been noted and discussed (Dodgson 2008).

Internationally, evidence of the migration of design approaches to non-traditional design fields is widespread. North American based business school representatives have been advocating these types of links such as Rochester Institute of Technology in New York MBA. Lord Cox and the British Design
council are also advocating these design approaches to benefit business, innovation and areas within the British public service as detailed in the 2008 ‘Innovation Nation’ paper. (Berger 2009; Brunner and Emery 2009). The Stanford University ‘d’ school, which applies design principles and approaches to a range of business and community challenges, applies these concepts into practice. Personal discussions with William Burnett and Dr Banny Banerjee, in a 2007 visit to the ‘d’ school at Stanford University, highlighted links with the Company IDEO and its founder David Kelly. Here design thinking is applied within interdisciplinary oriented teams of design business and engineering. The design thinking approach linked to business has also made its way into more socially responsible community centred projects. IDEO has made available a range of tools and information it has developed for such projects, such as Design for Social Impact (IDEO 2008). Their approach is one of taking the fundamental design thinking skills and knowledge learnt within industrial design and applying these in new areas of non-traditional design application.

The Design Deviser Archetype interview data
Data from interview respondents demonstrate that the Design Deviser Archetype is well established. This emergence is characterised by the application of design thinking approaches to non-traditional design areas. In the Australian environment, this seems most common through individual practice, with institution led approaches (such as the ‘d’ school) yet to appear in our local landscape.

Kim for example saw opportunities in applying and engaging her design thinking knowledge in:

*Kim*

Higher level thinking about not necessarily products but using design as a problem-solving tool to address issues. And I guess another part of it was I had by that point had some sort of environmental, I guess ideals that I didn’t necessarily feel were going to be satisfied by making more ‘stuff’.

Ted has expanded on his undergraduate degree with further education and this experience has helped develop his understandings of the expanded roles of
industrial design in western countries. It seemed that this additional education and probably business has re-focused aspects of the profession to take on what he called strategic industrial design including development of areas such as government policy. This was also in the context of a diminishing industrial design base of manufacturing and therefore there were other needs to be met.

Todd and Geoff are examples of where designers have added to base skills through additional qualifications. Both built on their industrial design bachelor’s degrees with additional education; Todd in government policy and Geoff in financial and business practice. Both articulated the strength of the design thinking components of their practice to their current roles. For Todd, his practice and position in policy development is highly influenced by his design background. As he articulated in his interview when asked about the mix of approaches he uses from his two key discipline areas of law and design,

> the design informs the way in which I approach problem solving. The law is just, it enables my understanding of how things have to work within, that a logical framework. Whereas, which I benchmark against when I am doing stuff. Design though is probably the way the influence the most, the way I conceptualise problems because they are just all obstacles to be overcome in the same way. I mean product design was about trying to make something fit for purchase within an environment that had to appeal in certain ways. It might have to appeal aesthetically for its marketing purposes. It might have certain operating requirements and when you break that down abstractly, it’s like a policy, you know.

In Geoff’s case, he sees his design approach being applied in his current job as financial professional in the banking sector where his role is to advise clients about various investment opportunities. He makes the comparison with his non-design educated colleagues who would approach a client with only one option, whereas he would develop a range of options for discussion with the client (the users). Geoff believes his design education allowed him to apply this creative approach to his practice.

> ... that’s then what I take to my current job that when I sit down with a client as opposed to I guess how many of my colleagues approach a client which is oh you’re Mrs A, B or C and this is what we do for you, I really, you know that’s probably one of my most favourite parts of the job is then I do get on a whiteboard after I’ve met with a client and just say well, you know and go
through it myself and just structure things in different possible ways, so money can go here and da-da-da and yeah. And look I love that creative aspect of my job and if I didn’t have the creative aspect you know it wouldn’t be something I’d be doing. But, so yeah look, yeah that’s the thing I guess in the training we learnt that there are 100 different ways of doing something and you should always flesh out the 100 different ways of doing things before you settle on the one best way of doing it and so that’s just what I applied and everything I’ve done since I guess so yeah.

Archetype 5: The Dissident Designer

The Dissident Designer Archetype is represented by the spider web graphic at Figure 5.14. In some ways this archetype is not well described by the themes developed from the interview data, as it is an emerging role which transcends current descriptors. However, to the extent the themes throw some light on this new archetype, the Dissident Designer can be seen as attaching a strong priority to Approach Thinking (A), though this may be intuitive rather than traditionally theoretical. The Facilitator (F) theme is strong, and the Dissident Designer is adept at working across and between different disciplines. Mobility (M) is a key characteristic of this archetype, as this designer is equipped with a diverse suite of skills and knowledge that allows for flexibility within and across work styles and situations. The theme of Social Conscience (S) is also highly prioritised and this is seen as an integral part of the Dissident Designer.

As is the case for Archetype 4, the Dissident Designer, the Communicator (C) theme has a relatively low priority for this archetype, as although the Dissident Designer can help visualise problems and solutions, their communication skills in aspects such as making and CAD are not as advanced as other archetypes. Perhaps most importantly the Dissident Designer attaches a low priority to the Identity (I) theme, and may or may not describe themselves as an industrial designer.
The Dissident Designer is non-conformist, thinks differently from many others and is seen as a creative innovator. These designers are often more focused on the front end of the design process: able to generate good ideas but less equipped to finalise a detailed design for production or project finalisation. The Dissident Designer is the classic ideas person, not a detail person.

This archetype is often misunderstood even in design ellipses, and can be seen either positively or negatively in the workplace. Some may perceive them as ‘difficult’ as these designers see things differently and can be perceived as a challenge to the status quo. Others view the Dissident Designers’ input as a fresh approach providing valuable innovation. Dissident Designers are creative and independent thinkers and often have an intuitive and in-built creative ability, but need to work with others with stronger abilities in finalising a design concept. Dissident Designers tend to reject the more formal aspects of the work environment, as they can find the limits and criteria imposed by production or an organisation frustrating. In a practice setting, they work most
effectively as part of a team that can support their ideas and help bring them to fruition. The role played by this archetype represents the disrupter innovator aspects linked to the business models of Harvard professor Clayton Christensen et al (2004)

As noted by Sir Ken Robinson, creativity is a necessary attribute to form original approaches developed from a variety disciplinary perspectives.

*The brain isn't divided into compartments. In fact, creativity, which I define as the process of having original ideas that have value, more often than not comes about through the interaction of different disciplinary ways of seeing things.*

(Robinson 2006)

**The Dissident Designer Archetype interview data**

While the dissident designer archetype was not strongly represented by the respondents, there were elements within and similarities to the Design Deviser. Geoff demonstrated elements of this approach with his entrepreneurial skills in developing commercially successful consumable products, but he not only had the idea, he was able to follow it through, unlike my definition of the dissident designer.
Archetypes placed in the Australian industrial design ecology framework

The five archetypes described above can be placed within the Australian Industrial Design Ecology Framework to help explain how current and emerging experiences within design sit within a broader context (see Figure 5.15: Placement of archetypes within the Australian Industrial Design Ecology Framework).

Archetypes 1 and 2, the Visual Creative and the Technical Product Designer, are positioned in the lower quadrants, below the horizontal axis. This reflects their shared focus on the producer-centred as opposed to the community-centred end of the spectrum, indicating their close links with more traditional Design for Manufacture (DFM). Both are therefore in the Adopter zone of the graph, indicating the focus of these Archetypes on adopting existing parameters and understandings of industrial design, with the Visual Creative marginally closer to the Adapter aspects. The two Archetypes most markedly differ in terms of their placement on the horizontal axis. The Visual Creative designer tends to the Art based end of the horizontal axis, showing the preference for these aspects; whereas the Technical Product Designer lies towards the Technical end of this axis.

Archetypes 3 and 4, the Digital Maker and the Design Deviser, are positioned in the upper quadrants, above the horizontal axis. This reflects their shared focus on the community-centred as opposed to the producer-centred end of the spectrum, indicating their relative disconnection from traditional Design for Manufacture (DFM) and their correspondingly closer association with applications of design thinking to novel and diverse situations. Digital Makers and Design Devisers do diverge on the horizontal axis, with the latter more closely aligned with technical, as opposed to art, aspects of design. However this disparity is smaller than the corresponding divergence between Visual Creative and the Technical Product Designer archetypes. In terms of the
Adopter, Adapter, Departer zones, the Digital Maker sits within the Adapter zone, while the Design Deviser is located within the Departer zone.

The fifth Archetype, the Dissident Designer, is barely contained within the Australian Industrial Design Ecology Framework. This Designer is definitively located within the Departer zone, and is completely separated from traditional DFM concerns having shifted their focus to the zone of social innovation. Likewise they are at the Art extreme of the horizontal axis, with technical considerations correspondingly de-emphasised.
Conclusion

The chapter described how diagrammatic models are used to advance and communicate abstract conceptualisations, and then illustrated how this was achieved in this research. The models developed, comprising the Triple Axes Model, the Design Development Wave, the Australian Industrial Design Ecology Framework and the five Archetypes: The Visual Creative, The Technical Product Designer, The Digital Maker, The Design Deviser and, The Dissident Designer, were detailed.

The Triple Axes Model, illustrating the aspects of design practice and education and the competing priority continuums.

The Design Development Wave, which demonstrates the different ends and roles of the design development and process.

The Australian Industrial Design Ecology Framework, based on the Adopter–Adapter–Departer (AAD) and the axis of producer centred vs community centred and the art vs technical axis.

The five Archetypes; The Visual Creative, The Technical Product Designer, The Digital Maker, The Design Deviser and The Dissident Designer. These are located within the Australian Industrial Design Ecology Framework.

Each of these models is important in conceptualising and presenting the variety of issues pertaining to the practice and education of industrial designers in a visually descriptive manner. This was an important step in the process of building the theoretical elements to describe the attributes of industrial design in design education and design practice.

The next chapter provides an analysis of the environment in which Australian industrial design practice and education reside. These models are applied in a speculative way to view the past, present and future of both design practice and design education. I argue for a direction towards a new resilient adaptive practice and the implications for practice and education are also discussed.
6. Resilient Adaptive Practice
6. Resilient adaptive practice

Introduction

This chapter views the ecology of Australian industrial design through an application of the models I have developed: Triple Axes Model, Design Development Wave, Australian Industrial Design Ecology Framework and The Five Archetypes.

The chapter first gives a thumbnail sketch of Australia in a global context, before outlining the historical and current environment in which Australian industrial design practice and tertiary education sector reside. I revisit the context of Australian manufacturing and education in this chapter, with a more detailed discussion than earlier chapter 1, so as to be able to better set the context for this chapter’s content. An understanding of this context is essential to decoding the evolution of design practice in Australia on which this research is focused. The changing face of manufacturing in this country, for example, has driven many of those changes.

