Informing an Integrated and Sustainable Urbanism through Rapid, Defragmented Analysis and Design.

Volume 1
Preface – Chapter 5

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Preface

Research Program:
This thesis has been conducted as part of the Embedded Research Program with SIAL RMIT University with participating urban design practice McGauran Giannini Soon (MGS). The research is supported by an Australian Research Council Linkage Research Grant under the supervision of Professor Mark Burry.

The interview and focus group component of this research has been conducted with ethics approval granted by the RMIT University Human Research Ethics Sub-Committee (Human Research Ethics Application – Register Number HREC A-095-07/07).

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**Publications:**
Parts of this research have been published as well as presented at various international conferences throughout the duration of the candidature. See Appendix 10.15 *Publications and Awards* and 10.16 *National and International Conferences and Exhibitions*.

**Declaration**
I, the candidate, Marcus White hereby declare the following:
Except where due acknowledgement has been made, the work is that of the candidate alone. 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. The work has not been submitted previously, in whole or in part, to qualify for any academic award. Any editorial work, paid or unpaid, carried out by a third party is acknowledged. Ethics procedures and guidelines have been followed.

Marcus White
Abstract

Urban design has splintered into increasingly narrow specialist disciplines since the mid Twentieth Century. Traffic engineers, statutory planners, civil engineers, landscape architects and architects each make specific but isolated contributions to urban design frameworks. Each consultant documents their position predominantly through text and two dimensional representations, occasionally with specious perspective images produced by a hand rendering specialist.

This fragmented and sequential design approach inadequately addresses contemporary urban agendas, practice constraints or the potential of digital design techniques, particularly in light of increasing fears of an imminent environmental crisis and peak oil, and concerns for health, amenity and accommodating an increasingly urbanised population.

The aim of my thesis is to identify and address disparities between contemporary urban design practice and society’s prevailing urban agendas for integrated and sustainable cities. The hypothesis tested by my thesis is that the gulf between prevailing urban agendas of society and urban design can be reduced by developing a ‘defragmented’ design approach that uses rapid, parametric, four-dimensional, digital analysis and design techniques, which build upon software commonly available within the industry.

This hypothesis has been tested in four ways: firstly through the analysis of urban agendas, design techniques and urban design paradigms, in both historic and contemporary contexts; secondly by identifying currently available technologies with the potential for adaptation and customisation; thirdly by development of new digital techniques; and finally by testing this defragmented approach on both simplified models and various case studies within an urban design practice as part of the embedded research program¹. Techniques I have developed and tested as part of the approach fit into four categories: firstly pedestrian connectivity – walkability and accessibility; secondly daylight amenity assessment; thirdly visual impact analysis assessing urban form visualisation, generation and composition; and finally feasibility modelling, including linked data yield analysis. I have evaluated the success of the approach in these studies with regard to practice constraints (time and budget) and contemporary society’s prevailing urban agendas.

¹ This thesis has been conducted as part of the RMIT SIAL Embedded Research within Architectural Practice, for more information see Appendix 10.1.
My rapid, defragmented design approach has resulted in new techniques shown to be used quickly and concurrently ‘in-house’ contributing to the urban design process, whilst meeting fee budgets and project deadlines. I have demonstrated that issues that are currently difficult to solve using the constraints of conventional planning techniques can be addressed more effectively than they are currently, whilst avoiding the considerable expense of specialised hardware/software or the appointment of additional consultants.

My thesis concludes that the rapid, defragmented approach can demonstrably yield more synergistic urban design responses. The inherently flexible approach can be tailored for a myriad of different urban design scenarios, as well as potentially other disciplines. The defragmented approach can expand the realm of urban designers and increase their contribution in the generation and advocacy of sustainable planning policy and reduce the disparities between contemporary urban design practice and society’s need for integrated and sustainable cities.
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

Accompanying Colour Plates CD
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Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>2D</td>
<td>Two dimensional</td>
</tr>
<tr>
<td>3D</td>
<td>Three dimensional</td>
</tr>
<tr>
<td>4D</td>
<td>Four dimensional (Three dimensional with the additional dimension of time)</td>
</tr>
<tr>
<td>AI</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>BIM</td>
<td>Building Information Modelling</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer Aided Drafting or Computer Aided Design</td>
</tr>
<tr>
<td>CFD</td>
<td>Computational Fluid Dynamics</td>
</tr>
<tr>
<td>CIAM</td>
<td>Congrès International d’Architecture Moderne (International Congress of Modern Architecture)</td>
</tr>
<tr>
<td>CSIRO</td>
<td>Commonwealth Scientific and Industrial Research Organisation</td>
</tr>
<tr>
<td>DDO</td>
<td>Design And Development Overlay</td>
</tr>
<tr>
<td>DDS</td>
<td>Density Distribution Surface</td>
</tr>
<tr>
<td>DOI</td>
<td>Department of Infrastructure</td>
</tr>
<tr>
<td>DSE</td>
<td>Department of Sustainable Environment</td>
</tr>
<tr>
<td>GFA</td>
<td>Gross Floor Area</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographical Information System</td>
</tr>
<tr>
<td>HAW</td>
<td>Harrison and White Pty. Ltd. See <a href="http://www.haw.com.au">www.haw.com.au</a></td>
</tr>
<tr>
<td>IFHP</td>
<td>International Federation for Housing and Planning</td>
</tr>
<tr>
<td>LEED</td>
<td>The Leadership in Energy and Environmental Design, Green Building Rating System, developed by the U.S. Green Building Council (USGBC)</td>
</tr>
<tr>
<td>M2030</td>
<td>Melbourne 2030 Planning for Sustainable Growth</td>
</tr>
<tr>
<td>MAX</td>
<td>Autodesk™, 3D Studio Max™</td>
</tr>
<tr>
<td>MGS</td>
<td>McGauran Giannini Soon, see <a href="http://www.mgsarchitects.com.au">www.mgsarchitects.com.au</a></td>
</tr>
<tr>
<td>MRA</td>
<td>multi regression analysis</td>
</tr>
<tr>
<td>NLA</td>
<td>Net Lettable Areas</td>
</tr>
<tr>
<td>OAPEC</td>
<td>Organization of Arab Petroleum Exporting Countries</td>
</tr>
<tr>
<td>OOH</td>
<td>Office of Housing Victoria, Australia, see <a href="http://www.housing.vic.gov.au">www.housing.vic.gov.au</a></td>
</tr>
<tr>
<td>OMA</td>
<td>Office of Metropolitan Architecture</td>
</tr>
<tr>
<td>PCA</td>
<td>Pedestrian Catchment Area</td>
</tr>
<tr>
<td>POD</td>
<td>Pedestrian Oriented Development</td>
</tr>
<tr>
<td>PPP</td>
<td>Public, private partnership</td>
</tr>
<tr>
<td>PRD</td>
<td>Pedestrian Route Directness</td>
</tr>
<tr>
<td>QS</td>
<td>Quantity Surveyor</td>
</tr>
<tr>
<td>RAIA</td>
<td>Royal Australian Institute of Architects</td>
</tr>
<tr>
<td>ResCode</td>
<td>Residential Code of Victoria</td>
</tr>
<tr>
<td>SAD</td>
<td>Survey Analysis Design</td>
</tr>
<tr>
<td>SBO</td>
<td>Special Building Overlay</td>
</tr>
<tr>
<td>SDR</td>
<td>Sustainable Development Research</td>
</tr>
<tr>
<td>SOS</td>
<td>Save Our Suburbs</td>
</tr>
<tr>
<td>SVF</td>
<td>Sky View Factor</td>
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<tr>
<td>TOD</td>
<td>Transport Oriented Development</td>
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<tr>
<td>USGBC</td>
<td>United States Green Building Council</td>
</tr>
<tr>
<td>VCAT</td>
<td>Victorian Civil and Administrative Tribunal</td>
</tr>
<tr>
<td>VGA</td>
<td>Visibility Graph Analysis</td>
</tr>
<tr>
<td>WSSD</td>
<td>World Summit on Sustainable Development</td>
</tr>
<tr>
<td>WCED</td>
<td>World Commission on Environment and Development (Brundtland Commission)</td>
</tr>
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</table>
Chapter 1. Introduction

1.1 Problem Statement

Climate change is now an almost universally accepted\(^1\) phenomenon (Hough 2008 p.157) with an ever increasing ‘mass of scientific evidence’ (Hamilton 2007 p.127) supporting a need to address climate change immediately, locally and globally. According to the Stern Report, ‘climate change poses a real threat to the developing world’ (2006 p.92). Kevin Rudd, then the leader of the Australian Federal Opposition stated, that ‘Climate change is already a reality – an undeniable reality’ (Rudd 2007 p.1). It is ‘one of the biggest challenges we face’ (Rudd 2007 p.1).

There is a clear link between climate change and the form of our cities (Kerton 2004 pp.8, 9). The energy consumption of buildings\(^2\) and transportation are major contributors of CO\(_2\) emissions, which make them major contributors to climate change (Garnaut 2007 pp.2, 3). Our cities are accommodating a rapidly increasing population\(^3\) with uncoordinated lateral expansion or ‘sprawl’ that is believed to be unsustainable (Batty et al. 2003; Kunstler 2006; Montague, 2006).

\(\text{Sprawl is perhaps the major problem facing urban planning at the beginning of the 21st century.}\)
\(\text{It encapsulates the key problem of urban transportation which revolves around the emphasis on the car as the dominant means of movement (Batty et al. 2003 p.11).}\)

Although there is currently an abundance of research being conducted by academics and practitioners into the impact of the built environment on climate change, referred to as ‘sustainable development research’\(^4\) (SDR), it is often limited to the micro level of individual buildings and materials or the macro level of data-based regional planning. Sustainable development research that has or is being conducted in the ‘in between scale’ of urban design is lacking in one or more of the following areas: it does not address the cultural aspect of sustainable development; it relies heavily on expensive specialist consultants; is technology-focused without inclusion of cultural aspirations, or is stifled by a strong nostalgic emphasis on revisionist aesthetics. As I will discuss in Chapter 4, in current theory and practice there is an

\(^{1}\) There are a number of interest groups such as the ‘Advancement of Sound Science Coalition’ who have labelled climate change as ‘junk science’, though it has been suggested that this is influenced by the funding from Exxon and other oil companies (Hamilton 2007 p.129).

\(^{2}\) According to an American non-profit organization called Architecture 2030, founded by architect Edward Mazria in 2002, www.architecture2030.org, buildings are responsible for almost half (48%) of all greenhouse gas emissions annually in the USA.

\(^{3}\) According to the Melbourne 2030 Planning for Sustainable Growth document, Melbourne’s population is forecast to increase by one million by the year 2030 (DOI 2002 pp.ii,14,28).

\(^{4}\) The meaning of this term will be defined in more detail in later sections.
absence of design techniques that embrace contemporary architectural discourse, contemporary culture, digital technology and feasible design approaches aimed towards sustainability.

1.2 Research Aim

The aim of my thesis is to identify and address disparities between current urban design practice and contemporary society’s prevailing urban agenda for integrated and sustainable cities. The way in which I have set out to achieve this aim is explained in Sections 2.4 and 2.5.

1.3 Research Stance

The stance I have taken as a researcher in the field of sustainability research is that of an active architectural practitioner with faith in the architectural profession’s ability to make a positive social, environmental, economic and cultural contribution to the design of cities through developing a holistic understanding of the multi-faceted nature of the built environment. My reading of ‘sustainable development’ acknowledges the three ‘interdependent and mutually reinforcing pillars of sustainable development: economic sustainability, social sustainability and environmental sustainability’, set out at the 2002 World Summit on Sustainable Development (WSSD 2002 p.79) but includes an additional forth pillar – cultural sustainability. This additional pillar involves cultural aspects of contemporary architectural discourse on aesthetics and formal composition informing development. I subscribe to Camillo Sitte’s concept of artistic urban principles, but of a contemporary artistic interpretation – not aesthetic revisionism.

The other stance I am taking, informed by the findings of Chapter 4, is that sustainable urbanism requires increased density that is well located (transport oriented development) and well connected, which makes sense financially and minimises the loss of amenity, particularly in the public realm. My findings in Chapter 4 suggest that resistance to increased density is often based on prejudice or greed, whether it is conscious or subconscious, and that the arguments against density must be countered in a more sophisticated manner in order to expose underlying and unspoken agendas.

My thesis has been conducted in Melbourne, Australia. Melbourne is the capital of the state of Victoria, which has a population of around four million, a number that’s expected to increase to five million within the next 20 years (DOI 2002 p.14). The Greater Melbourne area has a relatively low population density and has been expanding rapidly in area since the end of WWII.
Melbourne has a comparatively high per capita energy use and is therefore one of the biggest contributors to greenhouse gas emissions per capita in the world (Kenworthy 2003 p.17).

I have drawn upon over 10 years of architectural practice experience, in which I have had the opportunity to work in a number of Melbourne practices on a broad range of projects, from individual house to master planning commercial precincts to performing the roll of project architect for a $90 million mixed use tower development in the Melbourne Docklands. In this experience I have learnt to work within the financially frugal realities of practice, and have come to appreciate the potential for maintaining design quality by continually developing my understanding of the potential of digital design technology. This professional development has involved me taking on responsibilities that might normally be reserved for a computer manager, and developing digital techniques that might be considered in the realm of software engineer.

I have also developed an understanding of working within planning policy and design frameworks, which I have often found to be illogical, unnecessarily vague or based on archaic methods of measurement. For this reason I have chosen to conduct a considerable part of my research within the prominent architecture and urban design practice, McGauran Giannini Soon (MGS). I chose the practice of MGS due to its design involvement in the implementation of urban consolidation strategies in the area of Greater Melbourne and because the practice expressed a desire to extend their repertoire of digital design techniques.

As I explain in later chapters, my research has been conducted under the assumption that sustainable development research cannot be tackled in a traditional ‘pure research’ manner and is not necessarily singular or elegant, and needs to take on board many facets and juxtapose many seemingly ill fitting ideas. It should not be hindered by 20th century limitations of specialist research or practice disciplines and should heed the advice of Lazarus Long:

>A human being should be able to change a diaper, plan an invasion, butcher a hog, conn a ship, design a building, write a sonnet, balance accounts, build a wall, set a bone, comfort the dying, take orders, give orders, cooperate, act alone, solve equations, analyse a new problem, pitch manure, program a computer, cook a tasty meal, fight efficiently, die gallantly. Specialization is for insects. (Heinlein, 1972 p.248)

1 ‘Pure research’ otherwise known as ‘basic research’ or ‘academic research’, is research carried out without the direct aim of producing knowledge that is immediately applicable to industry, or to have direct commercial applications, (www.lbl.gov/Education/ELSI/research-main).

2 Lazarus Long is the main character in Robert Heinlein’s 1970s science fiction classic, Notebooks of Lazarus Long, Time Enough for Love (1972).
1.4 Scope of Research

I will now define the scope and limitations of this study. As I discuss in later chapters, the field of sustainable development research is broad and necessarily touches on many different research disciplines. In this section I outline the extent of the broader scope my research, the specific areas I focus on in more detail and the areas that have been excluded from the research.

**Broad Scope**

The research comprises an evaluation of prevailing contemporary urban design paradigms, and assesses each of them for their relevance and appropriateness in relation to my research aim. I have considered these different urban design paradigms, their associated design techniques, and utilisation of emerging technologies. I have explored where these paradigms and their techniques sit within a selective urban design history. I have looked at key problems of the fragmented nature of consulting and design disciplines, and how this fragmentation hinders sustainable development. I have superficially touched on the cross-over of urban design and sustainable development with other disciplines such as landscape architecture, geospatial sciences, civil engineering, traffic engineering, pedestrian analysis and lighting engineering.

**Focus**

I have focused on the planning and urban design context of Melbourne, Victoria Australia in the first decades of the 21st century. My research relates particularly to key agendas in the Victorian state government’s planning policy document *Melbourne 2030 Planning for Sustainable Growth* (DOI 2002) and develops an approach and design techniques directed towards the sustainable urbanism aspects of this document. I have conducted my research predominantly within the specific context of urban design practice in Melbourne, which I explain in greater detail in Section 2.3 of Chapter 2.

**Exclusions**

The practice-oriented nature of my research set a number of practical constraints. Researching predominantly within practice set boundaries, such as time and budget restrictions, but also directed the research towards utilising and building upon existing practice capabilities and technologies. It is not my intention that the research abstracts the issues beyond architecture and urban design practice.

My research touches on software useability, but this is not a major priority as flexibility and adaptability of techniques are of primary importance. I have drawn on developments in parametric modelling and building information modelling (BIM), and geographic information systems (GIS), as well as high-end engineering software, but due to financial constraints in practice, I have predominately used software commonly available within an architectural office.
The issues of climate change and sustainability need to be addressed from many angles and there are many equally valid approaches that I have not investigated due to my urban design practice focus. I have not looked at complex data modelling, ‘sustainability indicators’, LEED rating systems, or long term economic/environmental modelling systems such as ‘Sustainomics’\(^1\). I have not looked at alternative fuels, power stations sizes and locations (Co-Generation)\(^2\), or the problems of co-operation in governmental structures – federal, state and local.

Though my research touches on real-time simulation, the research did not attempt to include community ‘participatory design’. Instead, I looked at techniques that could be used to inform the work done by urban designers and further develop the advocacy of that work.

I have gauged industry interest in the direction of the research though the superficial use of focus groups and have touched on some social science aspects, but, due to my lack of expertise in this field of research, my thesis did not set out to be an in-depth ethnographical analysis of human responses to representation techniques. My research utilised architectural staff, who indicated the usefulness of the techniques within practice, but did not set out to be an empirical study on software usability, nor did it set out to map staff members’ potential to change their working habits/methods. I have considered the application of customised software particularly ‘user customisation’ by writing my own simple code, touching on computer programming, but have limited the depth of this investigation to the level of a ‘high-end user’ rather than that of a computer programmer.

The reality of practice-based research forced engagement with some economics, finance and marketing as well as construction and project management fields, but this thesis limits the economics discussion to that which is directly related to the scope or potential scope of urban designers.

### 1.5 Thesis Overview

In this chapter I have stated the problem as one centred on climate change and sustainability along with other contributing problems. I have stated the research aim as attempting to address disparities between current urban design practice and contemporary society’s prevailing urban

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1 For an explanation of the system of Sustainomics, see the work of Prof. Mohan Munasinghe, www.mindlanka.org/sustainomic.htm  
agendas. The scope of my research and research field were explained, defining the key term *sustainable urbanism* in the context of this thesis.

This thesis is roughly divided into two bodies of research, firstly the pure research body, which is history and theory focused, and secondly the applied research body, which is more active, participatory and practice focused. I use the term ‘roughly’ as it is not my intention to separate basic and applied research, as in the context of sustainability research I feel it is neither possible nor desirable to do so.

In Chapter 2, I explain the method for both the pure research\(^1\) and the applied research\(^2\) body of the thesis. The chapter is broken into four main sections. The first section states the hypothesis. The second section elaborates on how research within practice has been used to constrain the research. The third section gives an explanation of the method used for the pure research element of the thesis, and finally I outline the applied research method, explaining my new design approach, the principles for analysis, the types of experimentation, verification and validation.

Chapter 3, Chapter 4 and Chapter 5 make up the pure research element of my thesis. In these chapters I set out the intellectual framework and background to my research. In Chapter 3, I give background, locating this investigation in the context of urban design history with a discussion about the relationship between three facets of urbanism: society’s prevailing urban agendas, urban design paradigms and design techniques. I isolate and discuss key themes throughout history – moments when changes in urban agendas and changes in representation technologies (design techniques) affected the direction of urban design paradigms.

In Chapter 4, I elaborate on the relationship of the *three facets of urbanism* in a contemporary context. I explore the changes in the relationship between these three facets and identify areas where important social needs are not being addressed adequately by urban design paradigms and design techniques. This is done in three ways: firstly by identifying key urban agendas of contemporary society and the concept of sustainability; secondly by critically reviewing contemporary urban design paradigms and their use of emerging design techniques; and thirdly, by gauging where the symbiotic relationship between the three facets has broken down.

\(^1\) The term ‘pure research’, sometimes called ‘basic research’ or ‘fundamental research’, for this thesis refers to the abstract literature based research conducted outside of practice with no obvious immediate practical application.

\(^2\) The term ‘applied research’ refers to that which has been conducted in practice aimed at specific practice projects or problems.
In Chapter 5, I look at the local planning approach adopted in Melbourne, Australia in light of global society’s prevailing urban agendas, urban design paradigms and design techniques discussed in the prior two chapters.

In Chapter 6, I begin the *applied research* body of the thesis. I cover the process of developing techniques that are part of my new design approach. This chapter is divided into four main sections: *Pedestrian Connectivity: Walkability and Accessibility, Daylight Amenity Assessment, Visual Impact - Urban form: Visualisation; Generation; Composition*, and finally *Feasibility Modelling / Yield Analysis Techniques*. Each of these sections explains a number of design techniques developed in response to specific urban agendas described in Chapter 4 as well as local planning documents. The techniques are explored through simple limited variable models as well as targeted case studies. The success of techniques is then discussed in terms of speed, accuracy and effectiveness.

Chapter 7 includes three ‘defragmented’ case studies. In this chapter I discuss projects where I have applied my ‘rapid, defragmented design approach’ by simultaneously utilising various techniques described in Chapter 6.

In Chapter 8 *Discussion and Conclusion*, I summarise my research findings and acknowledge the limitations of the study, I then draw conclusions from the study and make recommendations for further research.

### 1.6 Terminology Used Throughout My Thesis

Before moving on to explain my hypothesis and the method for testing this hypothesis, I will elaborate on some of the key terms that are used and define them in the context of the thesis. This is important as some of the key words have multiple readings, and some have been used so much that they have almost lost meaning.

**Integrated**

The term integrated has dual meanings for this thesis. Firstly ‘to make part of a larger unit’ ([American Heritage Dictionary 2008](#)); urban proposals should not ignore the surroundings but acknowledge context and become a part of the larger unit, and secondly, to ‘admit a racial or ethnic group to equal membership in an institution or society’ ([American Heritage Dictionary 2008](#)). If new buildings that are part of urban consolidation are seen as ‘foreign’ to the ‘neighbourhood character’, or the occupants of the new buildings are immigrants, tolerance to the foreign must be shown, allowing the building and its occupants to be seen as equal, not discriminated against.
**Sustainable Urbanism**

My thesis sits alongside contemporary research on *sustainable urbanism*, which is a subset of what is commonly referred to in both popular and professional literature as *sustainable development*. The rapidly emerging field of sustainable development research is becoming increasingly significant (Bedall, et al. 2005 p.22). The two terms, *sustainable urbanism* and *sustainable development* are largely interchangeable for the purposes of this research, but *sustainable urbanism* will be the key term used throughout this thesis.

I will now look at the two words within this term. Firstly the word *urbanism* is both an abstract and concrete noun used to describe the conceptual and physical characteristics of a town or city. It is derived from *urban* which in turn comes from the Latin origin *urbanus*, from *urbs* ‘city’. (Concise Oxford Dictionary 2008).

Ildefons Cerdà coined the term *urbanism* in his 1867 manifesto *Teoría General de la Urbanización* [General Theory of Urbanization] (Rippon 2005 pp.5, 6, 7). As I discuss further in later chapters, Cerdà proscribed building heights, a direct relationship between streets and buildings, urban morphology with urban amenities such as light and air. I consider all of these to be essential components of a working definition of urbanism, and the focus of the work done by an urban designer. In terms of scale, the work of the urban designer falls somewhere between that of a regional planner and that of an architect. This ‘in-between’ scale of design brings with it the difficult position of impacting on both regional planning and architectural development.

The term *sustainability* is a derivative noun from *sustainable* – able to be sustained, or (of industry, development, or agriculture) avoiding depletion of natural resources. (Concise Oxford Dictionary).

Much has been written on sustainability particularly over the last 10 years with a number of different and sometimes contradictory definitions (Rashed-Ali 2007 p.2, 3). In the context of this

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1 According to the proceedings summary of the 2007 Texas A&M University international conference ‘Squaring Off: A New Paradigm in Urban Change’. The proceedings of the conference distributed via CD are promised to be located at www.capso.tamu.edu/sustainable-urbanism/ in the latter half of 2008.

2 The Catalan urban planner who designed the 1859 ‘extension’ of Barcelona (*Eixample* in Catalan) who’s work will be discussed in later chapters.
thesis, I will use the expanded meaning for the term sustainable development set out by the Brundtland Commission:\footnote{The Brundtland Commission, named after its Chair Gro Harlem Brundtland, was convened by the United Nations in 1983, originally called the World Commission on Environment and Development (WCED).}

\begin{quote}
[Sustainable development] meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED 1983 p.24).
\end{quote}

This definition however, is still open to interpretation. The word ‘needs’ could be up for some debate, though the report does refer to ‘the essential needs of the world’s poor, to which overriding priority should be given’ (WCED 1983 p.54). This definition stresses issues of social equity (Rashed-Ali 2007 p.3) and could be seen as ‘social-centric’. There are more ‘eco-centric’ definitions that put emphasis on ecological diversity stating that sustainable development is ‘one that improves the quality of human life while living within the carrying capacity of supporting eco-systems’, World Conservation Union (IUCN, 1991 p.228). There is also the view that there needs to be a balance of social and environmental issues with economics. The 2005 World Summit on Sustainable Development (WSSD) outcome documents reaffirmed the three interdependent and mutually reinforcing pillars of sustainable development as economic sustainability, social sustainability and environmental sustainability as set out at the WSSD held 2002 in Johannesburg, South Africa (WSSD 2002 p.80) (see Figure 1).

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{figure1.png}
\caption{Three mutually reinforcing pillars of sustainable development. Commonly used diagram by Johann Dréo 2006.}
\end{figure}

In addition to these three principles, there is also the cultural aspect (UDAL QLD 2003 p.7) that I feel should also be considered to ensure longevity of development.

\begin{quote}
Sustainability is multi-faceted – cultural sustainability creates conditions for cultural expression and development. It nurtures and supports a variety of cultural heritage and contemporary practice (UDAL QLD 2003 p.7).
\end{quote}
When most architects consider the Vitruvian trilogy\(^1\) ‘sustainability falls into the firmness and commodity categories, neither of which precludes delight’ (Sorkin 2005), therefore it is important that the social and environmental aspects recognise cultural (including visual composition) sustainability. Delight is an essential ingredient of sustainability.

The three (or four) pillars suggest that a broad, multi-pronged approach to the problem of sustainable urbanism is needed. Initially, the pillars imply that the study of sustainable development requires input from environmental scientists, economists and social scientists. However, as I will discuss in later chapters, the scope of these three pillars should reach beyond these disciplines. Sustainable development research necessarily engages with disciplines and research fields including but not limited to: architecture and design; art; planning; statutory planning; building services engineering; landscape architecture; motion picture special effects; economics; finance and marketing; construction and project management; civil engineering; computer science; information technology; health sciences; infrastructure; geospatial sciences.

The various disciplines, with their different approaches and perspectives, may give emphasis to different aspects of sustainability; what matters, however, is the multi-faceted picture emerging from the perspectives of several disciplines and involving not only the natural and social sciences, which so far have been in the forefront, but also the humanistic sciences (Stokke 1991 p.9).

**Informing**

Informing: (of a judgment), based on a sound understanding of the facts (Concise Oxford Dictionary). As I argue in the later chapters, urban design decisions are often based on prejudice, intuition or overly abstracted modelling, not necessarily based on ‘a sound understanding of the facts’. This is a key concept throughout the second half of my thesis, where an attempt is made to improve understanding of urban design problems by developing new digital design techniques.

**Rapid**

This word simply refers to the speed at which design and analysis responses are required in today’s practice. There is not the time to use inefficient design techniques; there is not the budget or the billable hours available for a week-long solar analysis study; there is rarely the time frame for in-depth consultant feedback for multiple different design iterations.

**Fragmented (into Specialist Disciplines)**

Fragment: ‘to break into pieces; cause to disintegrate’ (Random House Dictionary 2006).

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\(^1\) The Vitruvian trilogy refers to Roman architect Marcus Vitruvius Pollio, whose seminal document *De architectura*, now referred to as *The Ten Books on Architecture*, describes the aspects of architecture: firmness, commodity and delight.
The slow erosion or ‘fragmentation’ (Conklin 2006 p.12) of the role of the architect over the last century has been necessary as the level of complexity of the built environment has increased beyond the scope of what an architect could reasonably ‘puzzle over’ (Jacobs 1961 p.50). No one discipline could have control over all aspects of design so specialist fragments of the master builder role were inevitable (Neuman 1998 p.211, Piotrowski & Robinson 2001 p.92).

Before the splintering of disciplines into separate specialist areas, the Master Builder was the architect (Arnold 2002 p.52), the planner, the hydraulics engineer, the structural engineer, and the site foreman (Moffett et al. 2003 p.262). The first known architect was the Egyptian, Imhotep, a multi-disciplinary consultant who, along with being a practicing physician and poet, was both the architect and structural engineer of the first pyramid and first columns (Wilkinson 1971 pp.32-36).

Like Imhotep, the Roman architect Marcus Vitruvius also worked in a multi-disciplinary manner. In The Ten Books on Architecture, he stated: ‘Architecture is a science, arising out of many other sciences, and adorned with much and varied learning: by the help of which a judgment is formed of those works which are the result of other arts… [an] architect should be well versed in other fields of learning such as music and astronomy’ (Rowland & Howe (Vitruvius) 1999 p.8).

Since the Renaissance architecture theory and practice has fragmented (Benovolo 1993 p.101-104) and since the industrial revolution the practice of the architect has also fragmented into various specialisations (Piotrowski & Robinson 2001 p.205). The architecture and urban design process followed the Fordist production line methodology, adopting a linear process broken up into specialist parts leading to more efficiency.¹

Then there’s the challenge to the professionals – the architects, planners, designers, engineers, builders, utility representatives, city and county housing officials, and others engaged on the front line of building and reshaping communities. Historically -- and often, still today -- they have worked sequentially, first doing the land planning, then the underground pipes, then roadways and buildings and so on (Peirce 2006, ‘Terminal consumption’ section).

After World War II, national planning in the US ‘opted for replicable programs and contributed to the specialization of planning’. These programs ‘ensured the ascendancy of specialists and the fall of the generalists’ (Neuman 1998 p.211), despite significant criticism from American critic Jane Jacobs (1961 p.440) and Scottish landscape architect and writer Ian McHarg (1969 p.121).

¹ Architecture and engineering were split into disciplines from around 1700 and followed by further fragmentation over the next 300 years (Wilkinson 1971 p.35).
There appeared separate programs for clean air, clean water, endangered species, coasts, flood zones, waste, etcetera… As planning became segmented into sub-disciplines, working on housing, transport, urban design, land-use, environment, community development, economic development became separated. Specialists carved out niches, generated jargon, and ventured little past the walls they had erected (Neuman 1998 p.211).

In the 1960s American planner and writer Jane Jacobs saw problems with this fragmentation of the professions and the way in which analysis and design were performed in isolation.

Objects in cities – whether they are buildings, streets, parks, districts, landmarks, or anything else – can have radically differing effects, depending upon the circumstances and contexts in which they exist. Thus, for instance, almost nothing useful can be understood or can be done about improving city dwellings if these are considered in the abstract… (Jacobs 1961 p.440).

Jacobs suggested that the ‘kind of problem architecture is’ (Jacobs 1961 p.14), is one that should be seen as a dilemma organised complexity not as simple single or double variable analysis problems. She believed that the new scientific methods for large scale statistical analysis mean that:

…puzzles that once appeared un-analysable become more susceptible to attack. What is more, the very natures of some puzzles are no longer what they once seemed (Jacobs 1961 p.429).

Her position was expanded nearly a decade later with German-born urban design theorist Horst Rittel, who described urban design as a ‘wicked problem’ where there are so many variables with no definitive definitions for the problems, no right or wrong answers, and solutions were impossible to conclusively prove or disprove (Rittel & Webber 1973 pp.155-169).

After the ‘streamlining’ of the urban design process, the time frame of design was consequently compressed to shorter periods (Lyon 2008). The expectation of speed of delivery by the market caught up (and in some cases passed) the ability of the fragmented teams to produce design (Lyon 2008).

At the same time as the market was pushing for shorter design times, the design problems were becoming more complex. In the design industry in the late 80s computer aided design (CAD) hastened the speed of design (Muroyama & Stever 1988 p.70), and particularly design coordination amongst the discipline fragments (Muroyama & Stever 1988 p.71). This has allowed the fragmented disciplines to work with some overlap; though the process remains relatively
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

In a smart 21st century, that won’t do. It costs too much and it misses opportunities for better aesthetics, energy efficiency, and quality of life. The time’s at hand to move from silos to systems. It’s the right moment to ask the professionals to start thinking more broadly, to work closely with colleagues from the other disciplines from start to end of any project (Peirce 2006, ‘Terminal Consumption’ section).

Defragmented

The term ‘defragment’ is a neologism that surfaced in the mid 70s but became more readily used when Microsoft™ Windows NT Version 4™ was released (1996) with in-built computer optimisation software Diskeeper™ which included ‘Disk Defragmenter’. The defragmentation process looks at the whole of the computers hard drive and reorganises the small fragments of data into more efficient contiguous parcels, this minimises disk head movements (seeks), which in turn makes the computer run ‘faster and better’.

In the context of my thesis, the parts to be ‘defragmented’ are taken to be the different disciplines involved in the design and analysis process. This holistic approach involves considering an entire problem – looking at all of the smaller fragments within the whole and not splintering it into smaller parts to be analysed in isolation.

‘DeFRaG’ is also a term for a free ‘Mod’ for the seminal first-person shooter computer game named Quake 3 Arena.² This seems particularly interesting in light of the developments in user

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¹ This has been my personal experience in my 10 years of architectural practice. The difficulty in getting work from consultants in a non-linear fashion was also stated by MGS director Robert McGauran (see Appendix 10.13.2).

² Mod is a term applied to ‘first-person shooter’ and ‘real-time’ strategy computer games. Mods are user customisations of a game that modify weapons, storylines, settings and characters. In some cases so many modifications are made to a game that it essentially becomes a new game. (CGG 2005).
customisation possible in architectural software, and the ‘first person’ viewing position of Renaissance and Picturesque urban design which I discuss in Chapter 3.

The new industries such as biotech, software designer materials, environmental control and the world problems such as population, weather, global change, and energy involve information-rich sciences… 21st century science is marked by increasing complexity that frequently overwhelms the reductionist approach of the disciplines (Duderstadt 2003, ‘Disciplines or Dinosaurs’ section).

A holistic or ‘defragmented’ approach to urban design is needed which takes advantage of scientific discoveries and technological developments. The ‘challenges [of sustainable development] cut across the divides of national sovereignty, of limited strategies for economic gain, and of separated disciplines…’ (WCED 1987 p.12).

Coping with the transition from the industrial to the post-industrial society, fundamental changes in science have occurred. One of the crucial changes has been the development of transdisciplinary research and a new relationship between theory and practice (Scholz 2005 p.4).

In some respects my defragmented approach could be considered to be interdisciplinary, as it involves information that would normally be produced by specialised disciplines, or, to be transdisciplinary as my research attempts to transgress disciplines using one common language. Transdisciplinary studies is an area of research and education that addresses contemporary issues that cannot be solved by one or even a few points of view. The Charter of Transdisciplinarity sets out as its fourth objective that the ‘the keystone of transdisciplinarity is the semantic and practical unification of the meanings that traverse and lay beyond different disciplines’ (Freitas et al 1994).

Our modern history of specialization in the pursuit of knowledge has brought precision, but at the cost of insularity. It has given progress, but this progress is ultimately defeated by the limitations of its own method. And, the pursuit of knowledge without any sense of moral direction has led to perversions of progress and excessive abstraction from reality itself (Janz 1998 p.4).

My thesis however, differs from much interdisciplinary or transdisciplinary research in that it acknowledges that the potential advantages of involving many disciplines in a collaborative design environment are rarely realised within the realities of practice feasibility and liability. For this reason my research has involved the development of techniques within the architecture and urban design profession that attempt to compensate for the lack of input from specialist consultants by broadening the expertise of the architect – what could be described as simulated-transdisciplinary design – designing with future collaboration in mind – or ‘defragmented design’.

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1 The ‘First World Congress of Transdisciplinarity’, was held in Convento da Arrábida, Portugal, November 2-6, 1994.
2 This will be discussed in later chapters with reference to a typical architectural project timeline (Appendix 10.2.2).
Analysis and Design

The defragmented approach involves both analysis and design. These two parts of the process could be seen as separate due to the fragmentation of disciplines I have just touched on, where the specialist consultants analysis a problem before the design can occur, or, a design is produced which is then analysed by a specialist consultant. In the defragmented approach, analysis and design are inseparable – design is an intrinsic part of the analysis process and analysis is an intrinsic part of the design process. In practice, design and analysis are not sequential processes.

Three Facets of Urbanism

Sustainable urbanism is a broad, multi-faceted topic to be studied in an inclusive and multi-faceted manner (Stokke 1991 pp.7-29). In later chapters, I will investigate three of the many facets of urbanism simultaneously. My choice of these specific facets is informed by their major impact on urbanism and urban design practice. These three facets will be used as the basis for my background research in the first half of my thesis.

Urban Agendas

The first facet – society’s prevailing urban agendas – consists of an array of political, military, civil, social and cultural positions, interests or aspirations held by those people who have had an influence on shaping urbanism. The influential people throughout history have ranged from emperors, dictators, kings, popes and democratically elected politicians; to business stake holders, user groups, resident groups, developers, environmentalists; along with architects, engineers, and scientists. Each of these people or groups has pushed their own specific agenda in the context of the broader society’s urban agendas, informing the resulting urbanism.

Urban landscapes embody not only the efforts and aspirations of the people occupying them now but also those of their predecessors (Paddison 2001 p.84).

Society’s prevailing urban agendas include civic needs for health; political and military needs for stability; social needs for shelter; cultural desires for urban beauty, private financial interests as well as long term interest of future generations.

Urban Design Paradigms

The second facet – urban design paradigms – entails various theoretical design positions, styles or approaches where the word paradigm is ‘a set of assumptions, concepts, values, and practices that constitutes a way of viewing reality for the community that shares them, especially in an intellectual discipline’ (The American Heritage Dictionary 2008). For example, in the context of urban design, ‘Baroque’ could be described as an urban design paradigm, in that it suggests not only a visual architectural aesthetic style but also a modus operandi.
Urban Design Techniques

The third facet – *urban design techniques* – refers to the practice methods used by urban designers to analyse, design and represent their proposals. The design techniques include the drawing style, the medium used, the drawing skills, the methods of abstraction and technology used.
Chapter 2. Research Method

2.1 Introduction

In the previous background chapter I stated my research aim, my research stance, the scope of my research, gave a broad overview of the structure of the thesis and outlined my key terminology.

The function of this chapter is to state my hypothesis and to explain the method for testing this hypothesis.

I begin this chapter with the hypothesis statement, followed by an explanation of the research context within which I have tested the hypothesis. This is followed by an explanation of the research method for both the pure research and applied research bodies of the thesis.

2.2 Hypothesis

The hypothesis tested in my thesis is that a gulf between contemporary society’s prominent urban agendas and urban design can be minimised by developing a ‘defragmented’ design approach that uses rapid, parametric, four-dimensional, digital analysis and design techniques, utilising customised industry software. As is suggested in the thesis title, a rapid, defragmented analysis and design approach can be used to inform an integrated and sustainable urbanism.

2.3 Research Within Practice in Melbourne

As I discuss in the following chapters, much contemporary urban design theory has limited engagement with design techniques and representation technologies. Those who have been engaged with urban design and technology are predominantly the UCL/Space Syntax group, who have developed their position growing from purely academic research into a suite of techniques applicable in practice. My research differs from that of the Space Syntax group as I have conducted the research predominantly within practice, dealing with real projects from the outset. My research deals with the narrow time frames inherent in practice.

I have conducted my research within Melbourne architecture and urban design practices—with MGS Architecture and Urban Design, as part of the Embedded Research Program at SIAL RMIT (See Appendix 10.1 p.281) and partially, within my own practice Harrison and White.
The context of conducting my research within urban design practice lent itself to study and case study research approaches. The types of projects available within practice also had some influence on the types of studies that could be used to test the hypothesis. Although MGS had more than 60 jobs running with a range of project types and scales, I chose to use only medium- and large-scale urban projects for my case studies. The case studies used to test individual design techniques in Chapter 6, projects were chosen because they prioritised one particular urban agenda.

The apparatus (software/hardware) was limited by the real constraints of what was commonly available in the medium-sized practice, or to that which could be sourced cheaply, or that which I could develop myself in-house. Like most architectural offices, MGS did not possess GIS software, or high-end engineering software, such as CATIA™. It did, however, possess commonly available programs such as AutoCAD™, 3D Studio Max™ (3DS Max), normally used for rendering presentation models, and one copy of Revit™ (BIM). These programs by themselves ‘out of the box’ do not have inbuilt tools to perform analysis and design responding to society’s prevailing contemporary urban agendas, but AutoCAD™ and 3D Studio Max™ are open to customisation with ‘user programming’ (Autolisp™ or scripting), meaning there was the opportunity to improve the programs. In an assessment of modelling and drawing programs, both AutoCAD™ and 3D Studio Max™ rated highly on modelling features compared to price (see Appendix 10.2.1 p.283), so these programs made the logical building blocks for design technique development. MGS also possessed the Adobe Suite, including Illustrator™, Photoshop™ and Indesign™, which with the exception of Illustrator™, I also used for this research. It should also be noted that the new techniques developed for analysis and design were generally added onto (as ‘add-ons’ or ‘plug-ins’) existing programs within the practice, as opposed to developing new stand alone programs, to avoid problems of software incompatibilities with future software releases.¹

There are many potential investigations in a research program taking place partially within a practice. Topics such as: ethnographic analysis of workplace behaviours; information transfer and mapping workplace change; impediments to research in the industry; and opportunities and

¹ A problem with small stand-alone programs is that programs cease to work when file formats change. For example, a program that imports Autodesk AutoCAD .dwg (release 2000) files will not be able to import .dwg (2004) file formats unless the program is updated to handle the new file format. Whereas customisation using ‘plug-ins’ and scripting can generally be release independent, meaning as AutoCAD changes file formats every two years, the customisation technique does not need to be redone.
pitfalls of university and practice collaboration; are all worthy areas of research, though as I pointed out in Chapter 1, they have fallen outside of the scope of this thesis.