The second part of this chapter applies these models by using them to examine the past, present and future situation of industrial design practice and education. This is a speculative chapter looking at the question of what would design practice and education look like if it became more responsive to its graduates? The insights gained through this process demonstrate the
conceptual power of these models and provide a solid basis for their application to real-world problem-solving, the focus of the fourth and final section of this chapter. In this section, the implications of the research findings for Australian industrial design practice and education are described.

When I commenced this project, as an industrial design educator embedded in the higher education sector in Australia, I wanted to know more than anecdotal stories I heard of graduates and their careers or what seemed to be the limited views of employers working in the world of design for manufacture. I felt the content of industrial design education needed to change, reflect and address the changes that appeared to be happening in the context of Australian industrial design DFM and the changes forthcoming in higher education sector. I believe that something is missing in the story of industrial design and I have discovered that industrial design graduates can be resilient and adaptive.

Industrial design graduates may not get or want the chance to design an electrical appliance but the applied design method education they receive sets them up well to become resilient and adaptive. With a better understanding of the reasons why they can become resilient and adaptive and I propose a way of making this more explicit to designers and non-designers.

I believed a new theory was required to explain to designers and non-designers alike, the actual world of design for the graduates of industrial design. I developed a proposition to do this, based on the in-depth field work and analysis I have conducted. I went out and listened to these graduates and got their perspective on what their lived experiences have actually been and I have now returned with a significant respect for these resilient people and their passion for design in all its forms and the range that these may take.

I consider the view of some employers and industry representative bodies as an old way to view industrial design education and does not acknowledge the wealth of experiences and contributions industrial design graduates have made in their broad range of endeavours. The specific content of courses change in
for example skills and knowledge areas as outlined in chapter 2 but the design process or methods remains a constant in the development of resilience and adaption in the face of a rapidly changing world.

The next section expands and details the context for Australian manufacturing and higher education sectors before applying the models developed in this thesis.

**The context**

Industrial design education is not an isolated entity. On the contrary, it is embedded within the changing paradigms of Australian society: in particular the manufacturing sector and the university sector. While these environmental changes flow through to modifications in design education, there is a significant lag time. The expertise of teaching staff, the integration of curriculums, the underpinning funding structures – all need time to adapt.

This process is complicated because our target is undefined: it is unclear where industrial design is heading as a profession, and the roles for which we are trying to equip students are in flux. Finding ways to clarify this target, and to build corresponding responsiveness in the education process, is in large part the focus of this research.

Understanding evolutions in industrial design in Australia requires a grasp of the worldwide trends which have influenced both the Australian manufacturing sector and the Australian education sector. Both are undergoing significant changes which have direct and fundamental impacts on industrial design and related fields of practice. This section outlines Australia in a global context, and then describes the ways in which Australian industrial design education is affected by historical and contemporary features of both the manufacturing and tertiary education industries.
Our island home: Australia in a global context

Australia is the world’s sixth largest country: the island continent covers a land mass comparable in size to mainland USA or Europe (see figure 6.2). Despite contemporary travel and communication technologies, Australia’s antipodean location continues to ensure its relative remoteness: flying time from Australia to the west coast of the USA is approximately 15 hours while flying time to the UK is closer to 23 hours. The differing time zones also complicate communications.

In the 1950s Australia had a population of around 8 million people: today the population is approximately 22 million: approximately one-third of the UK’s population (62 million). In comparison with the USA, Australia’s population is closer to that of New York City (18 million) than to the total USA (over 313 million).

Australia is highly urbanised, with the main population centres located on the east coast in the major metropolitan area of Sydney, Melbourne, Brisbane and their associated regional areas of Wollongong, Newcastle and the South East Queensland. The aftermath of World War II saw our historical colonial links with Great Britain shifting towards a focus on the USA, while in more recent times a greater recognition of our geographic reality as part of Asia has emerged. Reflecting this reality, in the 2007–2008 financial year Australia’s two-way trading partners by rank were China in first position, Japan ranked second, USA ranked third, Singapore at fourth, and the UK at fifth position (DFAT 2008).

Australia’s federation in 1901 brought together states and territories in a single liberal democracy within a constitutional monarchy. Under federation, responsibilities such as health care and education are shared between the federal national government and jurisdictions (states and territories). For example, while primary and secondary education is administered by jurisdictions, universities have been primarily funded and administered by the federal government since the 1950s.
We are here: Canberra in the Australian context

Canberra, the national capital, was founded after federation and is a totally planned city. Its location between Sydney and Melbourne reflects the compromise site for the capital between these two rival alternatives. With a population of 345,000, Canberra is the seat of the federal government and home to foreign embassies as well as national institutions such as the High Court, the Australian War Memorial and the National Library. Canberra has several universities; the University of Canberra, the Australian National University, Australian Catholic University and the Australian Defence Force Academy. The Canberra population has higher levels of educational attainment than the national average: about 30% of Canberra adults hold a bachelor degree or higher, compared to the national average of 19% (Australian Bureau of Statistics 2005b). Reflecting its role as the seat of national government, Canberra’s main industries are government administration and defence, which together employ about 40% of Canberra’s workers.

Figure 6.1 Australia’s geographical relationship to Asia
The Australian manufacturing sector and industrial design

In Australia, industrial design has traditionally moved in lock step with design for mass manufacture. Industrial design has traditionally been seen as a service to manufacturing, either through in-house designers or via design consultancies contracted to performing design services for a variety of manufacturing companies. The Australian manufacturing sector has been impacted over the past 50–60 years by a range of international forces and by domestic interactions with them. These changes have necessarily led to flow-on effects in industrial design.

The 1950s – 1960s

Ramped up during the war effort of World War II, by the 1950s Australia had a significant manufacturing base, producing a range of commodities for both domestic consumption and export. Manufacturing production peaked at approximately 30% of GDP in the late 1950s and early 1960s (Australian Bureau of Statistics 2010). High domestic tariffs effectively excluded many overseas products from the Australian market and, at a cost, protected local production. For example, local car manufacturing thrived in Australia.
throughout the 50s–60s and demand for white goods and electrical equipment increased significantly (Australian Bureau of Statistics 2001).

Transformations: the 1970s and 1980s

The second half of the 20th century saw significant shifts in international trade and financial frameworks. Mechanisms to improve trade by reducing domestic barriers and commencing financial reforms were initiated. Australia was part of this process, with fundamental changes such as the floating of the Australian dollar, interest rates set independent of government, greater participation in global trade and reductions in domestic trade protections combining to transform the domestic economic landscape (Australian Bureau of Statistics 1997).

Contemporaneously, the importance of Asia both globally and to Australia continued to increase. Political and trade reorientations away from traditional focuses on the USA and Europe and towards our geographical northern neighbours reflected this. The then Australian Prime Minister Gough Whitlam’s ground-breaking visit to China in the 1970s signalled the shift in priorities, and the paradigm change from labour-intensive industry to post-industrial or information based economies was articulated in seminal works such as Sleepers Wake! (Jones 1990).

The economic reforms begun in 1970s opened up national manufacturing in Australia to international competition as trade barriers were dismantled and globalisation became more prevalent. Industry assistance levels fell from over 30% in 1970 to less than 5% in 2001 (Leigh 2002). From its peak of 30% of GDP in the 1950s and 1960s, Australia’s manufacturing base now represents less than 9% of GDP (Department of Industry Innovation Science Research and Tertiary Education 2012); see Figure 6.3. With many trade barriers removed, manufacturing can be relocated internationally in search of the lowest production costs. (Estimates of industry-based GDP are not available for the period 1939-40 to 1947-4, ABS 2005a) Australia, together with other developed nations such as the USA, has seen its manufacturing jobs exported to
developing countries where labour and overhead costs are minimised. Asian economies including China, India and Vietnam have become the locations for many such manufacturing jobs.

The steep decline in local manufacturing work has led to corresponding increases in the importance of the services sector of the Australian economy. In 2009–10, services such as banking, education, and tourism represented 66% of the Australian GDP, up from 45% 20 years earlier (Australian Bureau of Statistics 2010; Department of Industry Innovation Science Research and Tertiary Education 2012).

**Today**

The paradigm shift outlined above has not taken place without pain and controversy. Australia’s ongoing concerns about its lack of manufacturing capacity periodically make headline news: domestic car production is an example of these perennial political and economic debates. Should free trade, laissez faire approaches dictate policy, with the inevitable shift of employment off shore? Or should protectionism and government assistance be called upon
in some situations? Such debates date back to Federation in 1901 and show no signs of resolution today.

As Australian manufacturing has decreased, likewise work available in domestic DFM has also reduced both in-house and multi-client consultancies. The demise of mass market design work has facilitated the emergence of niche manufacturing (McColl 2099). ResMed, a small Australian company which designs and manufactures sleep apnoea masks, pumps and peripherals, represents this type of niche design area. However, this type of manufacturing is necessarily small-scale and the sector is of limited significance to the overall economy and labour market. Manufacturing downturns continue to impact directly on traditional industrial design roles, and industry groups are predicting further staff layoffs (Hernandez 2012).

The Australian situation exemplifies a ‘two speed’ or ‘patchwork’ economy. The mining sector, based on the export of raw materials to Asia and primarily China, continues to ride an on-going boom – as long as China’s growth continues. However, other sectors, such as manufacturing, struggle. Even the boom is not seen as wholly positive, as it has contributed to the high value of the Australian dollar relative to overseas currencies. This causes difficulties for Australian exporters, including manufacturing, where goods have become more expensive for their international markets. Ongoing global developments, such as the fallout from the Global Financial Crisis of the late 2000s and the ongoing economic turmoil surrounding the economies of the European Union, continue to resonate and cause concerns for the Australian, as well as the global, economy. The fundamental shifts in the orientation of the Australian economy outlined here set in motion changes to the Australian industrial design ecology still being played out today.
The Australian tertiary education sector

The transformative changes in Australian manufacturing over the past several decades have been reflected, and to some extent have driven, significant changes in Australian tertiary education. The education sector is a significant contributor within the Australian economy and is ranked third in Australian export earnings (Department of Foreign Affairs and Trade 2008). Its increasing economic prominence typifies the shift of the Australian economy towards services industries and away from manufacturing sectors described in the preceding section. Figure 6.4 shows graphically the increasing share of GDP derived from services industries. (Estimates of industry-based GDP are not available for the period 1939-40 to 1947-48, ABS 2005a)

As outlined above, Australian manufacturing has decreased as a proportion of GDP from 30% to approximately 9% over the past several decades, and even for the manufacturing still undertaken domestically, technological advances have reduced the number of workers required and increased the skill level of remaining positions. Employees with higher educational qualifications are needed both in the remaining manufacturing jobs and in the service industries which are replacing them. In the early 1970s only 3% of Australians aged between 20 and 64 had a university qualification; in 2001 that proportion had risen to 16%, (Australian Bureau of Statistics 2004) and the Federal Government aims to increase that to 40% by 2025 (Australian Government 2009). Instead of catering to only the scholastically elite, universities in the late 20th century and into the 21st century need to cater to a student body with diverse abilities and skills.
The increasing democratisation of tertiary education has led to a number of shifts in national funding mechanisms. A period of free tertiary education lasted only approximately fourteen years, 1974–1988 (Davis 2007), before increasing student numbers made this unsustainable. The deferred payment scheme currently in place allows students to delay payment of university fees until after graduation and attainment of a certain income level. However, today’s student still faces significant day-to-day financial requirements (equipment, books, services fees and living costs etc).