2.4 Pure Research Method

The demand emerging from the environmental imperative, however, easily outbids any of the previous ‘utopian’ demands. Although concern for the survival of mankind has been the raison d’être for these previous ‘utopian’ demands, they have been more limited in scope: the demands emerging from the ecological imperative are all-embracing. The challenges confronting our generation – and generations to come – are therefore multi-faceted, involving all the levels, from the local to the global, of many systems – political, economic and cultural – more or less linked to each other and governed by different kinds of ‘law’. Different aspirations are in conflict. Developments and decisions at one level of a system affect the developments at others at the same time, and ecologically viable development cannot be achieved without concerted action at all levels (Stokke 1991 p.11).

The research methods I have chosen to test my hypothesis acknowledge the need for a multi-faceted, holistic approach for sustainable development research. I have broken the thesis up into two main parts, firstly the university based pure research body (Chapter 3, Chapter 4 and Chapter 5), and secondly the practice base applied research body (Chapter 6 and Chapter 7). The two parts each relate to the two parts of the hypothesis stated in section 2.2. The pure research body aims to give background and explain the gulf that has emerged between society’s prevailing urban agendas and urban design, and the applied research body of the thesis sets out and tests a proposal for a new design approach and design techniques to reduce this gulf.

The structure of this thesis is unorthodox in that it gives almost equal weighting to synthesising the problems as to attempting to solve the problems. It has been suggested by Melbourne University academic, David Evans that a thesis is normally either literature based, or study based, ideally with one ‘background chapter’ where existing literature on one specific topic is chronologically reviewed, before stating a narrowly focused hypothesis or question (Evans & Gruba 2003 pp.12-16). My thesis does not follow this formula for a number of reasons. Firstly, due to the emerging nature of the research field of sustainable urbanism and the lack of literature on this specific topic, a traditional, chronological literature review is not particularly helpful. Secondly, the larger issue of sustainability is broad and as my thesis sets out to test the hypothesis that the multi-faceted problem of sustainable urbanism can be addressed through a multi-faceted design approach, it is necessary to touch on a broad scope of literature, synthesising my own version of the background to this research field, before offering my own potential solutions.

To test the assumption that a gulf currently exists between the prevalent urban agendas of society and urban design, in Chapter 3 I examine this relationship in a historical context, establishing that
a strong relationship once existed, followed in Chapter 4 by an investigation of the relationship in a contemporary urban design context testing the strength of this relationship in the present time, and then in Chapter 5 I look at the strength of this relationship in the contemporary local context (Melbourne, Australia).

In these three chapters, I investigate the relationship between prevalent urban agendas and design practice by looking at what I refer to as my three facets of urbanism. The first facet – society’s prevailing urban agendas, is looked at in parallel with two facets of urban design practice: urban design paradigms and urban design techniques.

To examine the relationship between each of the three facets in an historical context, I discuss a series of demonstrative urban design themes throughout history, looking at the impact of the different facets on each theme. Through this collision of historic design themes and facets, I attempt to tease out what I believe to be a strong, symbiotic relationship between each of the three facets.

The scope of the literature used for this study is broad by necessity, but is filtered by its relevance to the demonstration of the relationship between the three facets of urbanism. The selected literature touches on the work of late 19th and early 20th century urban theorists such as Camillo Sitte (1889), Ebenezer Howard (1898), Le Corbusier (1929), and the lesser-known but equally important Ildefons Cerdà (1967), as well as many of post WWII urban design’s ‘classic texts’\(^1\) by Lewis Mumford (1938), Kevin Lynch (1960), Jane Jacobs (1961), Ed Bacon (1976), Ian McHarg (1969), Christian Norberg-Schultz (1971), Robert Venturi (1972), Jan Gehl (1971), Colin Rowe (1978) and Christopher Alexander (1977). I have drawn upon more recent literature, particularly that of Spiro Kostof (1991) and Leonardo Benevolo (1993). This chapter also references urban design documents specifically concerning Melbourne, Australia, such as Barnett, Burt and Heath’s, We must go on – a study of planned reconstruction & housing, Melbourne (1944).

I use Chapter 4 to investigate the three facets of urbanism in a contemporary context. The method for this chapter involves identifying and discussing key urban agendas of today’s society, drawing from pivotal research with regard to urban agendas for sustainability by Newman and Kenworthy (1999), as well as key documents influencing academic discussion on the topic such as The Brundtland Commission (WCED 1983), Agenda 21 (United Nations 1992), and The Rio Declaration on Environment and Development (United Nations GA1992).

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\(^1\) List of classic texts according to Matthew Carmona and Steven Tiesdell’s ‘Urban Design Reader’, (2007), Elsevier Science & Technology, UK.
I then critically review prominent contemporary urban design paradigms in a global context with respect to their ability to address society’s prevailing urban agendas and their use of emerging design techniques. The method I use for this section is to categorise the numerous urban design paradigms into five groups using an analogy involving the well known ‘five stages of grief’ (Kübler-Ross’s 1969 p.IV), allowing the juxtaposition of greatly varying urban design positions. In this section I draw upon contemporary urban design discussion with reference to the key literature of Rem Koolhaas (1995), Bill Hillier (1996), Leon Krier (1998), Michael Neuman (1998), Michael Batty (2003), Mark C. Taylor, (2003) as well as James Howard Kunstler (2006) and his rival Robert Bruegmann (2005). I look at the work of prominent urban designers such as Andrés Duany of Duany Plater Zyberk & Company (DPZ) and Rem Koolhaas. I also assess the technology and methods (including software) used by the various designers.

This is followed by the review of the specific context of Melbourne, Australia, where I discuss a number of contemporary planning schemes and frameworks, including the current key local planning documents Melbourne 2030 – Planning for Sustainable Growth (DOI 2002) and a number of council structure plan documents (available online) as well as the design techniques that are currently being used to implement these documents.

Though Chapter 6 predominantly belongs to the applied research body of the thesis, there is still a pure research element; I refer to very specific technology literature, which, due to the rapid progress of design technique development and discussion, is mostly of a less formal nature. I utilise up-to-date references from the internet such as blogs and software user group discussions, as well as recent conference proceedings. Key contributions from the Centre for Advanced Spatial Analysis (UCL), London, UK, are utilised along with the work of Borislav Petrov (commonly known as ‘Bobo’) from the Virtual Republic Boboland; Tom Hudson (creator of Greeble plug-in, which I discuss in later chapters); and ‘Chuggnut’s Illicit Cheese’; Autodesk discussion group and similar groups. Due to the rapidly developing nature of the technology it is

1 Kunstler and Bruegmann offer positions of extreme opposite ends of the spectrum. Kunstler predicts the horrors of peak oil and the end of suburbia as we know it, where as Bruegmann suggest sprawl is a natural progression of cities. For an example of the tension between these positions, see Kunstler’s review of Bruegmann’s writing www.kunstler.com/Mags_Bruegmann
2 Chuggnut is a person who has created a website that features free tutorials for scripting and 3D modelling as well as numerous free scripts that he has written. For more information see www.chuggnut.com/.
3 Autodesk’s official discussion group is located at www.discussion.autodesk.com/index.jspa.
acknowledged that some of the more recent literature (in the last nine months or so) is not
discussed and may have already superseded some of the techniques developed in this thesis.1

2.5 Applied Research Method

Rather than denying the validity of professionalism we need to rethink our ideas about the role of
professions. Professional knowledge, inadequate and incomplete as it invariably is, is useful, but
is not apolitical. Knowledge developed within different professional and academic spheres that
sometimes conflict is useful (Gleeson & Low 2000 p.188). What we regard as entrenched disciplines today have changed considerably in the past and continue to do so. There is a definite hierarchy of academic prestige—or, perhaps better stated, an
intellectual pecking order—within the university. In a sense, the more abstract and detached a
discipline is from “the real world,” the higher its prestige… The changes in the nature of
scholarship, from disciplinary to multi/inter-trans/cross-disciplinary, from specialization and
reductionism to complexity… will likely reshape the intellectual architecture of the University, as
well as its organizational structure (Duderstadt 2003, ‘Disciplines or Dinosaurs’ section).

As I conclude at the end of Chapter 4 the current urban design paradigms and techniques used
by these paradigms are inadequate to address one of society’s prevailing contemporary urban
agendas – sustainability. The fractured nature of the disciplines in urban design practice, along
with the extreme pressures of time and cost, require a new fast-paced, but holistic approach to
urban design which utilises the full potential capabilities of contemporary software and hardware
currently within the possession of designers.

By identifying key sustainability objectives within the local urban context, as outlined by Victorian
government planning documents, and developing and applying rapid design and analysis
techniques, I test whether my rapid, defragmented approach with my new design techniques can
inform design proposal outcomes in a series of case studies.

My design techniques are tested in isolation on simple case studies (Chapter 6) and using multiple
techniques concurrently on more complex case studies (Chapter 7) to test whether a rapid,
defragmented design approach can inform an integrated and sustainable urbanism.

The method for this applied research loosely follows a series of steps set out in Figure 4. This
diagram shows the iterative structure for the research development, which includes the following:

1 One example of this is Square One™ program Ecotect™ which has very effective daylight analysis
tools such as ‘solar radiation’ and ‘right to light’.
Identifying specific key urban agendas of society in light of the background discussions.

The ‘analysis of analysis’ reviewing of literature and practice looking at the ways in which design analysis is currently being carried out.

Establishing existing techniques and gauging their effectiveness and usefulness.

Developing a new technique or techniques that respond/attempt to respond to the specific urban agenda.

Testing technique on ‘laboratory experiment’ (simplified models).

Field experiments (case studies)

Verification and validation.

Testing multiple new techniques on a ‘defragmented case study’.

The realities of research within practice dictated that these steps did not always occur in the order just outlined and some steps may be omitted depending on the technique, but this structure is described in this order for the sake of clarity.

Figure 4: Diagram of research method structure (for more detailed diagram see Appendix 10.3 p.287).
Identifying Specific Contemporary Urban Agendas

In Chapter 3, I outline the importance and potential of identifying and responding to urban agendas throughout history. After a review of literature and current urban design positions, Chapter 4 concludes by identifying sustainability as the prevailing contemporary urban agenda of society.

I have used this broad agenda along with specific agendas from the urban growth strategy for Melbourne, Melbourne 2030 Planning for Sustainable Growth (DOI 2002) to direct the specific technique investigations. I have grouped the various urban agendas into four thematic headings: pedestrian connectivity; amenity; visual impact; and feasibility.

The urban agendas from Melbourne 2030 that I have used for these specific investigations are based on the Policies and initiatives statement (DOI 2002 pp.2-5). For two years prior to its release, the document went through a process of consultation with community members and businesses, as well as input from various experts, culminating in a series of principles for growth. These principles are quite broad and can be considered to cover many of the urban agendas I discuss in Chapter 4.

According to the section titled ‘The basis for the report’, (DOI 2002 p.18) more than 5500 people want:

- More and better public transport and less road congestion
- A sustainable environment, with less sprawl and protection of environmental assets
- Car dependency reduced and walking and cycling encouraged
- A quality urban environment – with heritage and local character protected
- Shared growth and benefits with regional Victoria
- A strong economy and jobs growth, support for existing businesses and industries and encouragement of ‘knowledge’ jobs
- A strong sense of community, social equity, appreciation of diversity, and increased personal safety.

![Policies and initiatives](image-url)

Figure 5: Policies and initiatives, nine directions Melbourne 2030 Planning for Sustainable Growth.
Melbourne 2030 distils these social aspirations into a list of nine directions (see Figure 5). Direction 3 – *Networks with the regional cities* relates to infrastructure and the funding of rural rail networks and thus falls outside the scope of this thesis. The remaining directions relate to the realm of urban design and will be included in this investigation. The *Melbourne 2030* directions are discussed using four broad thematic headings to more closely align with my implementation of the strategies. Due to overlaps between these directions, each direction appears under one or more heading (see Figure 6).

<table>
<thead>
<tr>
<th>Pedestrian Networks: Connectivity, Walkability and Accessibility</th>
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<tr>
<td>• Direction 1 – A more compact city</td>
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<td>• Direction 2 – Better management of metropolitan growth</td>
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<td>• Direction 6 – A fairer city</td>
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<td>• Direction 7 – A greener city</td>
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<td>• Direction 8 – Better transport links</td>
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<th>Amenity Assessment</th>
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<tr>
<td>• Direction 1 – A more compact city</td>
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<td>• Direction 6 – A fairer city</td>
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<td>• Direction 7 – A greener city</td>
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<tr>
<th>Visual Impact – Urban Form: Visualisation, Generation, Composition</th>
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<td>• Direction 1 – A more compact city</td>
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<td>• Direction 5 – A great place to be</td>
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<tr>
<th>Density Distribution and Feasibility Modelling</th>
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<td>• Direction 1 – A more compact city</td>
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<td>• Direction 4 – A more prosperous city</td>
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<td>• Direction 9 – Better planning decisions, careful management</td>
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<td>(making planning process more predictable (envelope based planning))</td>
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Figure 6: Four themes as prevailing *Melbourne 2030* urban agenda headings.

I have used the four thematic sections headings in the Chapter 6, with smaller, more specific areas of research explored within those sections. In the *pedestrian connectivity* section I look at pedestrian connectivity and pedestrian catchment areas as well as equal access. In the *solar amenity* section I look at solar amenity of public spaces and overshadowing. In the *visual impact* section I explore visual connectivity, rapid visualisation modelling and heritage preservation. In the *feasibility* section I investigate density distribution modelling, volume and area measurement, and digital model data harvesting.
2.5.1 Principles of Analysis: Review of Literature and Practice for Specific Urban Agendas

I discuss contemporary techniques and technology used for analysis and design in Chapter 4 and Chapter 5. This is expanded upon as required where more specific design issues are explored. Principles for specific analysis and design techniques are investigated, looking at the logic behind the methods. What is the technique trying to do? How is it trying to do it?

2.5.2 Establish Existing Techniques and Their Short Comings

Within a practice context, I have interrogated individual techniques for effectiveness, speed of use, and cost whilst asking the questions: do techniques exist that address the specific urban agenda? How effective are the techniques? On a case-by-case basis, I examine techniques that are currently unfeasible, which are only possible with the use of specialist consultants, specialist hardware or software. I ask the questions: might it be possible to reproduce these results with customised software, or invent new techniques that address the urban agendas effectively?

2.5.3 The Technique Development

In response to the parameters above, I have created new design techniques using ‘user customisation’ of software (predominantly scripting). Though much of the discussion from the MGS practice encouraged me in the direction of developing ‘design tools’, the nature of the Embedded Practice scenario lent itself to development of design techniques. To elaborate on this point, the definition of tool is ‘a thing used to help perform a job’ (Compact Oxford English Dictionary 2007), whereas a technique is a way of carrying out a particular task, especially the execution of an artistic work or a scientific procedure (Compact Oxford English Dictionary 2007). A ‘tool’ implies a level of simplicity of use, whereas a technique implies a level of skill. To turn a technique into a tool (that can be used by anyone) requires a great deal of effort and time spent researching graphic interfaces and usability, and as will be discussed in later chapters, usability can be at the expense of flexibility. The practice (MGS) possesses commonly used architectural software, which has the in-built capability of user customisation. Consequently my technique development has utilised in-built user programming languages: Autolisp™, scripting and Max-scripting™, as well as using any useful freeware or plug-ins.

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2 As I mentioned earlier, MGS uses Autodesk’s AutoCAD™ which as a program is not discipline specific (sometimes called ‘ACAD Vanilla’ by CAD users), unlike the many discipline-specific applications such as Revit™ or Architectural Desktop™ (referred to as ‘vertical apps’). Though using the basic AutoCAD™ program is perhaps less user friendly for architect, it is more transdisciplinary.
All the current architectural modelling software is not authored by architects, and has its roots in either the movie industry or industrial engineering... This apparent lack in the current software is a weakness that can easily be exploited by an enterprising digital practice (Clarke 2004 para.2).

The process for researching new design approaches and techniques has been driven by the desire to deal with specific urban agendas in practice, as opposed to finding new ‘cool tools’ and trying to find uses for them. Of course, in the process of searching for and developing my own design techniques to address certain issues, I have come across other techniques or technologies that are applicable to other problems.

2.5.4 Laboratory Experiment

The techniques that I sourced as freeware, or new techniques I developed in direct response to the urban agendas, underwent a process of laboratory experimentation or test tube analysis. This means that I tested techniques on simplified versions of problems using simple models with minimal variables. Critics of this kind of reductive research, particularly in urban design, suggest that the reduction of the experiment to a ‘single-variable problem’ oversimplifies the intricately interconnected complexities and interrelationships of the city organism (Jacobs 1961 p.431). For this reason, I have supplemented the test tube analysis with applied case study research.

2.5.5 Field Experiments – Case Studies

I used fifteen case studies to test the effectiveness of the techniques in an urban design practice context. I deliberately chose projects from within MGS to test the individual techniques, with the effectiveness of the techniques gauged on these specific projects. Additional proof is evident in further projects within the office summarised in Appendix 10.13.1 (p.324), including those projects in which other staff members adopted the techniques. Three defragmented case studies were produced to test multiple techniques simultaneously (Chapter 7). The first study, *Prahran South Yarra - Horace Petty Housing Estate*, was conducted within MGS, the second study *St Luke's Church Development: Sydenham*, was conducted in my own practice of Harrison and White, and the third study, *A Real Walking City*, was produced outside of practice as a polemical design, testing the defragmented concept in a theoretical context unrestricted by practice constraints.

2.5.6 Verification

The techniques required verification for accuracy. In some cases this verification was straightforward, involving a simple comparison of the resulting analysis using the new technique.

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1 Freeware is software that is freely distributed and available for download free of charge.

2 This project sits within a tradition of theoretical city designs such as Le Corbusier’s ‘Plan Voisin’ (1925) for Paris, Frank Lloyd Wright’s ‘Broad Acre City’ (1932), or Metabolist Arata Isozaki’s ‘Clusters in the Air’ (1960-62) for Tokyo.
versus a more ‘manual’ existing technique. In other cases it involved comparing results with other existing verified software, or physically modelling the scenario. Where the level of accuracy could be traded off for increasing speed of use for a new technique, an attempt was made to establish the amount of error, or ‘accuracy compromise’.

2.5.7 Validation

The rapid defragmented approach and the new techniques were tested for validity and effectiveness in two main ways. Firstly, focus group presentations and discussions are used to gauge the relevance of the techniques and how ‘convincing’ they are. Secondly the effect the use of the new techniques has had on the practice MGS – do they find the techniques to be valid in every day urban design practice?

The focus groups were organised by MGS and myself and were made up of people who are policy makers in councils, and representatives from state government departments such as the Victorian Department of Infrastructure, the Victorian Department of Sustainability and Vic Urban. The focus group discussions were conducted as formal presentations, using digital projections. Responses to the techniques are gauged in the form of minutes (See Appendix 10.14 p.332). Attempts to gauge the response of ‘the broader community’ are generally not made due to a number of reasons. It is almost impossible to get a true representation of all members of society in any kind of ‘community participation’ session, as the majority of the community are too busy working or looking after their families to participate, resulting in a distorted representation from a vocal minority. There seems to be ‘overstated enthusiasms about participatory approaches, not fully taking into account the biases on both sides and the limits of this paradigm’ (TCSR 2005). For this method to be effective, participants would need to be paid accordingly, and vast numbers of participants would be needed – beyond the scope of this thesis.

The validity of the techniques within the architectural practice has been gauged by an assessment of the uptake of techniques used on jobs towards the completion of the Embedded Practice Program. This assessment involved the analysis of file structure, file content and representational outputs of projects from the MGS office. It also involved interviewing the urban design director of MGS. The techniques were tested for effectiveness in addressing urban agendas and for speed. If a technique could not be applied rapidly, then it either needed further development or it was not suitable for application in urban design practice.
2.6 Summary

In this chapter I have outlined the hypothesis tested in the thesis – that developing a defragmented design approach that uses rapid, parametric, four dimensional, digital analysis and design techniques can inform an integrated and sustainable urbanism. I have explained the process of targeting society’s prevailing urban agendas and developing new design techniques using commonly available user customisation (scripting), which contributes to the concept of defragmented analysis and design. I also explained in general terms how the defragmented approach has been verified and validated using a range of different research techniques, including simplified verification models, case studies, focus group discussions, practice ‘take up’ of techniques, and multi-technique defragmented case studies.
Chapter 3. Historical Context – Three Facets of Urbanism

3.1 Introduction

The city is not the manifestation of some iron law [but rather] the result of changing human aspirations (Lynch 1981 p.39).

As outlined in the first chapter, the aim of this thesis is to propose a design approach and new design techniques for urban designers to employ in response to the contemporary agenda for sustainable urbanism. As I discussed earlier, sustainable urbanism is a broad, multi-faceted topic and ought to be studied in an inclusive and multi-faceted manner (Stokke 1991 pp.7-29). I therefore provide a broad multi-faceted background review of both historical and contemporary urban design practice and theory in the pure research body of this thesis. The following background chapters have informed my hypothesis (stated in Chapter 2), that a gulf between contemporary society’s prevailing urban agendas and contemporary urban design practice can be minimised by developing a new design approach.

To test my hypothesis it is important to test the assumption that a gulf has occurred between society’s prevailing urban agendas and urban design that did not exist in the past. The aim of this chapter is to establish this assumption with an historical background discussing three significant facets of urbanism that have had a major influence upon the urban fabric of our cities. As I have explained in section 1.6, the three facets of urbanism are made up of the society’s prevailing urban agendas, and two important aspects of urban design which are urban design paradigms and the urban design techniques they use. I investigate what I believe to be symbiotic relationships between these three facets throughout the history of designing cities, with each informing the other. A culture’s milieu can impact on technological development (Mumford 1934); advancements in technology can affect urban design approach (Le Corbusier 1924, pp.30, 31); different design paradigms influence the social milieu (Hillier 1996); design techniques can have an effect on society’s prevailing urban design paradigms (Benevolo 1993 p.127); and so on.

I explore the interrelatedness of these three facets of urbanism by colliding them with a selection of four specific urban design themes chosen to best demonstrate these relationships. I have broken the chapter into four sections, each exploring one specific theme: urban order, composition, amenity and density distribution. Whilst each specific section is structured
chronologically, as the themes overlap in time\textsuperscript{1} the overall chapter is not strictly chronological and in some cases, the same design movement is discussed in multiple sections\textsuperscript{2}. The examples cited are not restricted to one particular geographic region, as I have sought out the most illustrative urban design examples which have occurred in different locations throughout the world.

3.2 The Ordered-Network City: Pack Donkey versus the 2D Grid

3.2.1 Street Layout Reflecting a Civilised Roman Society

Pre-Renaissance cities are described as either having grown organically – ‘the pack donkey’s way’ (Le Corbusier 1929 p.6) or having derived from a two dimensional grid plan.

*The pack-donkey meanders along, mediates a little in his scatter-brained and distracted fashion, be zigzags in order to avoid larger stones, or ease the climb, or gain a little shade; be takes the line of least resistance* (Le Corbusier 1929 p.6).

Le Corbusier’s concept of civilised humans planning cities with a 2D orthogonal grid in contrast to the unplanned, pack-donkey-organic echoed the thoughts of the British historian, Francis Haverfield, whose paper *Ancient Town Planning* (1913) suggested the orthogonally planned grid distinguished the civilised from the ‘moral inconsistency’ of the barbarian. “The savage, inconsistent in his moral life, is equally inconsistent, equally unable to “keep straight”, in his house-building and his road-making” (Haverfield 1913). He argued that Rome’s greatest gift to Europe was the definitive form of the town’s rectangular grid.

The Roman design approach of ordered, gridded street layouts (aspects of the design paradigm), expressed the Empire’s urban agenda to reflect their accomplishments as a civilisation, with the physical form of cities appearing ordered and therefore ‘civilized’. Another urban agenda that influenced the orthogonal grid approach relates to city defence. The grid was believed to be useful for military access for defence from attacks and protect the city from uprisings from within, ‘to keep under watch a restless population’ (Kostof 1991 p.95), for surveillance, control and even repression (Taylor 2003 p.30).

The layout of the Roman grid was possible because of technological advancements in design techniques, the understanding of scaled drawings and implementation (set out tools) such as the

\textsuperscript{1} For instance, I look at early examples of urban composition (eg. Renaissance) as well as more recent examples (eg. Brasilia), and then move on to look at early examples of urban amenity (eg. Garden City), moving onto modern examples of urban amenity (Bauhaus).

\textsuperscript{2} For example, Haussmann’s Paris urban intervention will be discussed in terms of urban composition, but is also considered with regard to urban amenity.
‘road measurer’ or hodometer conceived of by Vitruvius, and the groma which allowed the setting out of straight lines and right angles for gridded streets found in military camps and Roman settlements. It is difficult to ascertain whether the technology of the design technique influenced the design paradigm, or the design paradigm drove the advancements of the technology, or if both were driven by the urban agenda, but it is clear that there was a relationship between aspects of the three.

### 3.2.2 Grids Revisited

After the fall of the Roman Empire, Europe reverted to the irregular unplanned growth around the spiritual and physical focus of the Church (Bowe 2004 para.3). The Church acted as the focus of cities reflected the social milieu. Gridded cities appeared again in the new towns in France and England (around 1100 AD) due to another change in society’s prominent urban agendas: the rekindled need for protection, ‘fortified communities designed to counter each other’s ceaseless raids’ (Bowe 2004 para.3) The rekindled interest in the grid plan was continued into the Renaissance particularly after the rediscovery of the work of Vitruvius. Designers adopted the grid ‘to create a new paradigm in the treatment of public spaces and amenity while maintaining political and military prerequisites’ (Bowe 2004 para.4).

The 2D grid would continue to be used for Colonial settlements throughout the world (Taylor 2003 pp.28, 30, 31). With the rise of the commerce agenda, 2D grid plans became speculative, used in part due the ease in which real-estate could be divided up and sold.

> *Each lot, being of uniform shape, became a unit, like a coin, capable of ready appraisal and exchange* (Mumford 1938 p.184)

Real-estate generally being sold by square feet/metres (2D) calculated with length times width equals area, which is far easier to calculate than using trigonometry to calculate complex polygons, or even harder, volume of complex forms. The 2D grid method of planning was adopted all over the world. It was sometimes applied over sites regardless of topography sometimes resulting in areas of Street grid too steep for a car to drive up. Notable examples are San Francisco California (the home of the movie car chase) and Wellington, New Zealand which was designed in England using 2D site plans without topographical information and a designer

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1 A ‘groma’ or ‘surveyor’s cross’ was a primitive surveying device that used vertical staffs with cross members hanging plumb bobs. The surveyor’s assistant would walk ahead and move around until their staff lined up with the surveyor’s plum bobs.

2 For a prime example of a grid laid out indiscriminately over undulating topography, see *Bullitt*, the 1968 police thriller film starring Steve McQueen, directed by Peter Yates, distributed by Warner Bros, where a 390 CID V8 Ford Mustang and two 1968 V8 Dodge Chargers chase each other around the steep streets of San Francisco becoming airborne at intersections. This example exposes the mismatch of 19th C gridded street layout, steep terrain and the speed of the 20th C car.
who had never visited the site. In 1837 in the State of Victoria in Australia, the surveyor Robert Hoddle set out Melbourne based on the standard grid ‘colonial template’, with little planning input (Rippon 2005 p.4) and requiring major earth works to level areas of the city.

3.2.3 The Modernist Hierarchical Grid
The rational nature of the grid, and illustration of ‘universal reason and human equality’ (Taylor 2003 p.30), was appreciated by the Modernists who adopted the grid but began to give some streets prominence over others. The idea of street hierarchy was elaborated on by German Modernist architect and urban designer, Ludwig Hilberseimer (1927) who argued that the hierarchy of major (wide) roads and narrow (minor) roads would satisfy the urban agenda for safer streets for children, whilst increasing the overall speed of circulation of vehicles. This system was adopted by the Modern Masters – Lucio Costa’s with Oscar Niemeyer in their built city, the capital of Brazil, Brasilia, as well as Le Corbusier’s Chandigarh in India. The grid also reflected the classical tendencies of Le Corbusier’s town planning (Laurence 1993).

A mutated version of Hilberseimer’s street hierarchy occurred through the 1960s almost putting an end to the grid with serpentine street layouts for residential subdivisions. As architectural historian Spiro Kostof pointed out, residential areas were surrounded with moats of major roads and barricaded with noise walls with a single entry road (1991 pp.50, 82, 154-155). This form of suburbia was in a way a return to the walled medieval city, where the stone walls are replaced with concrete sound barriers, and the ‘scatter brained pack donkey’s way’ is reproduced by traffic engineers and town planners with asymmetrically planned streets and cul-de-sacs designed to slow traffic. Unfortunately unlike the medieval fortress cities, markets and other civic buildings are not to be found within the suburban enclosure due to land-use zoning, a concept that I discussed later in this chapter.

3.3 The Composed City: A New Perspective on the City

3.3.1 Understanding of Perspective
Though the gridded city resurfaced in some areas in Europe during the medieval period, the organic town growth continued in other areas (Moffett et al.2004, p269). Towards the end of this period, advancements in the artistic representation technique by Giotto (Giotto Di Bondone), and Masaccio (Tommaso Cassai) (Lubbock 2006 p.176, Kemp 1990 pp.16-18.) began to have an effect on the representation of cities (Cuthbert 2003 p.83). ‘Bird’s eye view’ drawings of cities in a pseudo perspective (somewhere between 2D and 3D) allowed for an overview of cities (Blessing 1973, Rowland 1966 p.1). Though there was some idea of depth, the buildings shown in these drawings were not proportional, complying with the gothic tradition of using scale to set up a
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

In the early 1400s, prominent architect of the Italian Renaissance, Filippo Brunelleschi demonstrated the geometrical method of perspective by using a painting of the Baptistry with a hole in it, standing in front of the building facing away from it holding a mirror (Kemp 1990 p.12) (see Figure 9). The understanding of perspective was later formalised by the author, artist, architect, poet, linguist, philosopher, Leon Battista Alberti in Della Pittura, a document that explained the technique (Lubbock 2006 p.176, Kemp 1990 p.12). This is noteworthy for two reasons. Firstly this is a clear example of the advantage of an architect being directly involved in developing their own design and representation techniques, a concept that I pursue in later chapters, and secondly, the new technique would lead to a new understanding of cities as potentially an urban composition, in turn, influencing society’s urban agendas.
3.3.2 Urban Composition – A New Urban Agenda

The new understanding of the perspective technique led to the city being represented with more accuracy as a whole (Cuthbert 2003 p.83), which helped to affect the public’s understanding and informing urban aspirations (agendas) for the city. These new agendas in turn affect the urban design paradigm.

In the second half of the 16th century, the urban setting became a collective concern… a large number of perspective city views in which a great deal of information was combined in a realistic rendering. For the first time the entire heritage of the European cities was precisely represented according to the tenets of Renaissance visual culture and given general circulation. The population became accustomed to the synthetic perception of parts of the urban organism and the relationship between the city and the geographical setting. Perspective, the tool used to create these images was subsequently and continuously employed for the rectification of urban settings. The new rectilinear avenues became more frequent and longer, and better emphasised the view of the vanishing point (Benevelo 1995 p.127).

Figure 10: Diagram of Alberti documentation of his understanding of perspective, source: www.kap.pdx.edu/trow/winter01/perspective/

Figure 11: Engraving of Mantua beginnings of a city expressed as a whole. (late 15C). Still, key buildings are represented with some detail and the ‘in between’ is ignored. (Bacon 1967 p.93).

Figure 12: A General View of the Port and Town of Amsterdam, engraving by D.G. Hucquier, 16th century (courtesy of www.bridgeman.co.uk) Note: the ‘in between’ is beginning to be filled in and considered as part of the city.
This application of perspective as an urban design technique impacted city design through the Renaissance and into the Baroque periods (Cuthbert 2003 p.84-87).

During the 1400s the urban agendas of the inhabitants of Rome varied from their predecessors (Mumford 1961 p.395). A new desire for an emphasis on the Church and the path of pilgrims was reflected with urban interventions – straight axial streets terminating in vistas marked by ‘way finding’ obelisks and religious buildings (Bacon 1967 pp.137-141). This urban design paradigm reflected the melding of the current urban agendas and the new design technique – perspective.

3.3.3 Piazza Del Campidoglio
A prime example of urban design paradigm taking into account a city’s urban agendas as well as expressing technological achievements (design techniques), is Michelangelo’s Campidoglio (1546) (Rowland 1966 pp.41-43) which remodelled the Capitoline Hill to reflect Pope Paul III’s vision for the new Rome, turning away from the Roman Forum towards the civic centre – St Peter’s Basilica (Cuthbert 2003 p.86, Rowland 1966 pp.41-43). The design involved ‘tidying up’ the space giving ‘clarity and formal order’ (Mumford 1961 p.401) by adding a veneer of Renaissance façade creating a trapezoidal plaza space to achieve the desired perspectival effect (see Figure 13).

The Campidoglio serves as a clear demonstration of the potential of the relationship between the three facets of urbanism with the resulting urbanism expressing more than just the sum of the three facets.

![Figure 13: (LHS) Michelangelo plan for the Capitoline Hill (Piazza del Campidoglio) source: www.recivilization.net/036thesecondman.html). RHS perspective engraving by Étienne Dupérac (1525-1604) source: http://commons.wikimedia.org/wiki/File:CampidoglioEng.jpg](image)

The concept of perspectival composition of urban form illustrated in the Campidoglio was also the case in illustrations demonstrating further potential in the perspective technique by Italian Mannerist painter Francesco Salviati (Figure 14), and French landscape architect to King Louis
XIV of France, André Le Nôtre (1613 – 1700) who’s design for the Palace of Versailles (Figure 15), emphasises axial composition and terminating vistas on a large scale (Bacon 1967 p.25).

Figure 14: Francesco Salviati’s (1560) abstract vision of an ideal city (a preview of the Baroque). Salviati sets up the object terminating the vista with a single point of perspective on the horizon, and then (counterpoint) balances this with the flaring shape of the terminating building setting up another set of vanishing points. (Bacon 1967 p.25).

Figure 15: Louis XIV’s Palace of Versailles (built 1668–74) gardens by André le Notre. Source: co-hort.co.uk/history_files/hist2.jpg
The bisecting axis created inspiring vistas, influencing Pierre L’Enfant in his design of Washington DC in 1791.

3.3.4 Narcissistic Urban Agendas

With the understanding of perspectival composition technique and the urban design paradigm came an understanding of the importance of the individual spectator’s point of view, raising questions of whether urban composition was for the glory of God or the individual. The French philosopher and mathematician, René Descartes, a prime contributor (Newman, 2005 p.236) to developing analytic geometry referred to as the Cartesian co-ordinate system (1637) suggested that space was the ‘projection of thought where every viewpoint can be deduced, abstracted, from the universal position of a God for whom all viewpoints are instantaneously accessible. Depth is the function of ratiocination; depth exists because man is not God’ (Weiss 1987 p.31). None the less the importance of the individual human experience continued to be of interest. French philosopher, Merleau-Ponty notes:

…every perspectival projection… returns to the spectator’s point of view, to that zero-degree visibility which is the pure latency of depth….There is a fundamental “narcissism of vision” inherent in all systems of representation (Weiss 1987 p.31).
This ‘narcissistic position’ in perspectival representation seemed particularly evident in the picturesque movement of the 1700s. One of the aspirations (urban agendas), of the wealthy English ‘leisured class’ was to show off their beautiful estates to colleagues during ‘pleasure rides’ (on horseback) (Clark 2004 pp.37-38). English Landscape designers such as Capability Brown and Uvedale Price used the projected perspective views as a compositional tool, which in turn informed their landscape plans (Broglio 2008 p.67). Key moments along a path were chosen as viewing points where one would dismount from horse and view the perspective composition of the estate.

In most literal aesthetic observations, we might note that it is only in the “major” art of architecture and the “minor” art of gardening that the artist – and the spectator – may literally enter and explore the perspectival projection, taking his body into the very work of art (Weiss 1987 p.31).

The picturesque design paradigm was possible because of the discovery and understanding of perspective, but it was also due to advancements in cartography and surveying (Broglio 2008 pp.51,69). The concept of triangulation used for surveying being fully understood at a similar period (Cavette 1996 para.4). This triangulation would have allowed landscapers to sculpt the ground surface to gently roll under the sublime follies and artificial ruins. This is yet another example of the technology of the design technique informing the design paradigm and the new three dimensional composition possibilities informing the prevailing urban agenda of the time (be it a conceited aim to show off one’s wealth).

Another example of urban scaled composition would occur over 50 years later in Paris, France between 1853 and 1869 with Baron von Haussmann’s interventions into the Parisian urban fabric (Sennott 2004 p.186), which involved carving through great boulevards through the medieval city, creating public squares and great vistas to civic buildings. This work recalled the perspectival interest of the Renaissance, the grandiose Baroque of Versailles.
The Austrian architect and city planning theoretician Camillo Sitte criticised the boulevards of Haussmann advocating curving or irregular streets for ever-changing vistas in lieu of ‘a monotony of vistas, and an architectural ineffectiveness’ (Sitte 1889 p.7). Sitte argued that the city should be considered as an art, with ‘spatial and formal composition that preceded the considerable population explosion of his century’ (Tavernor 2004 pp.78-83). He suggested that the pre-industrial medieval cities had an inherent beauty forged by the intuitive creativity that shaped the irregular streets and public spaces. It would seem that the ‘pack donkey’ was better at urban composition than Haussmann or the modern planners thereafter.

Despite these critiques, the Baroque style boulevards of Haussmann would also be revisited on the other side of the Atlantic Ocean (Field, 2007 et al, p155). In the 1890s and 1900s a reform movement recalled the planning of the Baroque mixed with Beaux-Arts elements, known as City Beautiful came to prominence in US cities such as Chicago and Washington D.C. which believed that the beautification of cities could counteract the moral decay of the poor, encouraging ‘civic virtue’ (Bluestone 1998 pp.245-62).

Both the picturesque and the axial boulevards of the Beaux-Arts movements were influenced greatly by the perspectival composition techniques (Field, 2007 et al, p128), once again illustrating a cross over between urban agendas, design paradigms and design techniques.

3.3.5 Picturesque-Modern

The concept of grand terminating vistas did not stop with the rise of Modernism. The capital of Brazil, Brasília, inaugurated in 1960, applied the CIAM\(^1\) principles established in the Athens Charter of 1933. Designed by Brazilian urban designer Lúcio Costa with and architect Oscar Niemeyer as chief architect (Underwood 1994, p.224), Brasilia is essentially a gridded city bent in the centre, the Eixo Monumental (Monumental Axis). The focal point of this axis is the Congresso Nacional (National Congress). Niemeyer and Costa worked closely to set up a strong relationship between the buildings and the city plan with the view down the centre of the axis used as the point for perspectival composition (Sennott 2004 p.164). Similar to picturesque designers, the perspective image (see Figure 17), was used to drive the composition informing the plan. The composition of the towers, bowl and dome of the Congresso are enhanced by the

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planning of the avenue, and the editing of other less important buildings by either keeping them away from the Congresso buildings, or by sinking them into the ground (see Figure 19).

3.4 The Healthy City: Urban Amenity

3.4.1 Unhealthy Industrial City

During the 19th Century, the industrial revolution brought the promise of better wages to cities, an alternative to the dire poverty of the countryside (Daunton 2004, ‘Death in the city’ section). This new urban agenda for workers to be located in close proximity to industry led to a great population increase and densification within the cities. The cities were not well suited to these numbers and epidemics of diseases such as cholera and typhoid from polluted water, typhus spread by lice, ‘summer diarrhoea’ – from flies feeding on horse manure and human waste contaminated food (Sandlin 2006 p.11).

In 1851, a boy born in inner Liverpool had a life expectancy of only 26 years, compared with a boy born in the small market town of Okehampton, who could expect to live to 57 (Daunton 2004, ‘Death in the city’ section).
This dramatic difference in life expectancy was believed to be due to disease related to the foul odour coming from the human waste that covered the streets, as well as the ‘several tanneries which fill the whole neighbourhood with the stench of animal putrefaction’ (Sandlin 2006 p. 10). Surprisingly the common belief was that the problems were to do with a ‘lack of through ventilation’ of the cities as opposed to say having people constantly wading through excrement.

…putrefaction and stench, was also a threat to public health. Until the general acceptance of the germ theory of disease in the later 19th century, fevers and epidemics were explained by “miasmas”, exhalations from decaying matter which poisoned the air (Daunton 2004, ‘Miasmas and morals’ section).

The desire to improve air flow in cities became society’s the new prevailing urban agenda.

3.4.2 Haussmann (Health and Air Flow, 2D Subtractive Approach)

Planning historians customarily attribute the origins of modern planning to Haussmann’s plan for Paris (Neuman 1998 p.209). Commissioned by Napoleon III, between 1852 and 1870 Baron von Haussmann’s renovation of Paris occurred. Haussmann’s renovation involved the radical reshaping of Paris with wide boulevards being cut through the medieval city in what Le Corbusier later described as ‘urban surgery’. (Le Corbusier 1929 p.93). The surgery was in direct response to the prevailing urban agenda for improving the health crisis in a ‘sick’ Paris. The wide boulevards would create better air flow (as discussed earlier); created compositional terminating vistas; and at the same time carry new a sewerage system. It was Haussmann who objected to a proposal to channel human faeces mixed with storm water to flow into the Seine (Kirkman 2007 para.6).

Le Corbusier suggested that the boulevards ‘were not based on strict deductions of the science of town planning. The measures he took were of a financial and military character’, though he does go on to praise the urban surgery for having ‘admirable foresight’ opening the city up to the ‘rabbits’, [he perversely describes motorists as rabbits] (Le Corbusier 1929 p.256).
The *Haussmannisation* also involved strict rules for new buildings along the boulevards, with height limits, including a set angle (45 degree) for mansards (Jacobs 1993 p.57), for visual unity, but equally importantly, to ensure good daylight penetration. Haussmann’s changes to Paris demonstrate a very strong cross over between the urban agendas of health and military control with the urban design paradigm.

### 3.4.3 Cerdà’s Comprehensive Theory of Urbanisation

*Today everything is movement, everything is expansion, everything is communicativeness* (Cerdà 1867 translated, Puig 1999 p.57).

In 1867 in Madrid, Catalan urban planner Ildefons Cerdà published his comprehensive theory of urbanisation, *Teoría General de la Urbanización*, with its five interconnected steps, covering theory, economics, law, administration and politics. Cerdà was the first person to use the terms *urbanisation* and *urbanism* (Rippon 2005 p.5), terms that have since become popular in the field of urban design. Urbanism is ‘the study or appreciation of the processes of change in towns and cities; making towns and cities work; city planning’ (Cowan et al. 2005).