Similar economic pressures have been brought to bear on universities as well as on students. The proportion of universities’ funding obtained from Government has decreased over time, with universities expected to generate the income shortfall via other sources, including from increasing the number of full-fee-paying students, Government awards for additional research, endowments and extra, paid courses. Universities have also had to trim expenditure: contact hours have been reduced, staffing levels are under threat and staff–student ratios have increased (Healy 2010). The university sector continues to be the subject of ongoing Governmental reform and review, with the impact of the recent Bradley review yet to be fully realised (Bradley 2008). A significant proportion of an Australian university’s funding is determined by the number of students that enrol. Universities therefore have an incentive to increase their student enrolment and graduate levels, and have no reason to
consider the extent to which qualification-relevant jobs exist for these graduates. The new 2012 transition to demand driven funding, where dollars will follow student enrolments rather than being allocated to universities, (Bradley 2008) will not address the mismatch between employment opportunities and the production of graduates. In fact, it may increase the number of potential students interested in such courses as industrial design while potentially reducing the number of universities courses offering this program in an uncapped competitive market.

Reflecting the globalisation and commodification of the educational market, international students make up a significant segment of the student population enrolled in Australian tertiary education. In 2009, 22% of all Australian university students came from overseas (Australian Bureau of Statistics 2011). In 2007–2008, educational services were ranked third in Australia’s export trade after coal and iron ore (DFAT 2008). Overseas students became an increasingly important revenue source for cash-strapped universities, as these students are required to pay full fees up-front. However, the strong Australian dollar and recent concerns about racism have placed downward pressure on this market. More fundamentally, as Asia inevitably shifts to educating their own home-grown designers, there will be a corresponding decrease in the perceived need to travel elsewhere for design education.
Impact of the context on industrial design practice and education

The context above described the genesis and nature of the fundamental changes to Australian society: essentially these stem from the demise of Australian-based manufacture, the rise of service industries and the commodification of tertiary education. These can be seen as the ingredients for ‘a perfect storm’ in the world of industrial design: traditional DFM design positions were lost along with their manufacturing base at the same time that universities were being encouraged to produce more industrial design graduates. Some of the effects of this perfect storm are outlined below.

Design practice implications

Developments in electronic communications (email, Skype etc) and other technologies (most notably CAD and rapid prototyping) have meant that a designer no longer has to be physically co-located with the manufacturing production factory. Theoretically, therefore, the shift of manufacturing jobs from Australia to other countries should not necessarily result in a loss of DFM design positions. There are numerous examples of designers working trans-nationally, with their input being communicated to geographically distant plants. However, despite being technologically possible, and in some cases put into practice, co-located manufacturing and design remains the norm, and most design for manufacturing work continues to follow manufacturing work itself.

For example, GMH Australia have designed and manufactured a range of cars in Australia since the 1940s but there are fears of both the manufacturing and the design services moving off shore (Australian Broadcasting Commission 2011, November 11). Likewise, the Australian car industry, for example, Ford Australia also announced government funding guaranteed for the next four years, which would be adequate only for the current model life cycle of the Australian-based Falcon and Territory models (Australian Broadcasting
Commision 2012, January 10). No funding is certain after that period. Both Federal and Victorian State governments have made significant financial contributions (now termed ‘co-investments’ rather than subsidies) to keep the plants operating in Australia. However, Ford USA has signalled its intention to move to single platform cars internationally in the future: a move that would ensure no further Australian-based designs would be produced for the local market. If this occurred, it would not only affect the manufacturing of the cars and parts made by smaller suppliers but also the supply of design services. Such services are a specialty area within industrial design in Australia, and this is at risk of becoming redundant in the domestic context. Therefore, the niche automotive transport industrial design specialty courses offered at some universities would also become unnecessary: an illustration of how changes in local manufacturing can have an immediate and significant impact on design education curriculums.

At the same time as traditional industrial design positions have decreased, the number of industrial design graduates has increased. Therefore, there is greater competition for fewer positions in traditional industrial design areas and this environment is articulated in the interview data. Several respondents noted that larger graduating classes spelt more competition for jobs and linked this to the need to look further afield for potential employment. Several interview respondents noted that jobs had been considered and located overseas; while even more important was the need to apply their skills in non-traditional areas.

Some data suggest that only approximately 6% of designers work in roles primarily designated as such (Higgs et al. 2005). While definitional issues make these data questionable, it is clear from interview data that industrial design graduates can be found applying their knowledge and skills in a diverse array of positions including point of sale, packaging, signage and exhibition design. (see Appendix 2) The boundary-setting dilemmas of the industrial design profession make it difficult to build an accurate picture of their location, roles and contribution to the community (Higgs et al. 2005).
As noted by Higgs, it is difficult to define the industrial designer, when:

*design as an occupation is one of the most horizontal of the creative industries, meaning it is more of an occupation within many industries than a specialist free standing industry.* (Higgs et al. 2005, p. 50)

These developments highlight underlying issues of the identity of industrial design: to what extent would we say that such positions are in fact design-oriented positions? Is this the disintegration or demise of industrial design as it was once known? Or is it merely an adaptation to a changed environment, reflecting the inherent flexibility and breadth of application of the design role?

**Design education**

As the role of the industrial designer is buffeted by international and national changes, the key question for design educators is: for what role should we be seeking to equip our students? And which stakeholders are best placed to discern this: is it the employers wanting job-ready graduates for the positions that exist today, or the educators more in touch with emerging international understandings of what designers may be called upon to do in the future?

**Shift from VET sector to university sector**

A historical factor to be borne in mind in understanding how these questions are to be answered is the continuing impact from the relatively recent move of industrial design from vocational education training (VET) institutions to the university sector. This shift, brought about during the ‘Dawkins’ educational reforms of the 1980s (Davis 2007), has impacts in the relationship of industrial design to other design disciplines and to the overall university setting.

For example, research outputs (as defined by government parameters) are linked to funding levels. Such research requirements constitute a greater pressure on industrial design with its skills-based history than more traditionally academic fields. This can therefore modify the original applied nature of industrial design education to a justification for its existence in a university environment. Another impact of the focus on research is a shift in
the staffing profile for industrial design courses. In times gone by, industrial design teaching staff were drawn from those with demonstrated expertise in the field. With the current pressure to produce ‘research’, the focus has shifted to those with higher research-relevant qualifications. A PhD is now the accepted academic standard for industrial design academics, regardless of whether they have professional practice experience in the field. This transition is still in train and the full implications to the student body and the profession are yet to be seen. It is too early to tell both what may have been lost, or gained, by this shift from the master–apprentice model of industrial design education to a more theoretical approach. However, at least some indications are that not all stakeholders see this as an improvement on previous practice. For example, the national professional body, the Design Institute of Australia, has lamented the perceived lack of applied job-ready skills and knowledge in the graduates of recent times (Robinson 2007).

Likewise for industrial design teaching, which has historically been based in traditions of ‘doing’ rather than ‘talking’, the centrality of face-to-face studio time can be difficult to understand by other more academically oriented disciplines with a different pedagogical pedigree.

The shift from VET to universities also saw an increase in the number of design schools: from 8 in 1984 in the pre-transition to university-based courses, we now have 12 university-based courses across Australia. There are two in South East Queensland, three in Sydney, three in Melbourne, and one each in Perth, Adelaide, Canberra and Newcastle. Numbers of industrial design graduates are not tracked at the national level; however, discussions with counterparts at other universities indicate the increase of design schools has led to ongoing increase in graduate numbers.

**Current responses**

As industrial design educators struggle to determine how best they can equip their students for an uncertain future, two approaches seem evident.
The first appears to take a ‘cover all bases’ technique: the core traditional curriculum remains, but the repertoire of new course material continues to increase. Students now cover the traditional sketching and rendering their predecessors studied, plus the new technologies of CAD. Curriculums still include model making and hand finishing but also rapid prototyping. Knowledge of new materials and processes continues to expand, and as well as physical anthropometrics for design, students are now taught ergonomics, group dynamics, user-centred design, sustainability and environmental concerns. At the same time as course material has expanded, economic pressures on university funding have reduced contact hours and staff–student ratios. The result is a double squeeze on students and teachers which cannot be continued indefinitely: something has to give, although exactly what will change remains to be seen.

The second reaction to the expansion of content is to extend the duration of the course and allow for greater specialisation. This can be achieved by changing from a four year undergraduate degree to a three year undergraduate plus two year course work masters model. Two of the 12 universities offering industrial design have in 2011 started a three year undergraduate course with the option of a two year masters industrial design specialisation (Schumacher and Trathen 2009). The extent to which this expanded course duration effectively meets the challenges of the future remains to be seen.

Applying the models

In earlier sections various models were developed and explained. These comprise:

- Triple Axes Model
- Design Development Wave
- Australian Industrial Design Ecology Framework
- The Five Archetypes.
In this section, I apply these models in a speculative way by using them to understand the past, decipher the present and give clues to what the future may hold for both design practice and design education. This process demonstrates the strength and usability of the models: it shows how various aspects of the Australian design condition are related and how apparently unconnected and individualised phenomena are in fact symptoms of more generalised issues. Finally, I consider how these possible futures give direction for how we should steer our practice and education.

In different ways, each of the models highlights the tensions and dynamism of a profession in flux, and how this mutable landscape drives continuing evolutions in design education. Changes in the dominance or priority of the various elements within the framework of industrial design practice and education can describe the past, illuminate the present and provide scenarios for possible futures; each depending on the size, proportional relationships, connectedness and emphasis of each of the elements. Privileging certain of these elements can reflect or create new policy frameworks that may send us back in time or propel us into emerging futures. In educational terms this means that changes of bias to aspects of the curriculum will determine different types of outcomes.

In undertaking this research, it became apparent that many of the decisions made regarding industrial design education and curriculum development reflected the choice of where learning outcomes should aim to sit on these continuums. Such outcomes reflect the reality that choices must be made: it is not possible that all aspects can be given equal weight in an undergraduate degree. Teaching hours are limited, costs must be contained and parity with other disciplines must be considered. The choices made in developing the curriculum along the axes described by the Triple Axes Model require continual monitoring and constant recalibration. We need to be mindful of the future employment prospects for graduates. To a large extent, the armoury or toolbox of skills and knowledge students take with them on graduation will dictate those prospects. As educators, we need to continually consider the
question: how well does our course equip students to survive and prosper in the real world, whether in Australian design or overseas? What is the learning environment most conducive to achieve these outcomes, and how can we help to create such an environment? The assessment structure, for example, is one factor in building the learning environment. Students are justifiably focused on marks and grades, but as educators we need to be conscious of the behaviours we reward and encourage through our marking system. For example, does the assessment system encourage taking a risk or playing it safe? Do our timelines for project based learning encourage making and learning from mistakes, while at the same time preparing students for the realities of the commercial world with its short lead times and unforgiving deadlines?