Prior to Cerdà publishing this study, Barcelona, much like Paris, had become extremely over crowded and stricken with similar health problems and thus similar urban agendas. In addition, the city had been closed to development beyond the medieval walls with real-estate prices unaffordable for the working class (Margrinya 2006 p.81), so in addition to society’s prevailing urban agenda for amenity of daylight and clean air, there was also a desire for affordability.

In 1859 Ildefons Cerdà produced plans for the extension ‘Eixample’ to Barcelona that embraced the grid layout with 45 degree chamfered corners and large diagonal avenues. Unlike the urban agendas for expressing civilisation or controlling a population, Cerdà believed the layout was to be an egalitarian, spatially just extension to the city. (Rippon 2005 pp.5-7). Cerdà’s proposal was ‘grounded in reality, seeking to adapt cities to the new needs for transport and expansion’, ‘by
new, rail based mobility, as well as the needs defined by the ‘hygienists’ (Margrinya 2006 pp.81).

Though Cerdà was aware of city remodelling that was happening elsewhere in Europe (such as Paxton’s London, Haussmann’s Paris and the Vienna Ring) his proposal was for a more of ‘a holistic, complete city’, extending the city with a networked rail system alongside a new ‘science of urbanization’ (Margrinya 2006 p.13). ‘Provision of drainage, light and sunshine, the spatial quality’ were ensured with his mantra ‘that buildings and the street were indivisible’ (Rippon 2005 p.5). Cerdà produced street sections that show a multitude of uses such as walking pedestrians, pedestrians dragging carts, horse drawn carriages and light rail. ‘He also designed the locations of services gas, telecommunications, and sewers etc.’ (Margrinya 2006 p.83).

Cerdà designed housing types around a perimeter block model, balancing bourgeoisie and working class expectations with hygiene requirements and housing affordability. (Margrinya 2006 pp.81, 84, 88)

_Cerdà however was far more that just a forerunner of those who have until recently be credited as the founders of modern urbanism. In many ways he actually went further than did those who came after him… his systematic zeal, his multi-disciplinary approach, and the thoroughness with which he undertook the analysis_ (Puig 1999 p.23).

Cerdà is noteworthy not only because his work illustrates the overlap between the three facets of urbanism, but also because of his holistic approach to analysis and design, a concept that will be revisited in later chapters.

![Figure 22: Street cross section showing central rail network, horse and person drawn cart lanes, pedestrian paths, storm water drainage and sewerage, gas and water lines, light pole locations, with tree locations and sizes.](image)

**3.4.4 Howard Garden City (2D Plans + Written Rules)**

Another important urban designer concerned with urban health that came after Cerdà, was Ebenezer Howard in the UK, who published _To-morrow: a Peaceful Path to Real Reform_ in 1898 (reissued in 1902 as _Garden Cities of To-morrow_) in response to the ‘Great Stink’ and health problems of UK cities. ‘What was needed was through ventilation, the provision of parks to act as lungs for the cities, and a general process of cleansing’ (Daunton 2004, ‘Miasmas and morals’ section).
Howard’s Garden City, zoned mix of country and city life, proposed a radial boulevard layout, central parks surrounded by public buildings, surrounded by the ‘crystal palace’, a kind of elongated glazed arcade shopping mall opening onto the park for shopping in ‘most doubtful of weathers’. All this ‘near to every dweller in the town’, within ‘600 yards’ [550 metres] from the furthest home. Moving out from the crystal palace was more discrete zoning, with a ring of schools and churches, with the industrial zone making up the outer ring surrounded by agriculture (Figure 23, Figure 24).

Unlike Cerdà’s manifesto which was extremely detailed and tested on the specific site of Barcelona as a ‘case study’, Howard’s proposition was less resolved, and included a disclaimer stating that the proposal was a ‘diagram only’ dependent on the eventual chosen site. This ‘gave a new dimension to the town plan; a versatile freedom during its creation’ (Lucey 1993 para.12).

Howard used the city of Adelaide, Australia as an example of how to deal with garden cities that grew beyond their capacity, by adding a satellite separated by parkland (see Figure 25) as is suggested by Colonel William Light’s 1837 Adelaide plan (Howard was however mistaken, as both communities were laid out simultaneously) (see Figure 26).
In 1903, English urban planner Raymond Unwin put Howard’s plans into practice with the town of Letchworth, the United Kingdom’s first garden city. Howard’s plans were subsequently adopted around the world, seen as a new alternative to high density cities, however much of the intent of the Garden City plan was over-looked or misinterpreted, resulting in new suburbs that did not have the walkable access to civic buildings, parks, shopping or work places. His Crystal Palace mutated into what is now known as the shopping mall. ‘Ironically, the garden city ideal of building on a green-field site was used to extend the cities of Britain further into the country side, the emphasis on low density settlement caused suburban sprawl’ (Laurence 1993 para.11). The concept of ‘suburban sprawl’ will be discussed in greater detail later in this chapter.

Ebenezer Howard’s ideas are still influential in urban design. In 1913 by Howard founded the International Federation for Housing and Planning (IFHP) (then called Garden Cities and Town Planning Association) which continues to run annual conferences today (see Appendix 10.16.3 p.341).

3.4.5 Modernist Separation and Movement

There is a great deal of criticism of the design approach of Le Corbusier and others in the Modernist paradigm. As mentioned earlier, the modernist masters such as Hilberseimer, Gropius and Le Corbusier, much like Ebenezer Howard before them, advocated the separation of land-uses with planar land zoning for urban health reasons, and for street hierarchy, for the perceived reason of improving safety. The concept of use-zoning is often attributed to the Modernist movement (Krier 1998 pp.67, 69), though as I have explained above, this is not the case. The modernists were, however the first to attempt to draw movement in their plans, developing a new design analysis technique using the fourth dimension – time. This use of the fourth dimension is thought to be the influence of artist such as the Italian Futurists and the work of Paul Klee. ‘Movement could now be thought of as part of the character of an object. When Gropius ‘designed a factory he did not merely design a modern shape, but added movement shown by arrows, as new dimension of form’ (Rowland 1966 p.104). The modernists drew not only the buildings and roads, but also the movements of the objects that inhabit them (people and cars). This use of the fourth dimension, ‘had a profound influence on town planning’ (Roland 1966 p.104), an influence that I will investigate further using contemporary technology in later chapters.

‘A city made for speed is made for success’ (Le Corbusier 1929).
Along with the representation of movement, the modernist city planners adopted the use of detailed city studies to make strategic recommendations to improve urban health and population movement. Scottish planner Patrick Geddes (1854 - 1932) is associated with the influential mantra of ‘survey-analysis design’ (SAD) design technique, which involved the rigorous surveying of a site and the design coming as a scientific determinism. ‘The SAD method produced sad results. It should be put out to grass like a poor old tired horse’ (Turner 1991 para.1).

...the result of a pseudo-scientific, clean-hands, drawing-board-rooted design method. For landscape architects it was the Survey-Analysis-Design (or SAD) Method. One conducted a semi-scientific Survey; one analysed the results (usually on drawings with jagged lines and arrows); then one performed a creative leap and produced a design. More often than not the design had little relationship to the survey and analysis. The method was not a success (Turner & Watson 2000, para.4).

The modern movement encouraged repetition for efficiency, particularly in the post war housing shortage. This architecture had a social conscience; its aim was to provide for all the inhabitants a social, an economic and above all a democratic city, planned for all the people (Laurence1993). The scientific determinist urban design approach involved many studies on maximisation of housing capacity against minimisation of amenity loss. Gropius, Le Corbusier and Hilberseimer each used the design technique of physical models with lights as well as drawn plans and sections with solar tables to work out their buildings effects on solar amenity – over shadowing (Rowe & Koetter 1978 p.57) (see Figure 29). The issue of measuring solar amenity remains an important one and will be examined in later chapters of this thesis.
3.5 The Consolidated City: Density Distribution

3.5.1 Euclidian Zoning and Suburban Sprawl

How a population is distributed within a city has been and remains a crucial factor of urbanism. Though the technique of land-use zoning had been adopted in many cities in Europe, and to a lesser extent in some cities in the US, New York City’s zoning ordinances in 1916 are commonly considered to be the first modern use of zoning (Burdette 2004 p.18). What began as a technique used for land-use separation became the basis for a whole urban design paradigm.

Driven by a desire (urban agenda) to separate lower class fabric markets from the upscale retailers of 5th Avenue, as well reducing density for the health, safety, and well being of the people of the city, the government was granted the authority to enable the new zoning ordinances (Burdette 2004 p.3). The amalgamation of common separation principles of Howard’s Garden City model, the modernist’s rationalist hierarchical model were adopted with the addition of ‘solar envelopes’ that gave the permissible building envelopes the well known pyramidal form. The new zoning was ‘sold’ to the public with the use of highly seductive renderings by architect and artist Hugh Ferriss, in what was a ‘testament to the influence dramatic drawings’ can have on a city (Neuman 1998 p.210). This was a pivotal point in urban design history. It marked yet another change in the techniques used by urban designers, a move away from urban plans ‘towards zoning as a determinant of urban and suburban growth’, shifting the emphasis ‘away from plans, designs, and
urban form to zoning, law, and land-use,’ (Neuman 1998 p.210). It was also perhaps indicative of
the beginning of the fragmentation of the architecture and urban design disciplines, with the
separation of the design (in the form of Euclidian zoning) and the representation of the design by
rendering specialist. The example of fragmentation of disciplines relates to the discussion in
section 1.6 (p.10) and will continue to be elaborated upon in later Chapters.

The term ‘Euclidian Zoning’, has nothing to do with the Greek mathematician Euclid, it actually
comes from the legal case of Village of Euclid v. Ambler Realty Co. (U.S. Supreme Court 1926)
where the business Realty Co. who owned land in the town of Euclid Ohio in the United States,
challenged the town planning zones which were in the process of being implemented, which
sought to prohibit industrial uses on their site. The argument put forward by Ambler Realty Co’s
lawyers was that the ‘zoning being unconstitutional’, was dismissed in the supreme court with the
verdict that the zoning was not an unreasonable extension of the village’s police power—the
‘power to regulate for the advancement of a community’s health, morals, safety, or general
welfare—provide the legal basis to zone’ (Burdette 2004 p.5). This judgment immediately altered
the position of the urban designer forever to one who would need to deal with the legalities of
urbanism.

The zoning technique – originally conceived to fulfil the urban agenda for better living conditions
– would have unforeseen effects on cities; according to many urban critics (Holcombe 2002),
zoning encouraged ‘urban sprawl’. ‘Euclidean zoning creates an innate fear of density’ (Burdette
2004 p.14). Zoning seeks to create low-density communities, and utilizes large roadway networks
and parking requirements to accomplish this (Burdette 2004 p.14). ‘Zoning of the post–World
War II era encourages “pods” of development – residential, office, and retail. The result is
multiple auto trips that mitigate against compact, mixed-use, energy-efficient development’
(Peirce 2006). By use of strict zoning and encouragement of low density the city spreads laterally.
The Compact Oxford English Dictionary definition the word sprawl, is: (verb) to ‘sit, lie, or fall
with one’s limbs spread out in an ungainly way; (as adj.) sprawling spread out irregularly over a
large area. In a document measuring the impacts of sprawl in the US, Reid Ewing defines ‘sprawl’ as:

… [having] four dimensions: a population that is widely dispersed in low density development;
rigidly separated homes, shops, and workplaces; a network of roads marked by huge blocks and
poor access; and a lack of well-defined, thriving activity centres, such as downtowns and town
centres. Most of the other features usually associated with sprawl — the lack of transportation
choices, relative uniformity of housing options or the difficulty of walking — are a result of these
conditions (Ewing et al. 2002 p.3).
Predominant American critic of both zoning and urban sprawl, James Howard Kunstler suggest that ‘sprawl involves a strict separation of human activities, mandatory driving, and huge supplies of free parking’ (Kunstler 1998 p.16). Kunstler speaks with distain about Wall-Marts and the Victor Gruen conceived mega-shopping-malls (Economist 2007)\(^1\) that are scattered across the American landscape. The phenomena of urban sprawl is world wide with the amount of area (area per capita) consumed by spreading cities through Europe ‘has more than doubled during the last 50 years as cities have begun to sprawl,’ (Batty et al. 2003 p.7). The most notable examples of sprawl are, however, in the US and Australia (Haughton & Hunte 2003 pp.81, 84). The new urban design technique of zoning is not the only cause of urban sprawl, but there is compelling evidence to suggest that sprawl and Euclidian zoning are strongly related. In this case the community urban agendas that relate to the 19\(^{th}\) century concerns for separation of programs for health reasons mixed with the new need to house returning soldiers and their families – “baby boom” (Burdette 2004 p.17), as well as other factors, such as cheap access to cars and cheap fuel, led to the ‘urban sprawl’. This debate about zoning and sprawl would become the centre of architectural and urban design debate for the next 65 years continuing to this day.\(^2\)

Many of today’s zoning and land-use regulations, building codes, and rules were written in response to public health and safety issues of a century ago, from tenement buildings without running water to slaughterhouses invading residential neighbourhoods. Today we’re stuck with sterile zoning and restrictions on building materials and methods alarmingly out of sync with present-day needs (Peirce 2006 ‘Terminal Consumption’ section).

Urban sprawl is generally perceived to be undesirable relative to more compact and higher density development, largely due to the lack of diversity that it encourages and the economic resources that it consumes (Batty et al. 2003 p.6).

During the last year of WWII in Melbourne Australia, Barnett, Burt and Heath (1944) illustrated concerns for projected population growth and urban sprawl with mapping of urban growth (see Figure 30). ‘The increasing outward, uneven spread of the metropolis of Melbourne is a typical early sign of the overgrown, strangulated city so characteristic of old world towns’. The authors then go on to advocate a ‘Howardesque’ Garden (Ebenezer Howard) city model of green wedges and a surrounding green belt. ‘We must provide an agricultural belt, five miles wide to encircle the inner perimeter being approximately ten miles form the city’s centre… Now is the time to do this… What a Godsend it would be to the future citizens of Melbourne!’ Going on to talk about

\(^1\) Refugee form Nazi occupied Austria, Victor Gruen did not like the unsocial suburban lifestyle of 1950s America, and wanted to design a community building type that was reminiscent of the arcades and plazas of Europe. He came up with the now universal model of the shopping mall surrounded by carparking. (The result was probably not what he had in mind).

\(^2\) To see the currency of this debate, see http://books.google.com/books?q=urban+sprawl+2008&btnG=Search+Books.
the cost of servicing the (then) outer suburbs, ‘served by roads, and light and water and sewage at tremendous capital cost… The stupidity of it all! The inefficiency of it all! The ugliness of it all” (Barnett, et al. 1944 p.57).

Figure 30: From ‘We must go on’, Outward spread of metropolis of Melbourne, 1914 to 1940 p.57.

The green wedge systems radiating from the centre mainly along existing water ways and creeks would terminate at the agricultural belt. Melbournians would be ‘never more than 10 minutes’ walk from a park, never more than 10 miles from the country’ (Barnett et al. p.59). This vision for Melbourne was never to be fulfilled, though there are some remnants of the green wedges (those not filled by freeway now). Ironically, Melbourne academic and anti-densification spokesperson Miles Lewis has praised this particular form of growth boundary, saying that the failure to adopt Melbourne’s green belt ‘can be attributed to the negligence or apathy of the State Government’ (Lewis 1999 pp.120, 121).
The questioning of sprawl as an appropriate mode of growth in Australia continued through the 1940s into the 50s and 60s by Melbourne architect and critic Robin Boyd with the scathing attack particularly on the aesthetics of suburbia, the pastiche of scattered tastelessness in the *Australian Ugliness* (Boyd 1968), though this had little effect on the lateral spread of the city.

### 3.5.2 Oil Crisis Loss of Global Stability and Reliance on Foreign Oil

One critical event that did have an effect on the lateral spread of some of the cities was the 1973 *Oil Crisis*, which contributed to shaping many aspects of recent urban agendas and urban design paradigms. On the 17th of October in 1973 the first ‘oil crisis’ began, when the members of OAPEC (Organization of Arab Petroleum Exporting Countries) decided that they would not export to nations that had supported Israel in the *Yom Kippur War* which included the United States and allies. By 1974, the price of oil quadrupled to nearly US$12 per barrel (CBS News 2007).

This crisis had a dramatic effect on the use of fuel in the affected countries with queuing for fuel and fuel rationing, as well as a rethink of the kinds of cars and engines by those at General Motors and an introduction to the US and Australia of smaller 4 cylinder European and Japanese cars such as Volkswagen, Toyota, and Nissan. (Stiglitz & Weiss 1981 pp.393-410) The US Congress issued a 55mph (88kph) speed limit on highways, which was ‘a good thing; not only did oil consumption go down, but fatalities decreased overnight’ (Horton 2006 para.9).
The concern was exasperated by U.S. oil production also being called into question. ‘In 1956, M. King Hubbert’ predicted that U.S. oil production would peak in the early 1970’s. Although Hubbert was widely criticized by some oil experts and economists, in 1971 Hubbert’s prediction came true’ (Deffeyes 2005 para.1), meaning that in many countries, a need to reduce dependence on oil became a prevalent urban agenda.

### 3.5.3 Copenhagen – Giving OAPEC the Finger (Plan)

One city that acted on this new international agenda to lessen city’s reliance on oil was the city of Copenhagen, Denmark, who went beyond just changing the speed or kinds or sizes of cars. A new paradigm emerged in Copenhagen that began to use a variety of planning techniques focused on minimising oil dependence. Copenhagen began to strictly enforce urban growth corridors along their existing rail system in the ‘finger plan’ using 5 rail lines separated with ‘green belts’. In an attempt to ‘wean itself off oil’ (Hume 2007), the city also invested heavily in rail and cycling as alternatives to cars. The city introduced new bike paths throughout the city, and reduced the amount of car parking, reducing it gradually, by 3% every year. According to Danish architect urban theorist, Jan Gehl (in his keynote presentation at the 2007 IFHP conference) by doing this gradually ‘nobody really noticed’. Copenhagen now has over 40% of all journeys in the city on bicycle and according to Ritt Bjerregaard, the current Lord Mayor of the City of Copenhagen, the aim is to increase this to 50% by 2015.² Through the 1970s Copenhagen also pedestrianised the Strøget (literally ‘the straight’ street), against much resistance from traders – ‘the merchants cried bloody murder’ (Hume 2007), but civic officials persisted and now it’s the premier shopping district with has about 80 000 people walking the street a day (Gemzoe 2001 p.30). Despite its massive spending on infrastructure and active dissuasion of cars, The World Economic Forum recently rated Copenhagen the third-best country for business on the planet (Hume 2007).

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¹ Marion King Hubbert was an American geoscientist who contributed the theory of the Hubbert curve theory, otherwise known as ‘peak oil’ (Deffeyes 2005).
² Lord Mayor of the City of Copenhagen, Ritt Bjerregaard’s keynote address at the 2007 IFHP conference in Copenhagen (23rd-26th September).
3.5.4 Growth Boundaries – In North America

A similar urban design paradigm emerged in parts of the United States, where a number of cities decided to actively pursue urban consolidation. In Washington DC, schemes similar to that of European cities such as Copenhagen’s finger plan technique were proposed. Growth was restricted to areas along transit corridors.

In 1973 in Portland Oregon, the Land Conservation and Development Act required:

> …every city in the county in the state adopt and enforce a comprehensive plan in accordance with a set of state-wide goals. Perhaps the most important of the objectives was the desire to protect rural areas and agriculture… the most important tools in achieving these results was the urban growth boundary, a version of the greenbelt proposed by garden city reformers since the turn of the century (Bruegmann 2005 p.204).

The plan was implemented to some extent with dense nodes at railway stations of the Metro system.
Like Copenhagen, Portland moved to emphasise pedestrian and rail transit along side measures for controlling growth. ‘Each work day, 23 percent of all downtown workers commute by transit, increasing to more than 40 percent during peak commute periods,’ (Moore 2001 p.18). These cities serve as important case studies for the concept of consolidated urban growth, a concept I pursue in later chapters.

3.5.5 Vale Modernism – The End of a Design Paradigm

Ironically, almost at the same time that cities were investigating consolidated urban growth, the concept of high density living was also being questioned. Modernist housing tower blocks that responded to a housing shortage agenda were being blamed for a number of social problems (Gallagher 2000, ‘Post War Optimism’ section). The turning point throughout the world occurred in 1973, which is sometimes referred to as the year modernism died, ‘the end of the long post-war boom in 1973 heralded the start of two decades of intermittent recession and rising unemployment. New social problems would fester in Modernist schemes across Britain’ (Gallagher 2000, ‘Ronan Point’ section). In Britain, since the 1956 Housing Act, councils had been paying a premium for construction of blocks of flats higher than 5 levels. The flats were filled with the current underclass and became beset with social problems and crime (Gallagher 2000, ‘Ronan Point’ section).

Le Corbusier’s dream of concrete towers floating over lush landscapes was misread and reproduced *ad nauseam* without any of the pizzazz of his own built versions such as the Unité d’Habitation in Marseille, France. Instead of the green landscape rolling under the towers, the *pilotis* (columns) were filled in, or became a landscape of carparking. A pivotal moment for these high-rise buildings occurred prior to 1973 in East London, when a building known as Ronan...
Point partially collapsed due to a domestic natural gas explosion killing a number of occupants. In the US, the Pruitt-Igoe housing estate was demolished (1973-75). According to Parisian urban artist Cyprien Gaillard:

*Modernism died in 1973, when they bombed this neighbourhood in St. Louis called Pruitt-Igoe* (Gaillard 2008 para.3).

In Australia, the Victorian Housing Commission (now the ‘Office of Housing’) had also been building high-rise precast concrete towers to house the urban poor. Construction was also halted around 1973, with the perceived failure of medium and high density social housing, as the housing blocks had become known as vertical ghettos (Hayward 1995), and shortly after the Australian ‘national government withdrew from involvement in urban planning’ (Gleeson & Low 2000 p.66). The cultural stigma of the high density living continued ‘it had left a virtually intractable social problem… submarket dwellings… a dumping ground, degenerating both physically and socially stigmatized’ (King 1987 p.250). Unlike European cities, where the majority of people live in medium density, in Melbourne there ‘remains a degree of suspicion about a form of accommodation [flats] historically occupied by fast livers, welfare recipients and European refugees’ (Lewis 1999 p.77). This suspicion of denser forms of housing that were part of the Modernist design paradigm continues in some resident groups in contemporary society which will be explored in the next chapter.

3.6 Conclusion

In this chapter I have outlined four important themes in the history of urban design. I have made reference to three key facets of urbanism (society’s prevailing urban agendas, urban design paradigms, and design techniques), to test whether a relationship existed in the past between society’s prevailing urban agendas and urban design. I have demonstrated that a symbiotic relationship between did exist between the facets by showing that many of the most important changes in the direction of urban design have occurred due to developments in representation and design technology; and major shifts in society’s cultural aspirations and understanding of their environment.

In Section 3.2 (pp.31-33), I illustrated that a relationship existed between the design of the shape of street networks; advancements in surveying technology; and urban agendas (military, cultural,

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1 BBC’s ‘On this Day’ article available at news.bbc.co.uk/onthisday/hi/dates/stories/may/16/newsid_2514000/2514277.stm.
2 The St. Louis Housing Authority (SLHA) ordered the demolition of the housing estate due to dangerous conditions caused by drug and gang problems (CIN 1999 para.5).
public health or financial) by examining the historic use of the grid. This important relationship between agendas, technology and street layout is investigated in greater detail in later chapters.

My discussion of urban composition in Section 3.3 (pp.33-40) shows that the technological discovery and comprehension of perspective influenced both social understanding of cities as a whole, and the approach to designing urban spaces. This influence was illustrated most clearly by Michelangelo’s Campidoglio in Rome, which was a clear built expression of cross-pollination between the design paradigm (Renaissance), design technique (perspective) and the urban agenda for the emphasis of the Church over the Forum (see Figure 35 RHS).

In Section 3.4 (pp.40-45), I established the importance of design responses to social needs for urban amenity and healthy urban environments. The visionary example of Haussmann’s Paris was cited, along with the holistic approach of Ildefons Cerdà in Barcelona, who demonstrated an effective balance of urban amenity such as daylight, air flow, and sewerage with an overlay of transport connectivity. These examples are important in the context of this thesis for their response to society’s health agendas, but more importantly, for their holistic cross disciplinary approach to urban design, particularly in the case of Cerdà, which has informed much of the later half of this thesis.

In Section 3.5 (pp.47-54) population distribution was discussed. I looked at separatist models of the Garden City (both Howard’s and Le Corbusier’s versions thereof) and Euclidian zoning along with some of the perceived effects. The representation technique of drawing movement and the social demand for safety of traffic influenced the ‘street hierarchy’ design paradigm having the unforeseen effects of contributing to the phenomenon of urban sprawl. I touched on counter arguments to density dispersion with reference to urban consolidation approaches in Copenhagen DK, Washington D.C. and Portland, Oregon in the US. I also touched on perceived social problems of high-density Modernist towers.
By exploring significant themes in urban design history through my conceptual filter of the three facets of urbanism, I have confirmed the first assumption in my hypothesis by demonstrating that a strong relationship between society’s prevailing urban agendas and urban design once existed. To establish that this relationship is no longer the case and that a gulf has occurred between the two, the following questions need to be answered: What are the urban agendas of today? What are the current urban design paradigms? What are the representation technology and design techniques now possible? What is the relationship between these three facets of urbanism today?
Chapter 4. Contemporary Context – Three Facets of Urbanism

4.1 Introduction

My hypothesis in section 2.2 (p.17), stated that a gulf between contemporary society’s prevailing urban agendas and urban design practice can be minimised by developing a new rapid, defragmented design approach.

This hypothesis is based on the assumption that this gulf currently exists. The major findings of the previous chapter confirmed the first part of this assumption demonstrating that a strong relationship between prominent urban agendas and urban design throughout history has occurred, by highlighting the symbiotic relationship between three key facets of urban design – society’s prevailing urban agendas, urban design paradigms and design techniques.

To explore the second part of this assumption, that this strong symbiotic relationship is no longer the case, and that a gulf has occurred, it is important to understand this assumption through a review of contemporary urban design in the light of important contemporary urban agendas of society.

The aim of this chapter is to test this relationship by reviewing the same three facets of urbanism discussed in Chapter 3, but with the focus on a contemporary context. I seek to answer the following four key questions:

- What are the key contemporary urban agendas of today?
- What are the predominant contemporary urban design paradigms?
- What design techniques are being used by each of the design paradigms?
- Is there currently a symbiotic relationship between the three facets of urbanism?

I have broken this chapter into three main sections, which attempt to answer the four questions above. Section 4.2 is directed at the first question and identifies seven key concerns informing the prominent urban agenda of contemporary society – sustainability. The aim of this section is to establish urban concerns needing to be addressed in order to achieve sustainable urbanism such as reducing reliance on oil in preparation for peak oil; reducing car dependency and CO₂ emissions from car use; providing a range of housing types to discourage ghettoisation through planning codes; and benefiting public health by improving the connectivity of public transport, pedestrian and cycle networks.

In the second section, 4.3: Five Contemporary Urban Design Approaches and Associated Techniques, I attempt to answer both the second and third questions stated above, by reviewing both
contemporary urban design theory, by looking at five predominant contemporary urban design paradigms, and by examining design techniques (and technology) used by each of these paradigms in practice. For this section I draw an analogy with the ‘five stages of grief’ by Swiss-born psychiatrist, Kübler-Ross (1969 p.IV). The reasons for this analogy will be explained at the beginning of the section.

In the third section, Section 4.4, I conclude the chapter with a summary of findings and discussion of the gaps in theory and practice which has directed my further research in the second half of this thesis.

As in the previous chapter, the examples cited here are not restricted to one particular region of the world. I discuss urban design paradigms in cities that share similar urban agendas to Melbourne, Australia. Sprawling cities in the US have the most obvious similarities, but, as I note, contemporary urban agendas are similar in many parts of the world.

4.2 Contemporary Urban Agendas

As I identified in the previous chapter, there are many social concerns informing urban agendas. In this section I discuss peak oil; climate change; public health; long commute times; social segregation; and urban amenity, along with the over-arching desire for sustainable development, which are considered to be of prime importance in contemporary society (Deffeyes 2008; Lucas & Millar 2008 p.2; Kuiper 2006).

4.2.1 Peak Oil – Loss of Cheap Fuel

The first of society’s urban agendas I will touch on is a need for urban strategies to deal with peak oil. The concern for oil shortages, which influenced a number of cities’ urban planning in Scandinavia and the US in the 70s, is now emerging as a global concern. As I alluded to earlier, in 1956 M. King Hubbert predicted using the Hubbert peak theory that US oil production would peak around 1970, which turned out to be accurate (Deming 2001 p.52). Further predictions using the same theory have also been made globally which suggest that world oil production will peak in the next few years. The geologist who worked with Hubbert, Kenneth S. Deffeyes argues that this peak already occurred in December 2005 (Deffeyes 2008, para.4).

“Global oil consumption is still expected to increase by 1.4 million barrels a day this year, driven by demand in China and the Middle East.” According to the Energy Information Agency, world oil production is now down a million barrels per day from the 2005 peak (Deffeyes 2008, para.4).
With the dramatic increase in the demand for oil in China, the Middle East and India, the effects of peak oil are exacerbated, and may result in world turmoil, social upheaval, more wars for oil, and a radical rethinking of what it will be like to live in suburbs in the future (Kunstler 2006 p.243). Car-dependent suburbia may become the ‘slums of the future’ (Kunstler 2006 p.18). Already in the US, the suburban poor spend on average 40 cents of every dollar of their income on transport (Peirce 2006, ‘Cities Taking the Lead’ section).

At the recent IFHP conference in Copenhagen (2007), Professor Peter Newman, a leading researcher in environmental science and sustainability from Australia, presented an image from George Miller’s 1981 classic Mad Max 2 as an example of what post peak oil outer suburbs may be like if immediate changes to the way people live are not made. In the film Max, played by Mel Gibson, travels around the wasteland along with other scavengers in search of fuel, killing those with stockpiles. Newman comes to a similar conclusion about the consequences of oil dependence to that of North American author and social critic James Howard Kunstler:

_We are not going to run Wal-Mart, Walt Disney World, and the interstate highway system on hydrogen, coal synfuels, tar sand or oil shale distillates, bio-diesel, ethanol, recycled french-fry oil, solar electricity, wind power, or nuclear fission. The stark truth of the situation is that we are simply going to have to make other arrangements – Suburbia will be coming off the menu_ (Kunstler 2005 p.2).

The cities that will be hardest hit by peak oil will be those currently with the highest use and those with limited transportation options – the ‘car dependent’ (Newman & Kenworthy 1989 pp.32, 38). US cities are using twice the transport energy consumption of Australian and Canadian cities, and 4 to 6 times that used by western European cities and wealthy Asian cities. Even in cities in the Middle East, where much of the oil is produced, oil use is around a sixth of that of US citizens (Kenworthy 2003 p.14).

The cities with comprehensive public transport systems will be better prepared for peak oil as public transport energy use is ‘only a fraction of private transport energy use, never exceeding 23% of the total passenger transport energy use in any region regardless of the extent of service and usage’ (Kenworthy 2003 p.26).
Within academic literature, only a small number of people disagree with this conclusion (for instance Robert Bruegmann (2005 p.77), Wendell Cox (2003) and Joel Kotkin (2005). The bulk of academic literature supports the conclusion that a consolidated approach with increased density and well-connected public transport will better prepare our cities for peak oil. Higher density also supports efficient transport and vice versa, ‘high density offers the opportunity for average trip lengths to be short and to foster successful, economically viable public transport’ (Pushkarev & Zupan 1977).

With the unprecedented success\(^1\) of the global warming documentary film *An Inconvenient Truth* presented by former US Vice President Al Gore and directed by Davis Guggenheim, the issue of peak oil moved to the forefront of popular culture and should now be considered a key urban agenda for contemporary society.

### 4.2.2 Climate Change – Loss of Environmental Stability

*Warming of the climate system is unequivocal* (IPCC 2007 p.7).

*Atlanta produces 105 times more CO\(_2\) per capita than Ho Chi Minh City* (Kenworthy 2003 p.1).

The second of society’s contemporary urban agendas is climate change\(^2\). *An Inconvenient Truth* also increased the prominence of climate change in the media and political discussions around the world. ‘Global warming has moved quickly up the agenda list of many cities and counties despite – or, arguably, in reaction to – the Bush administration’s studied indifference’ (Peirce 2006, ‘A Local Response to a Global Challenge’ section). During his visit to Australia, Gore caused a media stir when he compared John Howard, then the Prime Minister of Australia, to those who believe the earth is flat, ‘Though there are some few people who still think it’s flat, we generally ignore that view because the evidence has mounted to the point where we understand that it shouldn’t be taken seriously.’ (The 7.30 Report 2006) The evidence to which Gore refers is has been collected over many years (Betts et al. 2005 p.358, IPPC 2007 p.23) (see Figure 36).

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\(^1\)The documentary won Academy Awards for Best Documentary Feature and the accompanying book authored by Gore reached #1 on the paperback nonfiction New York Times bestseller list. The film has grossed over $24 million in the U.S. and over $49 million worldwide (BOM nd.).

\(^2\) Put simply, the theory of climate change is that a build-up of greenhouse gases (predominantly CO\(_2\)) in the atmosphere traps the sun’s heat, causing the earth’s temperature to rise and altering the climate in different parts of the world. For a popular culture explanation of climate change see “Crimes of the Hot” Futurama. www.youtube.com/watch?v=NS6UHfzhm5c.
The Stern Review on the Economics of Climate Change is a report released in 2006 by economist Nicholas Stern for the British government. Stern argues that there needs to be a decisive investment in combating climate change immediately, failing to do so could have dramatic impacts on global finance with GDP being up to twenty percent lower than it otherwise might be in some countries (Stern 2006 p.94). Stern states: ‘Urban design and land use planning regulations have the potential to facilitate a less energy intensive society, while balancing a range of wider economic and social objectives’ (Stern 2006 p.384).

Other key points are:

- All countries will be affected by climate change, but the poorest countries will suffer earliest and most.
- Average temperatures could rise by 5°C from pre-industrial levels if climate change goes unchecked.
- Warming of 3 or 4°C will result in many millions more people being flooded.
- By the middle of the century, 200 million may be permanently displaced due to rising sea levels, heavier floods and drought.
- Warming of 4°C or more is likely to seriously affect global food production (Osborne 2006 ‘the dangers’ section).

A clear sign of climate change moving into the mainstream political debate was a speech for the Annual Fraser Lecture at the Belconnen Labor Club in Canberra, 30th May 2007 from Kevin Rudd, then the leader of the federal opposition who stated:

Climate change is already a reality – an undeniable reality.
You can see it in the drought – the worst in living memory.
You can see it in our depleting water supplies and crippling water restrictions.
You can see it in the Murray River running dry.
You can see it in rising temperatures – 11 of the 12 warmest years on record occurred between 1995 and 2006.
You can see it in the melting of the Arctic ice cap, retreating mountain glaciers, and rising sea levels.

The core science of climate change is not in dispute (Rudd 2007).

Since 1990, greenhouse emissions from London transport have risen only by 1%. In Victoria, emissions have risen by 27% since 1990, to 14.5 million tonnes of CO₂ (Lucas & Millar 2008 p.2).

One of the major contributors of CO₂ is the use of the car. In the US, 33% of CO₂ emissions come from cars and light trucks (EPA 2004). Australian sustainability researchers Peter Newman and Jeff Kenworthy have suggested that increased density and improved public transport reduces ‘car dependence’ (1989) and thus reliance on oil.

Density reduces transportation energy through several mechanisms: it shortens distances for all modes and makes of transit, bicycling, and walking more viable as alternatives to the car; it also reduces the number of journeys, since when transit is used, many journeys are combined—for example, shopping on the way to or from the train (Newman & Kenworthy 1999 p.26).

Figure 37: (Kenworthy 2003), Per capita passenger transport emissions of CO₂ in 84 cities worldwide (Private and Public Transport).

1 The year of this phrase (1989) shows just how long the relationship between density and pollution has been evident, and emphasises the lack of action in planning and urban design. It should also be noted that these studies have continued to yield consistent results in more recent studies (see Figure 37 - 2003).
US cities generate an average of 4,405 kg of CO$_2$ per person from passenger transport, while the next highest group, the Canadian cities produce roughly half that level (2,422 kg). Australian cities are a fraction lower (2,226 kg). From there on the figures are much lower, starting with the Western European cities (1,269 kg) and followed by the high income Asian cities (825 kg) (Kenworthy 2003 p.17).

The graphs (Figure 37 & Figure 38) show a compelling relationship between density and fuel use with low density cities such as Melbourne showing an embarrassingly high level of fuel use per capita. According to Mike Batty, Professor of Spatial Analysis and Planning at University College London, one of the key problems with sprawl is ‘environmental: low density cities use more energy’ (Batty 2003). This is supported by Stern (2006 p.384) who states ‘Spatial and strategic planning can affect patterns of energy consumption. Higher-density urban environments, for example, typically consume less energy for transport and in buildings’.

Figure 38: Graph from Professor Peter Newman’s ‘Transport, urban form and sustainability’ presented to Gold Coast City Council (www.istp.murdoch.edu.au/ISTP/publications/pnewman/PNewmanUrbanformpres.pdf ) accessed 12-02-08.
It is clear from such evidence that the problem of high energy use and high carbon emissions per capita is now firmly on the contemporary urban agenda.

### 4.2.3 The Long Commute – Loss of Time

The third urban agenda of contemporary society relates to the time lost by long commutes in transit by car. Since the end of WWII, Australian and US cities have given preference to funding road building over investing in public transport. Road-biased funding, along with lateral expansion of cities has encouraged the ‘distance between homes, workplaces, schools and parks [to] be long’ (Kuiper 2006 para.3).

A study of comparative transport speeds in Canberra, Australia conducted in 2004, by environmental and mathematical scientist Dr Paul Tranter centred upon ‘effective speeds’\(^1\) to compare different car models against public transport and cycling, found that cycling and public transport were by far faster than most medium sized cars and considerably faster than the 4x4 (SUV) style ‘land cruiser’ (Tranter 2004 p. 9) when the time devoted to earning the money needed to keep cars running and insured is taken into consideration. This dispels the belief that cars give us the advantage of high speed. The perceived freedom that a car brings is also brought under scrutiny as car drivers are ‘entirely dependent on costly infrastructure, goods and services provided by a multitude of others,’ (Tranter 2004 p.3). Similarly in the sprawling city of Los Angeles, the average motorist is delayed by 93 hours each year in rush-hour traffic (Shrank & Lomax, 2004 p.39). The majority of Australians spend ‘on average, 1 hour 27 minutes per day on car travel’ (ABS 1996).

**Sprawl is regarded as a more costly form of urban development due to the spreading out of infrastructure (utilities and related services). Wasteful commuting through loss of time due to length of journeys and congestion, increased household spending on transport, lack of an alternative choice in transport due to the absence of public transport, loss of agricultural land, and the loss of environmentally fragile lands which include disturbance to local ecologies, all incur greater costs if development is low density and spread out** (Batty et al. 2003 p.6).

This loss of a population’s time is surely unacceptable or infeasible. When a nation loses the equivalent to a full working day each week, changing this situation should be a prime contemporary urban agenda.

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\(^1\) Effective speed can be calculated using the formula: ‘Speed = distance divided by time’, where distance = the total kilometres travelled, and time is the total time devoted to the mode of transport (including the time spent at work to earn the money to pay all the costs created by the particular mode of transport).
4.2.4 Social Segregation – Loss of Diversity

The fourth key urban agenda of society is the growing concern that different forms of urbanism can adversely impact on social equity (Kuiper 2006; Dodson & Sipe 2006). Sprawling cities have ongoing problems with a lack of housing diversity (Burchell et al. 1998). Sprawl ‘tends to segregate residential development according to income, which tends to exacerbate social and ethnic divisions’ (Batty et al. 2003 p.7). Hierarchical street layouts of cul-de-sacs and busy major roads trap both the young and old – ‘those who cannot travel long distances, the very young and the very old for example, are unable to live effectively in such areas’ (Batty et al. 2003 p.7).

The Euclidian zoning and sprawl separate the poor from jobs, with minority groups at a great disadvantage, in the US, particularly African Americans (Burchell et al. 1998 p.23). ‘Sprawl creates a concentration of [the] non-white’ (Batty 2003 p.7). In Melbourne Australia, people with low incomes are being forced to locate in fringe areas which are low density (ABS 2006b), with limited services such as public transport and community facilities, which creates concentrations of poor who are completely reliant on cars. ‘Australian cities’ low income households who move to the outer suburbs because they can afford to buy a home there tend to become more car dependent and so more exposed to rising fuel costs’ (Burnley, Murphy & Jenner 1997). Reducing this urban segregation should be a prime urban agenda for society.

4.2.5 Obesity Epidemic – Loss of Health

The fifth urban agenda of contemporary society is the perceived link between urban form and obesity. ‘There is growing evidence not merely of correlation, but causation between sprawl, a lack of physical activity and major health problems such as obesity, diabetes and depression’ (Kuiper 2006).

Obesity rates in Australia are alarmingly high. Australia is fast closing the gap with the US for being the fattest nation in the world (Lundy 2003). ‘Current estimates suggest that 2.4 million Australian adults are obese and a further 4.9 million are overweight. Levels of obesity amongst women have doubled in the last 15 years’ (Lundy 2003).

These health concerns have encouraged a new kind of urban health research into the relationship between urban form, density, street layout, land-use and obesity.

Proving that denser cities with mixed uses within walking distance encourages walking, and therefore encourages better health, requires numerous large-scaled studies. One such study
conducted in the US concluded that areas with more highly accessible gridded street networks that are more densely populated have higher health ratings than low density sprawled suburbs (Schwartz et al. 2004 p.184). Another US study titled 'Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars’ concluded:

Land-use mix had the strongest association with obesity (BMI $\geq 30$ kg/m$^2$), with each quartile increase being associated with a 12.2% reduction in the likelihood of obesity across gender and ethnicity. Each additional hour spent in a car per day was associated with a 6% increase in the likelihood of obesity. Conversely, each additional kilometre walked per day was associated with a 4.8% reduction in the likelihood of obesity. As a continuous measure, BMI was significantly associated with urban form for white cohorts. Relationships among urban form, walk distance, and time in a car were stronger among white than black cohorts. Measures of the built environment and travel patterns are important predictors of obesity across gender and ethnicity, yet relationships among the built environment, travel patterns, and weight may vary across gender and ethnicity. Strategies to increase land-use mix and distance walked while reducing time in a car can be effective as health interventions (Frank et al. 2004 p.87).