In this section, aspects of both Australian practice and education are addressed: sometimes separately and sometimes in combination. The interaction between both elements is ongoing: they form a dynamic ecosystem with their own feedback loops. The ecosystem cycle (self-reinforcing) of work (employer requirements) feeds into roles at work (what industrial designers are allowed/expected to do/capable of doing), which feeds into the education aspect (what are students trained for, what expectations they develop): where there are mismatches, problems arise. This ecosystem exists inside a context (box): the big picture (environment, economy, political).

The past: stability

In the past, Australian design practice worked in tandem with the strong manufacturing sector. Industrial designers played an integral role in the design and development of a range of products for both local consumption and overseas export. Jobs were not large in number, but they tended to be stable and well defined. Industrial design was a simpler practice with fewer complications, considerations and influences. Graduates could expect to find employment in local Australian owned and operated industries, such as Philips
Australia and Hanimex which produced electrical domestic goods. Employment prospects were clearly defined within the manufacturing realm: students learned how to design objects made by mass manufacture. The focus of education was skills-based, with known and well-defined techniques passed on from the existing generation of practitioners to the emerging generation in an almost trades-based, master-apprentice pedagogical approach.

The Australian design education sector was also characterised by stability. Industrial design was seen primarily as a skills-orientated profession. Courses were within what is now referred to as the vocational education sector, conducted by institutes of technical and further education, colleges of advanced education and the like. Graduate numbers were relatively low as industrial design schools were few in number.

In contrast to today’s environment, the parameters of the both the profession and the educational preparation of designers were clear, unambiguous and largely unquestioned.
The past as viewed through the models:

**Triple Axes Model**

![Triple Axes Model](image)

**Figure 6.5 Triple Axes Model applied to the past**

As illustrated in Figure 6.5, the Triple Axes Model shows past industrial design education and practice was biased towards the outcomes based, skills orientated and safe ends of the continuums. Design expertise tended to be brought in relatively late in the production process, after a ‘problem’ and ‘solution’ had been identified. In general, designers did not engage in upstream research and problem analysis, as design briefs were already developed by production team and marketing sections. Education processes reflected this pattern, with the majority of teaching focusing on repackaging existing technologies. For example, students were asked to design a new drill rather than to design a new way of drilling.
As shown in Figure 6.6, the Design Development Wave for the past reflects the focus on outcomes based, skills orientated and safe ends shown in the Triple Axis Model above necessarily pushes the wave to the right hand, producer focused back end. This reflects that past industrial design education and practice tended towards the right hand end of the wave: reflecting a focus on detailed manufacture, producer-focused back end versus the left hand end of the continuum which is the problem identification front end.

Designers were expected to focus on materials and their properties, production methods and manufacturing techniques. The front end was represented only in rudimentary elements regarding trends and aesthetics. The current day recognition of a user-centred design ethos was almost totally absent. Consideration of human factors, where taken into account at all, were confined to physical and anthropometric elements, with minimal consideration or understanding of the psychological aspects. There was only a limited industrial design literature, with few texts, journals or magazines available.
Australian industrial design ecology framework of archetypes

As shown in Figure 6.7, the Australian Industrial Design Ecology Framework shows past industrial design practice and education is located low on the vertical axis. It was heavily weighted to the producer centred end point with limited recognitions of the community centred approach. In terms of the horizontal zones of Adopter, Adapter, Departer, the practice was firmly sited within the Adopter zone: again showing the predominance of the DFM and producer centred nature of industrial design practice and education at the time.
The present: A state of flux

If the past environment for the practice and education for industrial design can be characterised by stability, the present must be seen as embodying a state of flux.

The practice of industrial design is diverse and its boundaries are contested. The number of Australian industrial design courses and the graduates they produce has increased significantly, driving up competition for available jobs at the same time that traditional DFM positions have become scarce. There are two views described by Robertson as to whether this should be seen as irresponsible and short-sighted policy leading to ‘funding initiatives that continue to drive an overheated educational sector without addressing the employing industries.’ (Robertson 2007) or alternatively as cause for optimism, and in fact the ‘flood of graduates was far from a threat to design but was an opportunity for the future’ (Robertson 2003).

It is clear that new practitioners have to adapt their skills and market themselves in innovative ways in order to find employment. There is often a mismatch between the realities of employment and the expectations of the graduate. Business and industry are keen to have job-ready graduates that are able to ‘hit the ground running’ within their existing business model. New graduates on the other hand may resist being pigeonholed to the role of CAD monkey and aspire to putting their environmental and social philosophies into practice in the workplace. They may find that co-workers and managers under-estimate the breadth of their education and their potential role, leading to frustration between what graduates understand their contribution could be and the role to which they are assigned.

Reflecting these uncertainties, Australian industrial design education is also in a state of change. The range of curriculum input for the student has increased significantly, incorporating social and environmental issues, human-centred design and experience design. New technologies are an everyday part of the student experience, with CAD and rapid prototyping an expected and standard
part of the course. Face-to-face contact hours are under pressure and students are more likely to be taught by life-long educators with less or no professional experience in the commercial world.

Responses to the explosion of course content have varied considerably. No single model predominates. Some universities continue to try to compress more into the same course duration despite the reduced contact hours, while others have expanded the 4 year undergraduate course to a 3 year undergraduate plus 2 year masters format.

In the international context, some industrial design courses have gone further towards resolving these dilemmas. One strand appears to be reconfiguring and expanding the understanding of what the role and function of industrial designers could be. One example is the concept of the T-shaped designer. This concept has been proposed by Tom Kelly and IDEO (Kelly 2001), where the vertical stroke represents the depth of discipline knowledge and the cross stroke represents the knowledge and understanding of the relevance other disciplines. In a similar vein, the ‘d’-school at Stanford University San Francisco mix design thinking with engineering industrial design and business.

Another strand of overseas development is the emergence of new specialties involving industrial design such as interaction design. The course expansion and breadth of role is typified by the work done in curriculum redesign at Carlton University, Canada, and the Strategic Industrial Design course in Finland.

Mirroring this dynamism and state of change is an explosion of literature and professionalism of the industrial design world. The proliferation of design magazines, design-related peer-reviewed journals and design specific books as well as the emergence of professional organisations such as the DIA, indicate the growing maturation of the field. At the same time that design has gained some recognition within everyday society, confusion continues about the nature and role of industrial design.
The present as viewed through the models:

Triple Axes Model

As shown in Figure 6.8, the Triple Axes Model shows present industrial design education and practice is being stretched beyond its narrower, more traditional DFM focus. The DFM aspects remain core in many situations but additional aspects are continually being added. This leads to stress in the education of new students as tensions increase: available teaching time is shrinking while course material which could or should be addressed continues to expand.

The present practice of industrial design shows a continuing and increasing diversification of applications. Interview data reflects the breadth of settings, even in single career trajectories, in which present day designers ply their trade.
Design Development Wave

Figure 6.9 Design Development Wave applied to the present

Figure 6.9 illustrates the ‘doing it all’ educational response to the diversification of industrial design. This approach tries to incorporate new elements without losing the traditional ones, and to educate graduates for all possible future roles. This is played out by design courses developing ‘everything plus the kitchen sink’ curriculums. The course aims to equally address all areas along the front-end : back-end continuum: students are meant to be both innovative and risk averse (the risk/safe continuum); to have high end skills acquisition as well as extensive theoretical knowledge (the skills/knowledge continuum); and to be able to detail design outcomes as well as apply appropriate design process (the outcome/process continuum). This educational approach runs the risk of trying to do too much and potentially not doing anything well.

Within the context of professional practice, the application of industrial design principles is gradually expanding, as the realisation grows that design thinking has significant contributions to make to the entire design process, not just the DFM end. For example, design approaches have been applied to social innovation and community centred aspects such as those espoused by IDEO with their work in designing K–12 education. In a similar way, the Philips Corporation is applying design thinking to the design and delivery of health care services (ICSID 2009).
Australian Industrial Design Ecology Framework of Archetypes

Figure 6.10 Australian Industrial Design Ecology Framework applied to the present

Figure 6.10 reflects the application of the Australian Industrial Design Ecology Framework to the present. In the Australian Industrial Design Ecology Framework diagram, the ellipses indicate where current forms of practice reside in terms of the Art–Technical horizontal axis; the Community-Centred – Producer Centred vertical axis and the Adopter, Adapter, Departer zones. In addition, the relative size of the ellipses indicates the relative size of employment in these types.

The diagram shows the largest ellipse is still at the Producer-Centred, Technical and Adopter part of the model, as most design jobs still are found here. However, the two smaller ellipses indicate the significant new jobs and roles in areas divergent from these traditions. The middle ellipse in the Adopter zone,
with its tendency towards the Art end of the Art–Technical Spectrum, holds a midway point on the Community-Centred – Producer-Centred continuum. The top ellipse, which is the newest and currently smallest employment market, shows the greatest separation from industrial design’s traditional parameters. It typifies the Departer, who has a role most focused on Community-Centred aspect, and also takes a balanced view on the Art–Technical axis.

The future: a post industrial design profession

I have characterised industrial design in the past as stability, and in the present as flux. However in the future, the profession of industrial design as we know it is gone. The future will hold no place for a narrowly defined role such as the ones for which many of us present-day industrial designers were educated.

In the post-professional future, graduates of future design-based courses will be integrated throughout many aspects of society. Associations with manufacturing will be no stronger than links with services such health, banking or tourism. Career trajectories will incorporate many forms of work (onsite, remote, trans-national, employee/contractor), many formats (part-time/casual/full time), and many disparate fields of application. Such formats are likely to co-exist rather than be a linear career progression: with job-sharing, multiple roles and various modes of employment and self-employment occurring contemporaneously. Job parameters are likely to be fluid and adaptive to emerging issues. Job titles and roles will reflect the archetypes outlined earlier in this chapter, with design graduates employed in roles based on interaction design, service design and strategic design. Design principles and design thinking will be recognised and respected as a field of expertise and specialisation by employers, businesses and the wider public.

Design has always borrowed from other disciplines, and interpreted and remodelled borrowed attributes to suit its own needs. We should not be surprised when other fields return the favour and borrow from design to
augment other areas such as business practices. The Departer becomes the new disseminator of the benefits and attributes of design skills knowledge and approaches. Roles will reflect this with work roles emerging to be filled by the disrupter, the devising designer and the design dissenter.

In terms of education, the current tension between competing poles of attraction will be resolved by a bifurcation of curriculums. Universities will realise courses can no longer ‘do it all’ and will instead offer separate courses focusing on separate areas on the Art–Technology and Community–Producer continuums. Designers of all career stages will be involved in life-long learning. They will ‘pick and mix’ across course offerings, individualising their learning experience to meet different employment opportunities, emerging trends and personal philosophies and interests.
The future as viewed through the models:

Triple Axes Model

Figure 6.11 Triple Axes Model applied to the future
As shown in Figure 6.11, the Triple Axes model shows future industrial design education and practice is polarised. The tension shown in Figure 6.11 has been stretched beyond its elasticity and has bifurcated into two disparate streams. The left hand diagram shows the shift to a more generalist, front end and theoretical type of design work. The right hand diagram shows the opposite end of the spectrum, where more narrowly applied, traditional DFM remains the focus.

In this scenario, single courses no longer attempt to ‘do it all’ and students who want to cover all bases will work through a modular series of offerings to achieve this end. The range of options and specialisations will increase, with a wider range of shorter courses orientated around the different aspect of the model’s attributes being offered by different institutions. Speciality units focusing on emerging issues will replace older style courses every few years. Design units will be accessed by students from a range of disciplines including science, engineering and sociology.

**Design Development Wave**

![Design Development Wave](image)

**Figure 6.12 Design Development Wave applied to the future**

Figure 6.12 shows how the Design Development Wave explains future developments in practice and educations. The future will fragment and what were once overlapping curves will in the future have no point of overlap or intersection. Figure 6.12 shows how the focus on front end process is discontinuous from the areas focusing on the back end. Future roles for
designers will gravitate away from traditional DFM confines: DFM roles will form the minority. The diagram reflects this reversal: the curve indicating the front-end focus is proportionally larger than the curve showing the back end focus.

**Australian Industrial Design Ecology Framework of Archetypes**

![Diagram showing Australian Industrial Design Ecology Framework applied to the future](image)

Figure 6.13 Australian Industrial Design Ecology Framework applied to the future

Figure 6.13 shows how the Australian Industrial Design Ecology Framework explains future developments in practice and education.

In the Figure 6.13 the ellipses indicate where future forms of practice will reside and their relative and proportional size in terms of employment prospects laid over the Art–Technical horizontal axis, the Community-Centred – Producer-Centred vertical axis and the Adopter, Adapter, Departer zones.
The diagram shows the largest ellipse at the top, in the Community-Centred, ‘Departer’ zone of the model. A large proportion of employment opportunities will be in design approaches to community-centred issues.

The second largest ellipse is located towards the art end of the Art–Technical horizontal axis and in the middle of the ‘Adapter’ Zone. Design of objects as bespoke solutions for particular contexts will increase in importance. For example, new urban spaces will be created with the need for unique and individualised artefacts including furniture, lighting and streetscape materials to also be designed. Such individualised design often incorporates a range of digital design software, advanced prototyping and materials.

The two smaller ellipses indicate the significant changes in producer-centred design for manufacture opportunities. One ellipse representing traditional DFM industrial design is located at the Producer-Centred end of the vertical axis, towards the technical end of the horizontal axis and in the Adopter zone. The other small ellipse is located at the technical end of the Art–Technical horizontal axis and in the Adapter zone, representing a stronger engineering link to industrial design.

Towards a resilient adaptive practice

This thesis has explored the mismatches between current industrial design education approaches, the lived experiences of recent graduates and the changing design employment ecology both globally and locally. It has also highlighted the background instability generated by the lack of consensus on the role, function and parameters of industrial design as a discipline and a profession: instability which both contributes to and is caused by these incongruities.

While a time of flux and uncertainty, the current situation is also one of great potential. Traditional modes of practice are disappearing; however, the latent capacity of design is largely untapped. Guiding the realisation of that promise
offers exciting prospects for design educators, practitioners and society more broadly.

The contributions made by this research have drawn in large part on the qualitative and rich data from in-depth interviews with participants. Their lived experience powerfully demonstrates that the future has arrived: while some may still speculate on the implications of a post-DFM environment, many of our younger industrial designers are living and practising new forms of design in that reality.

While from their individual perspective, participants’ career trajectories and setbacks may appear unique, when seen within the context of this study, the common features, and their links to the shifting design environment, are striking. The graduates’ resilience is a marker of their ability to navigate these shifts: adapting either their practice or their environment to optimise their role in a scene of changing personal and environmental conditions. The typologies I originally hypothesised – Adapters, Adopters and Departures – were validated and detailed through this research. Together with the resilience demonstrated by interview participants in the face of significant ecological shifts, these new insights indicate key lessons for the future direction for our profession: a direction which must be towards a new, resilient, adaptive practice.

This section considers how these insights can be applied to dilemmas currently faced by the profession and education of industrial design. A more conscious consideration of these dilemmas is needed by the profession overall: we need to ensure the choices made today best equip us for a future which is already emerging. The future is always unpredictable, but likewise there is scope for it to be influenced by our own actions. A post-industrial design future is inevitable, but the profession can influence how that transition occurs. As Drucker (cited in Cohen 2008, p. 124) states: ‘the future is unpredictable but it can be created’.

These issues need to be considered within the particularities of the Australian context. In economies which support larger manufacturing sectors, the
fragmentation and specialisation of industrial design is more easily accommodated. However, in Australia the historical approach of producing and supporting ‘all-rounder’ industrial designers will not be able to be maintained. Likewise, some specialisations emerging internationally will be harder to establish in Australia due to lack of design and manufacturing diversity. For example, international companies working on the design and development of communication and entertainment electronics such as Apple, Samsung and Nokia are of a size and diversity to enable them to employ specialised interaction designers. In the Australian context such positions will remain scarce.

I address here how universities can assist the transition from present to future through their core business of education, and thereby influence future design practice. It is important to note that increasingly universities will not only prepare new graduates for the future but must assist current practitioners adapt to the transition.

The implications of my research are clear: they inform my plan of action set out below. This plan is applicable nationally, but has immediate application within my own context, the University of Canberra.

What is the problem?

There are two main problems facing industrial design at present:

- First, the profession and education of Australian industrial design is essentially conservative, DFM focussed.
- Secondly, there is an almost complete lack of awareness outside the profession about the potential role and value add of design.

In relation to the first issue, the profession of industrial design is living in a past that no longer exists. The world has moved on and industrial design is being left behind. The profession needs to make the shift from passively and
slowly reacting to perceived change, to becoming an active participant, proactively setting the direction for the profession. This thesis sets out to hold up a collective mirror to the profession, to provide a wake-up call to the changes that have been going on right under our noses. The changes have been gradual and have largely escaped our collective attention and response. In relation to the second issue, few outside the profession have any awareness of what industrial designers do. An even smaller group may have an inkling about the breadth of potential applications of the essential elements of design thinking.

The irony is that the demise of traditional applications of design to manufacture coincides with a greater than ever need for design thinking. The national and international challenges facing us – climate change, increasing urbanisation, population growth and the demographic shift to an ageing population, to name a few – demand a design-led approach. Now more than ever design thinking is needed to address these wicked and complex problems. Once industrial design can relinquish its out-dated single focus on manufacture, and convince others of its value, the future applications of design thinking are vast and diverse.

What is the solution?

In this section I develop ideas for how the problems facing industrial design can be addressed. I have grouped these solutions according to the range of different target audiences which need to change, and I specifically focus on how such solutions should be implemented within my own local setting, the University of Canberra.
**Target audiences/levers for change:**

<table>
<thead>
<tr>
<th>People currently inside industrial design</th>
<th>People currently outside industrial design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design undergraduates</td>
<td>Non-design undergraduates</td>
</tr>
<tr>
<td>Existing workforce</td>
<td>Existing workforce</td>
</tr>
<tr>
<td>Decision makers (professional organisations, universities etc)</td>
<td>Decision makers (funding bodies, research bodies, politicians, government departments, etc)</td>
</tr>
</tbody>
</table>

**People currently inside industrial design**

We need to equip those currently inside industrial design for the emerging post-industrial design world. We have to change the mindset of those who set limits on what the application of design can or should be, and we likewise need to find new terminology which reflects, rather than limits, these potential futures. Finally, the industrial designers of today will have to become, in the future, the disseminators of design principles beyond the profession of design to the wider world.

**Design undergraduates**

I believe a priority for undergraduates is to broaden the project work they are assigned to include non-manufacturing contexts. For example, in the UC setting, undergraduate project work generally focuses on manufacturing. These projects are progressed via collaborations which have been established with Australian production companies, mainly in the Sydney area. Informed by the concept of concentrating on one’s local environment, future projects would focus on Canberra’s largest local industry, which is government. Projects should be designed to demonstrate how the new industrial design thinking is applied to policy and program delivery challenges in such settings. As it is, the industrial design education equips the graduates for a range of
situations, but these will need to become more overt and discrete and meld with other discipline areas.

Universities must resist the urge to make undergraduate design courses all things to all people. Instead, the focus should be on key areas of design principles which will be more adaptable to a range of settings, including, but not limited to, DFM. Correspondingly, specific skills-based requirements should be shifted to more stand-alone add-on modules to meet current employment requirements. These could be made available to both undergraduates and existing members of the profession.

At the UC level, existing links between design disciplines should be broadened to encompass non-design disciplines such as science, health and the social sciences. These interdisciplinary interactions at the undergraduate level should then be extended to postgraduate and beyond.

The interdisciplinary approach taken in regard to course design should also be applied to teaching staff. New topics and ways of thinking may need new ways of teaching. As innovation extends the reach of design to novel applications in health, government or education, experts in those fields could provide teaching perspectives, aided by design educators to tease out areas of commonality.

**Existing design workforce**

The existing design workforce requires significant retraining to learn to apply their existing skills and knowledge in new and innovative settings. What is required is to add to their existing models of knowledge and practice, which tend towards the producer-focused end of the continuum, through the addition of expertise within the community-focused part of the spectrum. In the UC context, and carrying forward the work done in undergraduate projects, this focus would be applied to government settings. Understanding the language and processes of government, and of policy development and program implementation, would be the first step. Working through how these processes map to the design process could illuminate opportunities for value adding, and the potential role for design thinking to be applied. One potential
beginning point is for round table forums to be hosted by the UC, which could bring together representatives from government agencies and others in an informal and mutually informative space. These would provide the basis for designers to gain an understanding of these other fields and begin to discern opportunities for future application of their expertise.

Reaching out to members of the existing industrial design workforce will in itself be challenging, as the ambiguity of industrial design identity means that linking with the diverse workforce is not simple. Likewise, ongoing education for those in full time work needs to be flexible and adaptive to their needs and available time. A range of options (in-service, conferences/seminars, webinars) should be offered as well as traditional university units of study. The UC could develop such offerings and begin to seek out designers in whatever roles they currently hold in order to build awareness and networks.