This conclusion is also reflected by the American Journal of Health Promotion: ‘Walkable cities mean less obesity… People who live in high sprawl areas weigh more than people who live in compact cities (Ewing et al. 2005 p.74) and ‘people living in sprawling places were likely to weigh more, walk less, and have a greater prevalence of hypertension than people living in counties with more compact development patterns’ (McCann & Ewing 2003 p.13).

As discussed in the previous chapter, urban agendas for healthy cities continue, but today these health concerns are less about cholera, typhoid and the plague, contemporary concerns centre upon the obesity epidemic, along with related health problems such as diabetes and heart disease. This indicates that improving the fitness of the population is now a key contemporary social aim and though nobody believes that these problems can be eradicated solely by urban design, the research shows that it can have an impact. Greater population density and better urban connectivity should be high on the list of urban agendas.

### 4.2.6 Fear of Amenity Loss

The sixth urban agenda persists from post industrial urban concerns for daylight and air movement. Although the spread of Typhoid and the Plague are no longer the prime concern, the preservation of amenity is still considered important. Recommendations for urban consolidation and increased population density for the perceived greater good (Kenworthy 2003; Frank et al. 2004; Schwartz et al. 2004) are met with fear by existing residents, who believe that having to share their suburb and existing services with newcomers to the area will result in a loss of their amenity as existing property owners. Newcomers to existing inner suburbs in Melbourne are seen by some as ‘parasitic’ (Lewis 1999 p. 91), leeching the existing amenity of those who got there before them. ‘The protection of amenity has been whittled away. In general quality and amenity
controls… are set far too low to meet community expectations’ (Lewis 1999 p. 230). These fears may have some basis and should be considered in a sustainable urban agenda.

4.2.7 The Over Arching Social Aim: Sustainability

The seventh and last of my contemporary urban agendas of society brings a number of the above issues together under one common theme – the urban agenda for sustainability. Peak oil and oil shortages relate to cities’ economic sustainability. Urban consolidation relates to social, cultural, economic and environmental sustainability. Climate change relates directly to environmental sustainability. Excessively long commute times has dramatic environmental impacts due to CO$_2$ emissions from cars and can also be considered financially unsustainable, due to lost potential working hours, and socially unsustainable, as the lost hours could be spent with family and friends. Obesity and social segregation effected by urbanism is both socially and culturally unsustainable. Each of these issues belong in one of more of the three pillars of sustainability, social sustainability, environmental sustainability or economic sustainability and along with the fourth pillar of cultural sustainability, are encompassed in the broad agenda of contemporary society – for sustainable urbanism (Figure 39).

![Figure 39: Diagram showing four pillars that make up the broad agenda of contemporary society – sustainable urbanism.](image)

As I discussed in section 1.6 (p.8), urban sustainability is a broad and complex problem which requires a holistic approach. It is apparent that for cities to be sustainable, they need to address the issues raised in this section, embracing the pillars of sustainability (Figure 39) as what make up an international urban agenda. Urban designers need to consider reducing carbon emissions by reducing car dependency to lessen reliance on oil in preparation for peak oil (globally). Development needs to have greater pedestrian connectivity and be more amenable to public transport than is currently the case. Walking and cycling should be encouraged for the sake of both public health and more efficient use of people’s time. Cities should provide a range of housing types and develop planning codes that discourage segregation and ghettoisation.
We are at a juncture where fundamental questions about the future of our cities—should settlements be dense or sparse, nucleated or dispersed, mono-centric or poly-centric, or a mix of all types?—have been raised by the issue of sustainability. It is widely acknowledged that to make cities sustainable we must base decisions about them on a more secure understanding of them than we have now. What is unclear is what we mean by a better understanding (Hillier 1999 p.111).

As I stated at the beginning of this chapter, the purpose of this chapter is to test whether a gulf currently exists between contemporary urban agendas and urban design practice by reviewing contemporary paradigms and techniques in the light of prevailing urban agendas of society outlined above. I believe that this is an important part of what is meant by having a ‘more secure understanding’ (Hillier 1999 p.111) of contemporary urbanism.

### 4.3 Five Contemporary Urban Design Approaches and Associated Techniques

#### 4.3.1 Predominant Urban Design Paradigms and Their Techniques.

There are currently a number of different urban design paradigms worldwide. There have been several attempts to group and categorise the different paradigms (Jenks 2002; Kelbaugh 2000; Loomis 1999). One such attempt is by North American academic and writer Doug Kelbaugh, who suggests that there are three main paradigms, “New Urbanism”, “Everyday Urbanism” and “Post Urbanism” (Kelbaugh 2000 pp.285-289). New Urbanism, initially called Traditional Neighbourhood Design, is a revisionist movement in the US originating in the 1980s predominantly from the work of architects Andres Duany and Peter Calthorpe. Everyday Urbanism, is the ad-hoc, ephemeral urbanism of the ‘everyday, ordinary life and reality, with little pretence about the possibility of a perfectible, tidy or ideal built environment’ (Kelbaugh 2002 p171), and is common in Latin America. Post Urbanism encompasses the avant-garde architectural-based urbanism by prominent architectural practitioners such as Frank Gehry (US.) and Rem Koolhaas (the Netherlands). There are a number of movements that are outside these categories however, such as ‘Landscape Urbanism’; ‘Smart Growth’; secondary movements such as ‘Pedestrian Oriented Development’ (POD), and ‘Transport Oriented Development’ (TOD); and various anti-development and environmental movements.

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1 Bill Hillier is the Professor of Architectural and Urban Morphology in the University of London. I will discuss his work in the Section 4.3.6.

2 The Dutch derived movement by landscape architects such as Karres en Brands, Adriaan Geuze, OMA’s Parc de la Villette, epitomised by the West 8 master plan for Borneo Sporenburg project in the outskirts of Amsterdam, (Waldheim 2006 p.46, 47).
In the previous section I discussed important key urban agendas of today’s society. Throughout these agendas a theme of sustainability emerged. This theme is somewhat more pessimistic than urban agendas discussed in the previous chapter. Whereas the use of the grid expressed the civilised nature of Roman society and perspectival urban compositions reflected cultural advancement, the focus of contemporary agendas is on perceived losses. The loss of cheap fuel; the loss of environmental stability; the loss of time; the loss of social diversity; the loss of health; as well as the continuing fear for a loss of amenity are all realities for which society needs to adjust and prepare for.

For the next section, I use the analogy of ‘coping with loss’, as the structure for my review of current urban design paradigms and the design techniques used within these paradigms. I categorise current urban design paradigms using the analogy of the ‘five stages of grief’ by Swiss-born psychiatrist, Kübler-Ross from her book *On Death and Dying* (1973 p.IV), published in the pivotal year of 1973 (the year Modernism died). The book is based on her research with terminal patients, dealing with loss in the post-modern world. My analogy of applying the ‘stages of grief’ to urban design paradigms, is used in part as a narrative device, structuring my review of paradigms and techniques, and partially as an attempt to give a new insight into the complex, pessimistic world of post-optimistic urban design.

The five stages of grief are: ‘denial’; ‘anger’; ‘bargaining’; ‘depression’ and ‘acceptance’. These five stages are used as section headings, under which I symptomatically categorise design paradigms into the particular stages of grief. I will also discuss the design techniques (eg. use of perspective, digital modelling technology, Geographic Information Systems) used by each of these paradigms to gauge whether there is a close relationship between the paradigm and techniques and society’s prevailing urban agenda for sustainable urbanism.

**4.3.2 Denial: ‘It Can’t Be Happening.’ (Pro-Sprawl (Most People))**

**Business as Usual**

The first stage of grief is *denial*. There are still many influential people who believe there is no such thing as global warming, that peak oil is a myth, and that there is no link between urban layout and diversity or health. As mentioned earlier, John Howard the former Prime Minister of Australia had expressed significant scepticism about climate change (Shearman & Smith 2007).
Before his defeat, John Howard lobbied state governments for land releases and for the removal of growth boundaries to expand cities further in response to housing needs (Gibbons 2006, para.1).

There is a narrow view that suggests that sprawl is no more or less than the efficient operation of the land market, and in this sense, is the outcome of a competitive process. The problem with this is that no process of development exists within a purely competitive market, indeed sprawl might be seen as the failure of the market to take account of the longer term economic externalities in favour of ‘short termism’. And of course social and qualitative environmental issues are rarely considered in this kind of debate (Batty et al.2003 p.6).

The ‘narrow view’ mentioned here refers to those critics opposing consolidation policies such as Randal O’Tool, Wendell Cox, Robert Bruegmann and Joel Kotkin in the US, and in Australia Tony Recsei, Patrick Troy, Miles Lewis, Bob Birrell, and Kevin O’Connor – the Pro-Sprawl or Anti-anti-sprawl.

Professor Robert Bruegmann (University of Illinois at Chicago), known for his critical position on urban consolidation, suggests that suburbia is the expression of free markets and is an outcome of ‘our democracy’ (Bruegmann 2005 p.8). This definition is similar to that of Joel Kotkin (research fellow at Chapman University, Orange County) who suggests that sprawl represents the ‘particular choices of individual human beings’ which shows ‘people’s logical desire to escape the high costs, crime, pollution, congestion and lack of privacy that accompanies life in dense cities’ (Kotkin 2005). These are common themes in pro-sprawl rhetoric, appealing to the North American’s desire to express ‘freedom’. They see urban consolidation by use of growth boundaries (which will be discussed in greater depth later), and preferred mixed-use zoning as infringements on people’s civil liberties However they are still happy to have single-use zoning, maximum height limits, and density restrictions enforced. Professor Robert Bruegmann visited Sydney in October of 2006, backing intuitive arguments of the Australian interest group Save Our Suburbs (SOS) with a series of academic observations.

Tony Recsei, the New South Wales SOS president said of Bruegmann that he:

…gave a masterly lecture in which he discussed the pros and cons of “sprawl” versus “consolidation”. His overheads made quite clear what we have been saying all along – the benefits claimed for “consolidation” do not happen… [state governments are] forcing high density onto unwilling communities under the threat of taking away the planning powers of their councils (Recsei 2006, para.3).

1 ‘Anti-anti-sprawl’ is a term used to describe the work of those opposing Smart Growth such as Robert Bruegmann and Wendell Cox, (see www.prospect.org/cs/articles?article=suburban_cowboys).
US economist Randal O’Toole, long time critic of planning policies in Portland Oregon, suggests that ‘low densities provide many benefits that people value, including lower land costs, private yards with gardens and play areas, less congested roads, proximity to recreation areas, and access to a wide variety of low-cost consumer goods and services… Few Americans are willing to give up their automobiles, single-family homes, and large backyards’ (O’Toole 2001 p.20). Unlike almost all urban design critics since the early 1970s, O’Toole supports traffic engineered freeway solutions,

…they’re actually building roads in Houston… They know something in Houston that we haven’t figured out here. You can build your way out of a traffic problem (Griffin 2007, para.3).

This is particularly interesting as Houston is often cited on lists of the world’s worst cities – one of the most sprawling cities, one of the highest per capita polluters (Newman and Kenworthy 1989 p.59), and also one of the ‘fattest cities’ (Medical News Today 2004, para.1).

James Howard Kunstler describes pro-sprawl arguments as beliefs that ‘suburbia is the highest expression of free markets… it is the natural outcome of our democracy, to the belief that God has ordained it’ (Kunstler 2006, para.1). Kunstler says that the level of the argument against consolidation is that ‘suburbia is fine and dandy because so many people like it’ (Kunstler 2006). Kunstler suggests that by allowing uncontrolled growth based on freeway expansion and bulky goods strip malls:

…we created a landscape of scary places, and we became a nation of scary people (Kunstler 1994 p. 273).

There is also an argument put forward that the high class professional population is trying to rob potential fringe dwellers of owning their own detached home, ‘like the City Beautiful and Prohibition reform movements before it, the anti-sprawl movement has been heavily supported by individuals drawn from an upper-middle-class professional population… from an elite group of academics, central-city business leaders’ (Bruegmann 2005 p.135).

Despite warnings by scientists such as the CSIRO’s Dr Peter Newton’, the denial of climate change and the related need to change the urban fabric continues. Newton asserts, ‘to maintain a business as usual model of urban development is to condemn the future population and industry of that city to a sub-optimal living and working environment (Newton 1998).

1 Dr Peter Newton is a Chief Research Scientist at CSIRO (Commonwealth Scientific and Industrial Research Organisation), the national government body for scientific research in Australia.
Even deeper in denial of the need to alter urban fabric are those who believe that all problems can be solved by technology:

\[\ldots\text{new technology could reduce our dependence on cars by providing a system of public transport that is not constrained to particular routes and particular times... introduction of driverless taxis guided by automated vehicle control systems and powered by environmentally friendly energy sources. Such vehicles would travel in automatically controlled platoons, so enormously increasing lane capacity and safety (Recsei 2004).}\]

Techniques and Technology: Zoning Overlay or Overkill (GIS)

The urban design techniques used by those in ‘denial’ are not dissimilar to the techniques they have used for the last 50 years, though the continuation of the ‘business as usual’ planning using Euclidian Zoning techniques has become increasingly difficult due to the complexities of contemporary society. In addition to zones, ‘overlays’ are also used, to provide greater control over the use of a piece of land. A site in Melbourne, Australia that is zoned R1Z RESIDENTIAL 1 ZONE, could have a number of other restrictions overlaid, which proscribe the type of residential that may be built on the site. The site could have some of the following overlays:

- DCP01 CONTRIBUTIONS PLAN OVERLAY
- HO231 HERITAGE OVERLAY (HO231)
- LSIO LAND SUBJECT TO INUNDATION OVERLAY
- DDO1 DESIGN AND DEVELOPMENT OVERLAY - SCHEDULE 1
- ESO1 ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 1

These ambiguous overlays titles are then explained in many written pages of legislation in the local planning scheme. Due to this increasing complexity, a number of councils started using advanced mapping software, Geographic Information System (GIS) systems (Bille 2000 p.728). GIS systems are essentially CAD with geographic referencing and easily attributable data allowing the user to store a multitude of information in a vector object. For example a rectangular block can have; the vector information of the size and shape of the rectangle; the geographically referenced location of the rectangle; the land-use; the council rates payable; as well as the different zoning and overlays that apply to the rectangle. The GIS programs also have the in built statistical analysis tools to map how the rectangular block compares in size and council rates to all of the other blocks in the suburb.

In Australia, most councils now use some form of GIS, primarily MAPINFO™ (65% of GIS users) over the other leading software by ESRI ARC GIS™ (26%) (Yigitcanlar 2005 pp.42-51). Both of these GIS packages are essentially 2D to 2.5D (2D with a height attribute) and have an ‘emphasis on data [rather] than on modelling, on routine applications for management rather

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1 Example from services.land.vic.gov.au/maps/pmo.jsp
2 Available at www.dse.vic.gov.au/planningschemes/index
than the more grandiose applications to strategic planning’ (Batty & Densham 1996 section 1) It may be because of this that people within councils primarily use GIS for large scale Urban Planning departments (91% of staff), and quantifiable areas of planning like professions such as Property Services (68% of staff), whereas in more subjective design departments, take up is much lower eg. Urban Design (34%) and Urban Renewal (17%). GIS software is very strong on data/statistical analysis but has traditionally been 2D, and relatively weak on 3D. Even with the extended packages offered by software developers ESRI™ and MapInfo™ that allow 3D modelling there is resistance to the uptake of the 3D capabilities (Pietsch 2005). This results in dense GIS maps (see Figure 40), which convey large amounts of information but can be unclear.

Three Facets

The ‘denial’ urban design paradigm remains fairly stagnant in approach, relatively unchanged since the post WWII period, whilst the key agendas of society listed earlier, have moved on dramatically since this time. Therefore the relationship between key agendas listed above and the urban design paradigm is almost non existent. The techniques used by the ‘denial’ paradigm have some relationship with contemporary techniques with some use of information layering technology with GIS software, but are still essentially performing the same separatist Euclidian zoning that has been used since the 1920s in a digital environment, not in a way that addresses society’s urban agenda for sustainability. The diagram (Figure 41) illustrates relationship between the three facets of urbanism, showing a small amount of overlap between the design paradigm and the design techniques, and society’s prevailing urban agendas not overlapping either of the other two facets.
4.3.3 Anger: ‘Why Me? It’s Not Fair.’ (SOS, NIMBY & BANANA)

The next stage of dealing with loss is ‘anger’. Throughout the world there are groups of residents who are angry about any form of change within their immediate surrounding areas. Advocates of urban consolidation sometimes refer to these groups as NIMBY, which stands for ‘Not In My Back Yard’ (Bruegmann 2005 p.269), or BANANA (Build Absolutely Nothing Anywhere Near Anything) (Obrinsky & Stein 2007 p. 4). NIMBYism is a term that became common during the 1980s to describe:

> the opposition of neighbourhood groups against any change in their community that could have even the remotest possibility of diminishing their home prices (Bruegmann 2005 p.189).

In Australia, the Save Our Suburbs (SOS) group came to prominence in the mid 1990s particularly in Victoria under the Kennett Liberal government. In 1993 the Victorian State Government introduced VicCode 2, for medium density housing. This was designed to ‘increase urban consolidation and to reduce urban sprawl’ (Lewis 1999 p.186). It dealt with aspects of site coverage, density, over-shadowing, open space and energy efficiency. It was met with resistance in ‘politically sensitive streets of Liberal [voters] heartland’ (Lewis 1999 p.186).

‘We’re Full – Parasites are Moving into Flats in my Leafy Suburb’

> In middle and inner areas unit developments are parasitic upon existing properties because their amenity is being destroyed, while units gain amenity at their expense… [units] strip part of the value from adjoining property… [including stealing] services and roads (Lewis 1999 p.163).

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1 This concern for land value has been shown to be unfounded with a study by Harvard’s Joint Center for Housing Studies who used U.S. Census data from 1970 to 2000 to conclude apartments do not threaten the value of nearby single-family houses. (Duty & Tucker 2006).
This attitude towards sharing existing space and services persists. The ‘I got here first’, attitude is in keeping with Australia’s dubious past intolerance of perceived infringements on their Australian way of life. Inner suburban areas of Greater Melbourne such as Hawthorn and Camberwell owned by predominantly middle upper class whites have been ferociously protected from ‘inappropriate development’ by resident groups.

The Boroondara council has the highest percentages of members of SOS (Lewis 1999 p.243), and also one of the highest percentages of English speaking, Australian born residents (ABS 2006a). Higher density in the form of medium density flats bring more migrants to communities, as occupants of medium density housing are predominantly not of Australian decent (ABS 1998). In an article ‘How to Live With the NIMBY Syndrome’, writer for the Ethical Spectacle, Sy Schechtman, describes the ancient custom of ‘nimbyism’, and how the bible repeatedly advises the Jews to treat the stranger well, ‘Remember, you were strangers in the land of Egypt.’ (2003 para.6). He goes on to describe nimbyism determining the fate of many Jews through the Second World War, describing the ship St. Louis as the ‘Ship of Fools’ ‘with about 1,000 Jewish refugees from Nazi Germany was refused entry into Cuba, the United States, and other countries, in 1938, when the Jews could still leave, before the start of the war in 1939.’ (Schechtman 2003 para.6)

Nimbyism, fear of the stranger, is an integral part of racial segregation, too. And part of this, unfortunately, is fear of the black stranger (Schechtman 2003 para.9).

Recsei suggests capping population and forming Ebenezer Howard-esque satellite cities:

...new satellite cities adjacent to existing cities should be developed to cater for a portion of the additional population that we have decided we need. These satellite cities... should be of optimal size, with about 200 000 residents each... (Recsei 2004).

Figure 42: Lebensraum sketch illustrating the conceptualisation of a model National Socialist City satellite with a population of 200,000 people. (source: Teut, Anna, Architektur im Dritten Reich (Architecture in the Third Reich), 1933-1945, Frankfurt, Ullstein, 1967, p.308)

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1 White Australia policy restricted non-white immigration to Australia from 1901 to 1973. For further information on this, see James Jupp’s From White Australia to Woomera: The Story of Australian Immigration (Jupp 2007 p.8).

2 By resident groups such as SOS and BRAG (Boroondara Resident’s Action Group) www.brag.asn.au.
Though it is not explicitly discussed by SOS, there is a strong undercurrent of anti-immigration within their rhetoric. The President of SOS when criticising urban consolidation, states:

_The trouble is, Smart Growth is still growth. As more and more people come to live in that restricted area, up goes the population density… The Commonwealth government must take some responsibility. It cannot just assume, as it does now, that the States can forever shoehorn all new arrivals into existing communities… If we decide that our population has to increase [at all]…_ (Recsei 2004).

SOS advocates capping population growth, ‘Set a targeted limit to Sydney’s population,’ (Recsei 2004). This position of restricting growth is similar to other angry community members (see Figure 43), represented by the member for Oxley in 1996, Pauline Hanson. In her maiden speech in parliament she recommended limiting immigration:

_I believe we are in danger of being swamped by Asians. Between 1984 and 1995, 40% of all migrants coming into this country were of Asian origin. They have their own culture and religion, form ghettos and do not assimilate_ (Hanson 1996).