**Decision makers (professional organisations, universities etc)**

Decision making bodies within the industrial design profession are relatively few in number. The Design Institute of Australia (DIA) and the Australian Design Awards undertaken by Standards Australia are potential target audiences in this context. Likewise, less formal networks and agencies, such as the national Industrial Design Educators Network, (IDEN) would also appropriately be included. These bodies are potential sources of leadership and dissemination across the profession, and they firstly need to be familiar with the issues raised in this thesis. Opportunities to present, discuss and disseminate this work (that is, to hold the mirror up to them) should be sought in the future. A greater and more widespread understanding of the issues is the necessary first step to build engagement of these bodies to design the future. Issues for consideration via these networks would include addressing the geographical issues and the economies of scale issues in Australia. Not all universities will be able to offer all courses. How can we foster healthy competition and diversity while at the same time reduce unproductive rivalry between educational institutions? In addition, the networks could promote
more honest recognition and responses to design within the Australian context. Fundamentally, as this thesis argues, the reduction in local manufacture should drive a reduction in the teaching and focus on DFM. On the other hand, Australia’s dependence on the mining sector should generate discussion about the design implications of this industry. Links with a greater diversity of ‘employer’ bodies to encompass non-manufacturing agencies would be an important step in this process. Likewise, universities will have to confront and manage the staffing and other changes required of a university by doing this, as implementing the change to the new design world will not be easy.

**People currently outside industrial design**

Perhaps an even bigger challenge than addressing the change within the profession is informing those outside the profession. How do we re-present, re-badge and market the new industrial design to target audiences who do not know what design can offer? How do we demonstrate our relevance to the uninitiated at the same time as consolidating our own expertise in non-traditional areas? The ways forward are explored below.

**Non-design undergraduates**

Design educators need to find a way of exposing non-design students to design approaches. Cross-disciplinary approaches are required. These could include interdisciplinary projects, where students from various disciplines work together on a problem-based project, under the guidance of design approach. There may also be opportunities for shared modules, where the units would have credit for various disciplines including design. Another approach may be for design units to be recognised as electives for a broader range of courses. Perhaps a ‘fundamentals of design thinking and approaches’ unit could be developed which would have cross-disciplinary application. The object of all these options would be to increase the awareness of a range of undergraduates of design principles and their potential application in their fields.
Existing workforce
Design thinking principles have extensive application across a range of industries: health, banking, tourism and hospitality, to name a few. However, few in these industries have any understanding of the potential benefits of such an approach. Under this approach the aim of the profession is to raise the awareness of those in non-design fields to these possibilities. The idea proposed above of holding round table forums bringing together representatives from government agencies and others would have a dual purpose. As well as informing designers about government, they would inform other non-designer participants about the potential application of design thinking in their fields.

Decision makers
Decision making bodies beyond industrial design are numerous and include funding bodies, research agencies, politicians and government departments. Such organisations exhibit the same lack of understanding of the potential role of industrial design we see elsewhere, and the first aim of influence in this target audience is to raise awareness and remove limitations which exclude design from potential fields of application.

For example, current research in the profession is linked primarily to industry. How can we shift that to include new applications? Designers will need to convince research funding bodies such as the Australian Research Council (ARC) and AusIndustry to broaden their understanding of what design can offer.

Conclusion
The chapter began by providing an overview of the relevant context of Resilient Adaptive Practice: it outlined Australia’s place in a global context, and the past and present ecology in which Australian industrial design practice and education is located.
The second part of the chapter described how models can be used to advance and communicate abstract conceptualisations, and then showed how this was achieved in this research. The models developed, comprising the Triple Axes Model, the Design Development Wave, the Australian Industrial Design Ecology Framework and the Archetypes, were detailed.

In the final section, I explained how the models can be used in practice, by examining the past, present and future of industrial design practice and education through their perspectives. In the fourth and final section I used these insights to strategise solutions and map a way forward.

The next and concluding chapter outlines the overall research thesis, the significance of this research and the details the key knowledge contributions.
7. Conclusion
7. Conclusion

This thesis identified and investigated a current disconnect between industrial design practice and industrial design education, and its complex and dynamic context. I argued this disconnect is caused by the failure of design education to adequately respond to changing roles in the profession, stemming from the demise of DFM – the birthplace of industrial design – and corresponding diversification of roles in non-traditional areas. I researched industrial design graduates’ career paths through rich qualitative methods, developed a theoretical framework to critique the relationship between practice and education, and ultimately recommended ways to improve this. The approach taken was deliberately Australian-centric, as I wanted to understand Australian industrial design separate from predominant European or North American perspectives.

My research questions comprised:

- Can models be used to explain the experience and career trajectories of recent industrial design graduates?
- How can such models clarify the extent to which existing forms of industrial design practice remain relevant today, and identify emerging forms of practice?
- How can the experience of recent industrial design graduates contribute to an understanding of factors influencing practice?
• What models or concepts can help translate these insights into assisting design educators educate for the future, not just the present?

This approach consciously avoided the commonly-held but simplistic view that there are insufficient design jobs for too many design graduates. Such an approach would have led to a study of DFM employers of industrial designers and would therefore have been confined to existing understandings of design roles. Instead, I wanted to investigate the perspective of new design graduates as the source of data on emerging design roles. This more holistic approach expand the understandings of the contribution graduates of industrial design make to the economy and community in addition to and beyond traditional understandings of roles for industrial designers.

As initially explored in the introductory Chapter 1 and literature review in Chapter 2, two inter-related concepts are investigated in my description of the context. First, the definitions and boundaries of industrial design are revealed as contested, permeable and mutable. Secondly, the manufacturing base from which industrial design has grown is undergoing a global shift from developed to developing nations. The uncertainties driven by both factors intersect and multiply, resulting in increasing diversification of industrial design practice.

Many of the traditional skills developed by industrial designers of the past have been devalued or changed. On one hand, computer software has made basic design tools available to the masses. On the other, computer aided design (CAD) and rapid prototyping have established new areas of technical specialisation in areas conventionally part of the industrial designers’ ‘turf’. As the pace of change increases, the predictability of future job requirements, or even of the jobs themselves, correspondingly erodes.

As described in Chapter 3, I acknowledged my role as researcher with a particular perspective informed by the very nature of being embedded within the two intrinsically linked worlds of industrial design practice and design education. This chapter also explained my choice of qualitative methods as most appropriate to addressing my research questions. Alternative
methodologies, such as numerically based quantitative questionnaires, would not have allowed the exploration of lived design experiences I sought. Instead I based my analysis, visualisation and theory building on primary research consisting of one on one interviews with recent graduates from the University of Canberra four year undergraduate industrial design degree. Recognising the need for new descriptors for the experience clusters which emerged from the data, I devised, applied, tested and confirmed the Adopter-Adapter-Departer model (Key Knowledge Contribution #1). The AAD model components proved to be robust and useful categories to explain the career trajectories for recent industrial design graduates of the University of Canberra highlighting the extent to which conventional or traditional forms of industrial design practice have shifted over the past 15 plus years. For example, Adopters in ‘core’ industrial design roles deal first-hand with the implications of ‘over-specialisation’ (e.g. becoming a ‘CAD monkey’); Adapters demonstrate through their own lived experience the breadth of application of design thinking, in ways separate from traditional understandings of industrial design; while Departures show that apparent attrition from the design profession can be re-framed as a positive diffusion of design approaches to the broader community. The AAD model is proposed as a generic model that could be used by others to determine its usefulness as part of a future research.

Chapter 4 described how key commonalities emerged from the rich and informative interview data of the graduates lived experiences. I used illustrative quotes from these interviews to support the development of the themes of communicator, approach thinking, social conscience, facilitator, mobility and identity. The themes, and their relationships, were visualised by means of the Thematic Map of Australian Industrial Design Practice (Key Knowledge Contribution #2). This Map illustrated the depth of skills and knowledge which contemporary industrial design graduates draw upon in their various forms of practice.

Chapter 5 detailed the application and development of models to visualise abstract ideas relevant to industrial design education and practice. In the
process of developing a responsive theory I proposed three theoretical descriptive models and five archetypes of industrial design practice.

The models comprised: **(Key Knowledge Contribution #3)**

- The *Triple Axes Model* which described the relationship between three pairs of competing priorities: process vs outcomes, knowledge vs skills, and risk vs safe. Variations in industrial design curriculums can be understood through their comparative locations on these continua.

- The *Design Development Wave* which described the balance between back and front end design processes. The *Design Development Wave* shows how choices in design education reflect the compromises and tensions outlined in the *Triple Axes Model*.

- The *Australian Industrial Design Ecology Framework* which drew upon the characterisations of Adopter-Adapter-Departer to map the breadth of design practice. It graphically locates these within a framework described by the axes of community centred vs producer centred, and art vs technical.

The five industrial design Archetypes (**Key Knowledge Contribution #4**)

composed; Visual Creative, Technical Product Designer, Digital Maker, Design Deviser and Dissident Designer. When placed in the *Australian Industrial Design Ecology Framework*, these conceptual constructs reflected lived experience and helped explain how shifts in the profession impact at the individual level.

**Chapter 6** expanded upon the contextual discussion in **Chapter 2** through more detailed analysis of the environment in which Australian industrial design practice and education reside. Globalisation and free trade have ensured the demise of low-skilled manufacturing in Australia, with even high-skill sectors such as car manufacture under continual threat of closure. At the same time, Australian universities face significant funding cuts and increasing pressure to perform against standardised performance criteria. In such a state of flux, uncertainties over the role for which industrial design seeks to equip its graduates can create vulnerabilities for the discipline.
The chapter also applied the models to an examination of the past, present and future situation of industrial design practice and education. Taken together, these models and archetypes constituted the concept of *Resilient Adaptive Practice* (**Key Knowledge Contribution #5**). The value of the concept was tested first with the past and present: as it explained and aligned with observed reality, it could be applied to possible futures with a degree of confidence.

This revealed that while pockets of traditional DFM still exist (traditional understanding of industrial design; identified as Adopters), roles that apply industrial design principles in novel design situations are increasing (stretching the boundaries of what is industrial design; identified as Adapters), and finally, industrial design graduates are applying their skills and knowledge in non-design roles (roles traditionally defined as non-design; identified as Departers). These changes have already happened: patchwork employment, innovative adaptation of design principles to available work roles, off-shoots into small-scale and bespoke production and shifts to non-design jobs are the commonplace lived experience of industrial design graduates. However the profession as a whole and in particular design educators have been slow to recognise, understand and respond to these shifts. In general, their focus is on a DFM past that is unrepresentative of the future. I identified two main barriers to undertaking the needed renewal processes: first, an essentially outdated DFM focus of the profession and education system and secondly, a corresponding lack of recognition of the potential applications of industrial design approaches outside the DFM world.

The seismic change in locus of manufacturing which has transformed the nature of industrial design calls for a correspondingly comprehensive review of the fundamentals: what does it mean to be an industrial designer in the 21st century, and how should educative and professional structures support this work?

The resilience and flexibility exemplified by successful graduates needs to be recognised as the new critical success factors: our educative models and professional structures must be re-modelled to advance these. My concept of
Resilient Adaptive Practice provides a model to embrace, rather than resist, the explosion of unknown and unknowable futures. Instead of seeking to predict and codify future role requirements of the next generation of designers, it focuses on core design principles and the promotion of personal and professional resilience. One of the few things we can be certain of is that change will continue. The best skill we can equip future designers with is the ability to adapt and respond to such change.

This thesis is the first step in enabling this reform process: it holds up a mirror to design practitioners and educators, enabling the self-reflection required to lay the ground work for change.

Future research

As noted above, the perspective taken is from the University of Canberra. While located within a national and international context in which commonalities and trends are discernible, it is therefore necessarily Canberra and Australian focussed. Future research could expand to industrial design graduates of other institutions and apply and test the models detailed above.

Research is also needed into new ways of carrying these models into educational practice. While the goal of building new forms of resilience into design education and practice is clear, methods for achieving this are less well understood. The diversity of approaches within design education both in Australia and internationally provides the conditions for natural experiments in this area. As changes in design education continue, methods to capture and compare comparative data should be developed and implemented. Such methodologies will better enable our reflective practice as a profession within design education, and ensure continued improvements both in the grounding we provide new graduates and our evolution of new forms of professional practice.
References


ABC News 2011, television broadcast, ABC TV, Canberra, 11 November.

Midday Report 2012, television broadcast, ABC TV, Canberra, 10 January.


Bazeley, P 2007, Qualitative data analysis with NVivo, Sage, Los Angeles.


Boyer, EL 1990, Scholarship reconsidered: priorities of the professoriate, the Carnegie Foundation for the advancement of teaching, Jossey–Bass, San Francisco.


Brunner, R & Emery, S 2009, Do you matter? How great design will make people love your company, FT Press, New Jersey.


Campbell, E 2010, The meaning of business, the utility of craft and the great how? of our times.


Carson, D & Cameron, G 1998, Partners in design—a feasibility study, University of Canberra.


Crotty, M 1998, The foundations of social research, Allen & Unwin, Sydney


Davis, G 2007, 'Fairness, fees and equity in higher education.' AFR Higher Education Summit.

Davis, M 2008, 'Toto, I've got a feeling we're not in Kansas anymore.' Interactions XV.5 September + October, pp. 28-34.


Design Institute of Australia 2005, 'Industrial design industry overview 2005 A collection of discussion papers outlining trends and conditions in the industrial design profession.' Melbourne.


Downton, P 2003, Design Research, RMIT, Melbourne.


Gideon, L 2009, 'A design ethos for a world in crisis - human values for Asian design.' DesignEd Asia Conference: Forget the future. What are today's design education issues?, Hong Kong.


Hara, K 2007, Designing design, Lars Muller, Baden.


Hippel, EV 2005, Democratizing Innovation, Cambridge, Massachusetts, MIT Press.

Howard, JH 2008, Between a hard rock and a soft space: design, creative practice and innovation, Council of the Humanities, Arts and Social Sciences, Occasional paper 5.


ICSID 2010, Definition of design. Viewed 10 May 2010 http://www.icsid.org/about/about/articles31.htm


IDEO 2011, viewed 23 June http://www.ideo.com


Laurel, B 2003, *Design research: methods and perspectives*, Massachusetts Institute of Technology, Massachusetts.


The Concise Oxford Dictionary
Press, M & Cooper, R 2003, The design experience; the role of design and designers in the twenty-first century, Hants, Ashgate.
Schumacher, P & Trathen, S 2009, 'Changing the structure of industrial design education from four year bachelor's degrees to undergraduate plus masters degrees in the Australian context', Design Ed Asia Hong Kong.
Solomonides, I & Reid, A 2007, 'Engagement and creativity for design education', Connected 2007 international conference on design education, University of New South Wales, Sydney, Australia.
Stappers, PJ 2007, Doing design as a part of doing research in R, Michel (ed), Design research now: essays and selected projects, Birkhauser, Basel.
Stern, PN & Poor, CJ 2011, Essentials of accessible grounded theory, Left Coast Press, Walnut Creek.


Ulrich, KT & Eppinger, SD 2008, Product design and development, McGraw Hill.


Visocky-O'Grady, J & Visocky-O'Grady, K 2009, A designer's research manual: succeed in design by knowing your clients and what they really need, Beverley, Rockport.

Ware, C 2008, Visual thinking for design, Morgan Kaufmann, Burlington.


Yee, JR, Michlewski, K, & Bohemia, E 2007, 'Interrogating the academic research process in UK design education from design and business management perspectives', Connected 2007 international conference on design education, University of New South Wales, Sydney.

Zec, P 2007, Hall of fame, Volume 2, Design for a better quality of life, Montreal, Canada.
Appendix 1: Interview Guide

The below is the interview guide used in the conducting of the semi structured interviews detailed in Chapter 3. The guide had a general structure, as the semi-structured approach used meant the order was not strictly adhered to as I encouraged the conversation to flow as freely as possible. This promoted a more narrative style that often suited the interviewee.

**Intro and thank you**
Thank you for your willingness to participate and to be interviewed.

**Background**
I've been looking at UC industrial design graduates and what they have done since graduating

*Background and interest in industrial design*

**FIRSTLY** I want to start by asking you to tell me about your Journey into industrial design?
When did you become interested in industrial design?
What did you imagine you would be doing after leaving uni?
What did you imagine you would be doing after leaving uni before you started?
Did this idea change while at uni?
When did you first think of doing industrial design?
What or who influenced you to enrol in industrial design?
Did you have an idea of what it was or might be?

Can you tell me what you have done, since graduating? (design wise/work wise)
Tell me more, can you expand on............?
What did you do in this ....... job?

**CURRENT**
What do you do in your practice/job now?
What is your current understanding of industrial design.

In Australia
Internationally
Has this view changed over time e.g. since you left uni.
How has industrial design changed?
Why do think this has happened?
How is Australian industrial design perceived from overseas?
Have you had any dealings with China?

EDUCATION
Have you done any other study, of any sort, since you left University of Canberra? Formal or informal
Yes: what in
Did you finish congratulations?
When was this?
Has it proven useful?
Would you like to engage in further education and what in?

FUTURE
Their
Where do you see yourself in the future? Say 5, 10 years from now
What will you be doing
Do have a plan/ How will you get there?
Why would you like to do this?

INDUSTRIAL DESIGN PROFESSION FUTURE
Where do you see industrial design as a profession heading?

INDUSTRIAL DESIGN CONTRIBUTION
What contribution should or could industrial design make to the future of Australia?
Why is this important
How would you go about it
What role can or should industrial design play in Australia now and in the future?
Why
How
What problems or types of problems do you think industrial design can make a positive contribution to or make a difference?
Why
How

What, if anything has changed in your perception of industrial design, nationally and internationally?
What if anything needs to change? (NOW)
What if anything will change? (FUTURE)
What if anything will Stay the same, return to past ways or change in some way
Were there / or are there, aspects of industrial design education/practice that have and / or influenced or helped at work

EXTRA DESIGN PRACTICE
Do you peruse aspects of design outside your 9-5 job
e.g. explore those interesting designs you always wanted to play with
Yes
Tell me more about these
What does it mean for you
How do you go about it.

INDUSTRIAL DESIGN EDUCATION
Is there anything you would like to add re the education of industrial designers?
What
Why
How
Is there anything else you would like to add or ask?

THANK YOU
That was great. May I contact you again if I need to clarify anything with you?
Appendix 2: A Graduate’s individual journey

Intro to findings

This section views each individual graduate’s chronological employment journey and career decisions. This is separate from the themes that emerged that are detailed in chapter 4. I have done this because the journeys of individuals offer important insights into how individuals navigate their practice and the use of the AAD model.

Recap AAD

These career trajectories are examined through the use of the AAD model. The significance of the AAD model is that it highlights the real world impact of the mutability of industrial design on individual practitioners, and the career choices they make on their journey.

Adopters manage to cope with the uncertainties inherent in the profession of industrial design and maintain their connection to aspects of traditional industrial design.

The Adapters manage to cope with the uncertainties inherent in the traditional profession of industrial design by a combination of resilience and career diversification to develop new ways of practice.

Departers generally find the mutability of the profession outweighs their desire to stay but hold some connection to ‘design’.

The Adopter, Adapter, Departer (AAD) model assumes a similar position as a graduate finishes industrial design in Australia, that of an adopter, armed with the knowledge and skills to participate in the practice of DFM. I was also
interested to know where these graduates came from and what was their journey into university and industrial design.

Like the criteria for selection of respondents for the interviews there are varied aspects of an individual’s initial progress and process into industrial design. This background information was not known before the purposive sampling and selection of the interviewees.

**Introduction to Individual Characters (graduates)**

**Example summary of one of each of the AAD categories.**

**Kim 'Adopter’**

As one of the more recent graduates Kim came to industrial design after doing mainly science and maths at a regional school and initially “toying with the idea of doing architecture. And a family friend explained about industrial design and this sounded: “heaps cooler than Architecture” wanted to make use of her brain and to make things. There was a strong sense of social responsibility in Kim’s content that informs her practice as a she formed a view towards the end of the degree that there wasn’t necessarily many employment opportunities and nor did everyone want to design ‘kettles’.

Therefore “what are our other options for employment?” She felt she came from a relatively large graduating year and therefore that this would also impact on people’s ability to find work due to the increased competition. She did not want to have spend more time post graduation working as a ‘CAD monkey’ before being given the opportunity to become engaged in “higher level thinking about not necessarily products but using design as a problem-solving tool to address issues. And I guess another part of it was I had by that point had some sort of environmental, I guess ideals that I didn’t necessarily feel were going to be satisfied by making more ‘stuff’.
Kim did not enter an adoptive practice at all after leaving university. She was able to use some of her skills in an administrative situation in a large local organisation. After a short interstate stay she returned to Canberra and a contract with this same employer where her organisational, managerial and writing skills were being recognised. She travelled overseas for a short period and returned to a local position in a national urban planning company, a more design oriented position. A key element of her practice is her ability to communicate for and between profession types, liaising between graphic designers and engineers. As industrial designer she has an empathy and understanding of different professions.

Kim

...So that was based on a whole heap of input from engineers that don’t like talking to anyone, and then trying to get all of that into a format that the community could read through a graphic designer that has no idea what the content is about. [laughs] So being that go-between and having a bit of an understanding, like how a graphic design firm operates, having a little bit of understanding about the process of an engineer: I’ve no idea about what they’re talking about normally. But I guess being an intermediary because you have been involved in a whole lot of different things, because I think industrial design is a little bit like that: it gives you a lot of broad skills, like doing the graphics is really important. I think that’s very handy; photography is good, but mostly just because it’s interesting.

Kim’s practice is also based on her developed understanding of the context of industrial design and design thinking and design process. She realised and articulated that she had learnt about design process and how this could be used in a variety of situations and a user centred design approach and understanding.

Jane 'Adapter'

Jane had come to University of Canberra industrial design after having completed a degree in a related field (management). She completed a Sydney based secondary school education with an art and languages background. She came across the industrial design profession while working in manufacturing, having never heard of it prior to this. She was interested in pursuing
something more creative and industrial design seemed to match her interests including the idea of “making stuff”. She was also influenced by her previous travels to Europe where she met an industrial designer and this reinforced her desire to pursue industrial design. After graduating, Jane was quite methodical in her approach:

Jane

So as soon as I left Uni I moved back to Sydney where I’m from and then I wrote a top 5 list of companies that I wanted to work for, and I called them all up...."

She initially worked as an intern for a national major design consultancy which became a permanent position. A change of circumstance and new opportunity arose where her partner moved to Europe for a job. Jane moved to Europe and found work with a company that worked in the area of digital technology and fabrics. Again, there is a level of goal driven methodical approach to securing this job. After a year another opportunity arose from a contact of previous Australian employer who was seeking an industrial designer to work in a design consultancy she describes as old school “the engineers on one side, the designers on the other side”.

She was made redundant from this company after a year due to economic circumstances and what appears to be some issues of poor management. This design consultancy job did lead to experience in luggage design and she found work designing luggage for a leading retailer for approximately two and half years. This involved trips to China to check manufacturing processes and she says that she was exposed to industrial design in the way that I imagined it when I was in Australia.”

Jane then moved in to sports luggage for another two years and this is where the transition to the fashion aspects began. Another opportunity presented itself in fashion via trend forecasting:

Jane

And it was like a really, it felt like a really amazing opportunity so I took the job, and it was a bit, that was my hardest decision, was going from, going to
factories and working with product and actually designing stuff to go in to a job which I’m doing now where I’m not actually designing stuff. I am designing it to a point, to like the drawing stage and describing and like researching and doing all that stuff, but I’m not actually going to factories or anything like that.

She has been in this position for over three years at the time of interview but now includes freelance luggage design work in her practice to augment her creative outlet that is now less in this position.

**Geoff. 'Departer'**

Geoff came from a locally based secondary school education with a design and technology background. A family member suggested industrial design. After graduating he worked as a contract draftsperson for a short period, considered starting his own business. This is significant for Geoff as it reveals his earlier entrepreneurship thinking, but he was offered a position at a point of sale design company where he stayed for quite a few years. It is the culture and the varied and tangible nature of the job and organisation that seems to have kept him there for some years. He was not pigeon holed as a designer and found he was working with the engineers as well as production people.

But it was here that he made the transfer to ‘departer’. He became an accounts manager, he saw that is where you were able to meet the client and a better understanding of the running of the business. But he makes a strong claim to the connection with design and how this background influences his practice.

The company was downsizing so he was made redundant. He saw this as a good thing as it gave him the opportunity to develop his own consumable product aimed at a niche in the market at the time. This entrepreneurial aspect of his practice was support by his creative side and design approach including the personal psychology aspects to this successful business venture. Geoff educated himself in the area of business through the New Enterprise Incentive Scheme (NEIS). He uses his design approach in his current job as financial professional in the banking sector.
Geoff

“...that's then what I take to my current job that when I sit down with a client as opposed to I guess how many of my colleagues approach a client which is oh you’re Mrs A, B or C and this is what we do for you, I really, you know that’s probably one of my most favourite parts of the job is then I, I do get on a whiteboard after I've met with a client and just say well, you know and go through it myself and just structure things in different possible ways, so money can go here and da-da-da and yeah. And look I love that creative aspect of my job and if I didn’t have the creative aspect you know it wouldn’t be something I’d be doing. But, so yeah look, yeah that’s the thing I guess in the training we learnt that there are 100 different ways of doing something and you should always flesh out the 100 different ways of doing things before you settle on the one best way of doing it and so that’s just what I applied and everything I’ve done since I guess so yeah.”

Where did they come from?

As part of the interview, the graduates were first asked to tell the story of their journey through industrial design, including prior to industrial design at University of Canberra, what they did at school or what or who influenced them to do industrial design. This warm up question often revealed both differences and similarities about and between each of them.

There was a strong association within these graduates to initially study engineering or architecture as possible professions to follow before they decided on industrial design. Five considered architecture before deciding on industrial design. Three had considered industrial design and three had come from starting forms of engineering.

Seven came direct from school, three had completed some other form of education, a trade, a diploma and a degree. Two had commenced forms of engineering but transferred to industrial design. The illustrative quotations below demonstrate varied backgrounds and decisions regarding selecting industrial design as a course to study at university.

Students come to industrial design from all sorts of academic backgrounds. Some have done art at school, some design and technology some both, some neither. Some come directly from school others commenced or finished other qualifications. There are also different characteristics of student and graduate
attribute. Some have a more, what I would call ‘creative art approach’ to industrial design others come to it with a more engineering orientated approach.

In the period of this study, graduates from approximately 1995 -2005 the University of Canberra course has not used any form of portfolio or other means of assessing ‘design acumen’ other than the relevant ‘Australian Universities or UAC ranking or entrance mechanisms. Some other universities do use an additional selection mechanism to assess potential students.

_Aiden_

I was looking at trying to get into university, originally for architecture, but I had much more of an artistic bent than I ever did at mathematics and science bent or engineering bent, so I never really focused on those subjects at school. So I didn’t get a high enough TER to go into architecture and I thought industrial design was related. I’ll try it and then maybe more across and once I started the course.

_Geoff_

I would’ve been looking for an alternative which was the combination between engineering and an artist, and it was my Auntie that then said oh look at this industrial design thing, which I knew nothing about and looked into it and that’s when, then I applied for that. So I got offered a place at UC in Industrial Design the day before I started my cabinet making apprenticeship, three days of cabinet making apprenticeship and said no, this is not for me and then yeah started uni you know a month later or whatever it was and yeah, and loved it from there so it was my kind of journey into there, so. The balance between engineering and art I think.

_Scott_

Okay, yeah sure. So I, all through school I thought I was going to be a naval architect. I did all the techie subjects like maths and physics and engineering science etc, and I went straight into uni doing mechanical engineering...

Unlike some other professional applied courses, industrial design attracts students from a variety of scholarly backgrounds. For example, engineering, that can have some links with industrial design, attracts or requires students with a strong background and foundation in maths and sciences. Industrial
design in Canberra attracts students with a mix of secondary school subject material.

Some students come from a design and technology or art background at school, while others have come from a more mathematics and science base. Five graduates talked of their science and mathematics background in school and why this led to initially consider engineering. Four talked of art in school and one of these did both art and science/mathematics. Three engaged in a design and technology program.

This would be similar for architecture but traditionally this has more of a mathematics focus or perception that it is necessary. Of course engineering does have a very strong mathematics and science genesis and students are generally not accepted at university without this background. For industrial design it is a mixed bag of school backgrounds of art, design and technology, mathematics and science.

This reinforces the very varied nature of industrial design, industrial design practice and no doubt influences peoples ways negotiation of their own practice.

This mixed nature of industrial design can also be seen to influence where industrial design resides in an educational institution. Even in Australia Industrial design courses sit in a variety of organisational structures or affiliations such as within Art departments, schools of Architecture and Engineering and in more recent times industrial design has affiliations with Marketing, management, business schools and the humanities. All these locations are possible and work because of the breadth of industrial design in the product development process. Where students may be taught/engaged in front end aspects of marketing and problem identification through to the detailed specification or CAD files and materials and processes.

The University of Canberra does not or did not use a portfolio component to enter industrial design so those that had no design folio were not disadvantaged. They were accepted based on academic performance alone.
Post-graduation, where the graduates went

I initially mapped out each graduate’s career journey and trajectory based on a review of their interview to visualise the various steps in their path. I re-read the interviews and wrote a summary of each journey highlighting the relevant components of the practice.

Figure A  Example of mapped path of graduates career points.
Five came from regional NSW and another from regional Victoria: Lucy, Kim, Todd, Nigel and Paul. Three were from Sydney Scott, Jane, Aiden; four from Canberra: Charles, Fiona Ted and Geoff. Seven came on to university directly from school. One had done a trade first (Paul), and Todd and Scott had commenced engineering at different universities before making the decision to change to industrial design, while Jane had completed a prior degree and Charles had done a related diploma. At the time of the interviews four worked in Canberra, three in Sydney, two in Melbourne (five nationally). Three participants were international, based overseas in either North America or Europe.

Figure B Graduate geographical pathways
Only one who was originally from Canberra is now working in Canberra. Of the other three original Canberra people, one is based internationally, one in Melbourne and the other Sydney. The other three now in Canberra come for regional NSW. One original Sydney person is back in Sydney, the other two are international. See Figure C.

The above is a representation that University of Canberra industrial design does not only attract students from the ACT and nearby NSW areas of Queanbeyan. The regional NSW graduates here came from places at least 200kms away. Interesting to note that three of the regional NSW graduates now work in the ACT.

**Graduate timeline diagram**

![Graduate timeline diagram](image)

*Figure C: Graduate timelines*
Range of jobs

The 12 graduates interviewed have had a variety of positions or types of work over a five to ten year period of the mid 1990’s to the mid 2000’s. A total of approximately 25 different areas, covering and demonstrating the breadth of practice that these industrial designer graduates have been placed. Within some of these there are further subsections of types of work from concept development and “CAD monkey” to project management within a design development process.

This can be seen as a problem or opportunity (2009; Trathen and Varadarajan 2009a). Is such diversity due to a lack of work in traditional industrial design areas of employment or a personal choice to work in these other fields?

Some graduates mentioned friends that work in these other fields such as furniture, sporting goods and clothing, including:

- Running their own Design Consultancy
- Developing their own designs
- Working for Design Consultancy
- Design and manufacture companies
- User interface
- User experience
- Branding
- 3D animation
- Government policy development
- Private firm urban planning research
- Point of sale
- Signage
- Management
- Business manager
- Financial
- Luggage design
- Trend forecasting
- Specialist design and engineering
- Teaching/uni
- Exhibition
- Independent own design work: furniture, jewellery
- Jewellery
- Home wares
- Marketing
- Model making
These positions also encompass a number of the skills obtained through an industrial design education

- Knowledge used
- Sketching
- Computer. CAD
- Adobe suite type
- Writing ability
- Design thinking
- Design process and approach
- Problem solving

Between them they have worked in various geographical locations nationally and internationally in Asia, the Middle East, Europe, UK and Scandinavia and North America.