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**Consolidation the Cause of Housing Shortage**

There are many who believe that urban consolidation is what has been pushing housing prices up causing the housing affordability crisis in most Australian cities. SOS president Tony Recsei blames anti-sprawl planning policies for increased property prices, ‘We are beginning to pay the price. The land price for a house in Sydney has skyrocketed up two-and-a-half times, from the average of $83,000 in 1992 before high density policies were implemented to the current $203,000’ (Recsei 2004). This sentiment is shared by other consolidation critics such as Randal O’Tool (2001) and Robert Bruegmann (2005) and was believed to be the feeling of the Australian constituency when the Australia Federal Treasury documents were leaked to television station Channel 7 suggesting substantial land releases to combat a lack of housing affordability.

According to economics correspondent for ABC’s _Lateline_, Stephen Long, ‘it is a complete furphy that a lack of land release is the main cause of the run-up of house prices which has forced first
home buyers out of the market’ (Long 2007). Long goes to explain the complexities of housing affordability, none of which relate to land release on the outskirts of cities:

One was the great disinflation of the past decade that led to low interest rates, meaning people could borrow more. The other was competition in the mortgage market so we have an abundance of lenders tripping over each other to lend money. That meant that people could borrow more, did borrow more. There was more demand for housing. Asset price inflation, a run-up in prices which meant people out of the market found it harder to get in. The other issue is demand for housing is strongest in areas within a reasonable distance of city centres and close to where jobs are. So land release[s] on the city fringes, [are where] there is a lack of demand […] It will do little to address the issue of housing affordability where people want to live (Long 2007).

Long explains that the prices are also driven up by the relatively wealthy middle class with multiple properties, encouraged by tax incentives that favour existing home owners, there are:

…a lot of investors in the marketplace and that’s also forced out first home buyers. What’s driven that is partly the tax concessions including the halving of capital gains tax (Long 2007).

It has also been suggested that the other pressure on housing prices actually comes from the NIMBY groups themselves and their impact on housing policies, U.S. Senator Mel Martinez (U.S. Secretary of Housing and Urban Development) stated, ‘whether by intent—through the so-called NIMBY syndrome of exclusionary zoning, expensive building fees, and burdensome regulatory barriers—or unintentionally, local governments are driving up housing costs and driving out affordable housing’ (Duty & Tucker 2006 p.10).

Vital workers in our communities are being pushed farther and farther from the cities where they work by NIMBY opposition, resulting in greater sprawl, worse traffic congestion, and horrendous commutes in cities across the country (Duty & Tucker 2006 p.10).

A common argument put forward by NIMBY and BANANA groups in opposition to densification is that ‘people prefer not to live densely’. In the North America, ‘Fannie Mae’ (Federal National Mortgage Association (FNMA)) has been conducting surveys about housing preferences for years. The findings have changed little. Regardless of income, race or current tenure status, 75-80 percent of households would prefer to live in a single family home with a private yard.’ (Gordon &. Richardson 1998 para.6). These results may be somewhat misleading depending on how this question was asked. When asked ‘would you prefer a house to flat’ it assumes all else is equal whereas if asked ‘would you prefer a house that is isolated, with poor access to public transport, shops or culture, or a flat that is walking distance from a railway station, shopping strips, cafés, art galleries?’ Interestingly from a similar survey also by Fannie Mae, found that ‘more Americans would consider living in a medium- to small-sized city than any

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1 Fannie Mae is the colloquial name given to the Federal National Mortgage Association (FNMA) a government sponsored enterprise (GSE) of the United States government used by researchers and professionals.
other place’ (FNMA 1997, ‘Where Americans Want to Live’ section) And that ‘By overwhelming margins, Americans agree that they would prefer a merely good home in a great neighbourhood (75%) or in a very convenient location (66%) to a great home in a merely good neighbourhood (19%) or in a fairly inconvenient location (29%)’ (FNMA 1997).

Techniques and Technology: Media Saturation and Viral Marketing

The techniques used by the ‘anger paradigm’ differ from those of the ‘denial’ paradigm. NIMBY and BANANA groups do not use GIS but are very effective lobbying governments through the use of mass media, internet and email (see Figure 45). SOS has a very sophisticated approach to use of the internet with websites such as www.sos.org.au, which share information such as different state organisations; information about recent planning policy changes; links to SOS propaganda videos on You-tube (www.youtube.com/user/Wildhiland), as well as pro-sprawl websites such as www.demographia.com. There are also instructions on the website advising residents how to restrict urban consolidation in their areas by objecting to projects in planning. A recent example is the Residents Guide To Objecting (SOS 2005), which sets out arguments for objecting to any kind of development that ‘experience has shown’ to be effective. The document has a section called ‘Maximise your objection with Council’, and lists effective arguments for objecting to most proposals such as to argue that the ‘height and mass/bulk are visually unacceptable’; ‘the proposed development does not integrate with the neighbourhood character. Important characteristics include roof form, building height, building materials, landscape and fencing’; or that ‘the density of the development is excessive.’

Figure 45: SOS instructions on how to amplify the exposure of their position on urban consolidation with the use of targeted emails (learning from techniques of viral marketing).
Three Facets

Much like the ‘denial’ paradigm, the ‘anger’ paradigm does not have a strong relationship with broader society’s urban agenda for sustainable urbanism. It is concerned with a narrow agenda of a small group of residents. There is some relationship between the paradigm and some new techniques with their use of viral email strategies but these techniques do not relate to the sustainability agenda. The overall relationship between the three facets of urbanism is represented in the diagram below (Figure 46).

4.3.4 Bargaining: ‘A Vain Hope That the Bad News is Reversible’ (New Urbanism)

New Urbanism Background

The next stage of dealing with loss is ‘bargaining’, where one holds onto a vain hope that the bad news is reversible. I suggest that New Urbanism belongs to this stage. Originally known as ‘Traditional Neighbourhood Development,’ or Neo-traditionalist, New Urbanism is an articulated resistance to modern city planning and to urban sprawl (Loomis 1999, para.9). New Urbanism grew predominantly in the United States in the 1980s out of a post-modern critique of modernist urbanism. The movement is built on observations by writers such as Kevin Lynch, Colin Rowe, Jane Jacobs and the work of European architects Leon and Rob Krier (see Figure 48) and the California based architect Christopher Alexander. The movement emphasises ‘traditional’ design elements like those listed in Kevin Lynch’s ‘The Image of the City’ (1960 pp.49-83), who described the physical form of the traditional city as being made up of five elements: paths, edges, districts, nodes and landmarks. ‘We dedicate ourselves to reclaiming our homes, blocks, streets, parks, neighbourhoods, districts, towns, cities, regions, and environment’ (CNU 1996 para.5). The movement emphasises public plazas, terminating vistas and draws from a set of historicist housing styles. It aims to shift the emphasis of the street from the car to the pedestrian, by the de-emphasis of street hierarchy in favour of ‘traditional’ street layouts (see
Figure 47). The New Urbanists take on many of the arguments put forward by Jane Jacobs, who argued:

\[
\text{...against any large-scale redevelopment... familiarity and interactive community life where people look out for one another was the most desirable character of urban life... [a view point that was] greeted and accepted wholeheartedly by the misty eyed, middle aged population that achingly yearned for days of yore... She wanted any large scale development to come to a shuddering stop around her extremely nostalgic model (Puri 2007 p.42).}
\]

The first book in seminal New Urbanists Duany Plater-Zyberk (DPZ) list of ‘Books Essential to the New Urbanism’ is Christopher Alexander, et al’s *A Pattern Language* which it describes as the ‘The design equivalent of the Bible’, a book which illustrates around 250 unitary patterns from traditional architecture, and sets out rules for traditional design. Alexander calls each spatial region a ‘center’, emphasizing that it is not an isolated entity, but an embedded field within an infinitely larger system of fields with gradually diminishing contextual influences. One cannot look at a part of the whole without looking at its relation to the whole, and the complex influences of its location within the field (Mehaffy 2002, para.7). In a similar vain, the group of New Urbanist called the Congress of New Urbanism (CNU), has set out the ‘Charter for New Urbanism’ with a total of 27 key principles for urban design, under the headings, ‘The region: Metropolis, city, and town’, ‘The neighbourhood, the district, and the corridor’ and ‘The block, the street, and the building’. The charter mixes ‘modernism and progressivism with historicism and nostalgia’ (Loomis, 1999, para.8).

Some of the key principles from www.cnu.org/charter are:

- Urban growth boundaries: ‘Metropolitan regions are finite places with geographic boundaries’, protecting ‘natural landscapes.’
- Brown field development: ‘Infill development within existing urban areas conserves environmental resources’.

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1 See the ‘Reading List’ on www.dpz.com/research.aspx.
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

- Connectivity: ‘Transit, pedestrian, and bicycle systems should maximize access and mobility throughout the region while reducing dependence upon the automobile.’
- Mixed use development: ‘Neighbourhoods should be compact, pedestrian-friendly, and mixed-use’.
- Many activities of daily living should occur within walking distance, allowing independence to those who do not drive… encourage walking, reduce the number and length of automobile trips, and conserve energy’.
- Affordable housing: ‘Within neighbourhoods, a broad range of housing types and price levels can bring people of diverse ages, races, and incomes into daily interaction.’
- A form of Transport Oriented Development (TOD): ‘Appropriate building densities and land-uses should be within walking distance of transit stops, permitting’.
- Distinctive form for Civic buildings.

![Image](85x430 to 297x572)

Figure 49: New Town of Seaside, Florida, by Andrés Duany & Elizabeth Plater-Zyberk (DPZ), 1982, LHS aerial photo, RHS screen grab from Peter Wier’s film ‘The Truman Show’.

The most well known built examples of New Urbanism are ‘Seaside’, Florida (by DPZ) 1982, ‘Celebration’, California by Robert Stern for Disney 1996, and the village of Poundbury, Dorset, UK, by Leon Krier for the Prince of Wales 1993. On the coast of the Gulf of Mexico DPZ designed the new town of ‘Seaside’, embracing historic styles of the American South and concepts of walkability and civic vistas. The resulting development have a strange newly built old city look that was exploited in *The Truman Show* film, the 1998 fantasy comedy film directed by Peter Weir, written by Andrew Niccol. In the film the central character, Truman Burbank (played by Jim Carrey), lives in a constructed reality for the entertainment of those outside in a fake town called Seahaven.
Figure 50: Sketch aerial view of Poundbury, in Dorset, by Leon Krier.

In the late 1980s the European architect Leon Krier was commissioned to design the village of Poundbury, a new-town in Dorset by the Prince of Wales. The town was designed according to ‘traditional’ planning methods (see Figure 50).

An equally well known New Urbanist development designed by Robert Stern for Disney™, in 1996 was called ‘Celebration’ at the edge of ‘Walt Disney World’ in California, designed in a similar vein to Poundbury and Seaside but with even stricter control over aesthetics. There is a limited palette of housing styles from which residents are allowed to choose and permission is needed before any colours or planting are changed on existing houses (Pollan 1997, para 16). With a population of 1500, intended to eventually reach 20,000, the development has been a financial success though unforeseen social problems

1 have occurred, ‘Celebration is an experiment the company [Disney] has decided it won’t repeat,’ (Pollan 1997, para.39).

New Urbanism gains support by a range of people from different back grounds.

\[\text{Its supposedly draconian land-use regulations, emphasizing public open space, represent a leftist environmentalism, although the imagery these controls produce in New Urbanist towns and architecture appeals to the political and social right (Loomis 1999, para.6).}\]

Many of the key principles outlined above are keeping within the environmental sustainability imperatives discussed earlier. New Urbanism encourages increased density within walking

1 Four years after opening the school, ‘Celebration school administrators, teachers and even executives of Disney’s Celebration Company [were] being whipsawed by turmoil’ (Frantz 1999). The Celebration kindergarten-through-12th grade approach and experimental teaching syllabus led to a situation where many families ‘transferred their children to other schools or even packed up and left town’ (Frantz 1999).
distance of transit, encourages walkable streets with pedestrian safety at the forefront of design. The preference for ‘brown field’ development over green field development at the suburban fringe is also commended by environmentalists.

According to Leon Krier, ‘New Urbanist principles have the simplicity and practicality of moral precepts rather than the tyrannical sophistications of utopian reform. They are not so much prescriptive as they are permissive’ (Salingaros 2001, ‘Market Forces’ section). This permissive yet prescriptive model of urbanism enforces historic styles which appeal greatly to the political and social right leading to some of the movement’s biggest criticisms (Loomis 1999, para.8).

**New Urbanism and the ‘New Right’ Aesthetics**

In the book *Success in the art of prediction, Architecture 2000 and Beyond* by Charles Jencks (originally published in 1969), Jencks predicted a right wing neo-classical revival (2000 p.26) parallel to Philip Johnson’s defence of the ‘new craving for monumentality’ under the Nazis (Johnson 1933 pp.137-139), would occur in the United States ‘around 1984’ (Jencks 2000 p.66). According to assistant professor Michael Kaplan, from the Indiana University, Andres Duany (DPZ) acknowledges:

> German town planning during the Third Reich as one of his sources of inspiration. Seaside, with its authoritarian building code and derivative style is, in the end, a scheme for the affluent by an enterprising private developer, hardly a paradigm for socially responsive urban development (Kaplan 1995, ‘Lessons of fascism’ section).

The comparison between New Urbanism and the Third Reich’s urban design does not seem totally unfounded. New towns of ‘Herman Goering Werke’ at Salzgitter and founded in 1938 as Stadt des KdF-Wagens (“City of the KdF Car” now Wolfsburg), like the New Urbanist designs, had an ‘emphasis upon the new community settlement design patterns stressed neo-classicism; the need for unity through building (Einigung), romanticism, mediaeval settlement patterns and the community as an arm of the state’ (Mullin 1982 p.256).

Eric Owen Moss of EOM architects in California talks about the input of New Urbanism in the Hurricane Katrina rebuilding with similar scepticism,

> It’s right-wing developer-speak masquerading as populism…. The ideological image-making would appeal to a kind of anachronistic Mississippi that yearns for the good old days of the Old South as slow and balanced and pleasing and breezy, and each person knew his or her role (Hales 2005, para.12).
Others have argued that the new urbanism is just another marketing ploy aimed at segmenting buyers according to aesthetic tastes in order to sell more houses. They argue that new urbanist communities are unauthentic and that we cannot go back to the past. (Ford 1999 pp.247-257)

‘Town Building is No Mickey-Mouse Operation’

Michael Pollan’s analysis of New Urbanist / Disney town Celebration, amusingly called ‘Town Building is No Mickey-Mouse Operation,’ printed in 14th December 1997 in The New York Times (Pollan 1997) suggested that ‘Disney’s expertise is in building theme parks for paying guests, not towns for citizens. A real community is messy, ever changing and inevitably political – three adjectives that pretty much sum up everything the culture of Disney cannot abide’ (Pollan 1997, para.10). The Dutch architect Rem Koolhaas, an advocate for ‘messy’ urbanism, has likened New Urbanism’s application of old urban models to:

*The current Volkswagen Bug, a cutesy consumer product translated from a vehicle intended for the mass introduction of automobility* (Loomis 1999, para.11).

Though there is support from both the political left and right, New Urbanism also receives criticism from both sides. Criticisms from the right suggest that New Urbanism is too paternalistic, that the free market should decide urban form that it is anti capitalism, therefore anti democratic; it ‘embraces pie-in-the-sky social engineering based on a false diagnosis of society’s urban problems’ (Gordon & Richardson 1998, para.4). The left criticises the authoritarian nature of stylistic limitations and the built examples of New Urbanism’s failure to address one of the charter’s key objectives for affordability:

*…a broad range of housing types and price levels can bring people of diverse ages, races, and incomes into daily interaction… At Seaside, the 1996 average sales price reached $503,500 [US] (Garvinn 1998, para.20). The towns are turning out to be rather elitist settlements with average income levels much higher than in the surrounding areas* (Gordon & Richardson 1998, para.9).

As well as appealing to the political and social right (Loomis 1999), the imagery that the strict aesthetic controls produce in New Urbanist towns and architecture can lead to blandness and the ‘kind of repression that exists in the notion of a classical architecture’ (Eisenman 1989 pp.9-10). This ‘blandness’ occurs despite New Urbanist’s deliberate reaction *against* the rationalist aesthetics of the Modernists before them, who they criticise for their minimalist aesthetics and ‘blandness’ (Brolin 1976 p.42).

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1 In this debate, I suggest it may be useful to remember that zoo keepers use environmental ‘enrichment’ (constantly making changes) to keep their animals from going mad from the repetitive and predicableness of their captivity, (Keeper’s corner 2007) - it seems reasonable that humans deserve similar ‘enriched environments’.
Techniques and Technology: Free Hand & SketchUp

The design techniques used by New Urbanists are not especially advanced, particularly in their use of digital technology which, I suggest, is immediately apparent in the name of the movement\(^1\). To some extent however, like the NIMBY and BANANA groups discussed earlier, the New Urbanists make some use of the internet to generate support for the movement. The Congress for New Urbanism (CNU) (www.cnu.org) has an extensive collection of resources for architects and urban designers in the ‘charter’ (www.cnu.org/charter), a series of ‘form based codes’ for legislators to appropriate, pre-prepared presentations for designers to give to clients stating the case for New Urbanism, contact details for a list of CNU members, an ‘image bank’, links to CNU conferences that are promoted around the world, and a number of academic papers.

The representation methods are deliberately archaic, using pencil and watercolours to give drawings a ‘historical’ or ‘timeless’ feel, whilst the looseness of the non ruled line work also suggests a sort of freedom (see Figure 51). Interestingly the blocks of colour describing uses are purely two dimensional and do not allow any mixes of use within the smaller blocks despite ‘mixed use’ being one of the principles of the CNU charter. Recently New Urbanists\(^2\) have started using Google’s SketchUp™ program\(^3\), taking advantage of the ‘friendly’ user interface and particularly the different presentation modes ‘Watermarks and Sketchy Effects’\(^4\) (See Figure 52).

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\(^1\) Most computer aware architects know that when naming anything, for example a CAD file, it is poor nomenclature to use words like ‘new’ or ‘latest’ as part of the name (eg. New-plan.dwg), as files are inevitably updated or revised, leading to renaming the file ‘new-new-plan.dwg’, or ‘new-new-plan-final.dwg. The computer savvy will keep the same name and make a ‘superseded’ copy. This allows file linking (XREF) (like internet links), and also keeps a copy of the older plan to reference.

\(^2\) CNU members using SketchUp www.cnu.org/profile/profile_expertise/Schematic+design

\(^3\) Google’s SketchUp™ is a 3D polygon modelling program available at www.sketchup.com

Figure 52: New Urbanist designs drawn in Google’s SketchUp™ program. LHS Salem Gardens Development; Nashville, Tennessee by DAAD designs, RHS Cottonwood Park, Thornton, CO, by Land Architects.

Three Facets

The ‘bargaining’ paradigm relates in a number of ways to the urban agenda for sustainable urbanism in that it is concerned with walkability and to some degree, use-mixing and urban consolidation. The paradigm does not have a strong relationship with contemporary techniques that are possible other than touching on the new SketchUp™ program to simulate old world drawing styles. My reading of the relationship between the three facets of urbanism is illustrated in Figure 53 below, which shows some overlap between the design paradigm and the prevailing urban agendas of society, but no overlap between these two and design techniques.

Figure 53: Diagram showing relationship between three facets of urbanism in the ‘bargaining’ stage (New Urbanism).

4.3.5 Depression: ‘I’m So Sad, Why Bother?’ (Post Urban, Starchitects and the Avant-Garde)

Post Urbanism

The next stage of grief is ‘depression’. One urban design position sometimes referred to as ‘Post Urban’ (Gilbert 2002), is that described by architect Rem Koolhaas of Office of Metropolitan Architecture (OMA). In Koolhaas’ book S, M, L, XL he states that urbanism is dead (Koolhaas & Mau p.967) and that the uncontrollable generic city has taken over. American architect Mark Gilbert, suggests that the Koolhaas rhetoric brings to mind Shakespeare’s Mark Anthony: ‘he is here to bury the city, not to praise it’ (Gilbert 2002 p.1). He claims there is no longer hope in achieving urban coherence or unity in any way and that it is futile to try (Kelbaugh 2001 p.144).
The role of the architect in this phenomenon (manipulation of the urban landscape) is almost negligible. The only thing architects can do from time to time is to create within those circumstances more or less masterful buildings (Koolhaas et al. 1996 p.43).

Koolhaas suggests that the ability of architects to impact on the built environment and on people’s lives is grossly overestimated, and that much of the criticism of the Modernist architects is misplaced.

There is an unbelievable overestimation of the power of architecture in the terms of [the] good it can do, but even more in the terms of [the] bad it can do or can’t do. Architects have been instrumental in this assessment through their accusation of modern architecture. In the various complaints and criticisms that they developed during the 60’s and 70’s, and in the howling wolves against the imagined misdeeds of modernism, I think architects in a very important way have weakened their own profession (Koolhaas et al. 1996 p.43).

As has been discussed in the previous chapter, for the latter half of the 20th century the impact of architects has been minimal on urbanism, the most dramatic impacts being driven by traffic management, statutory planners (those who set up the use zones), and real-estate developers.

[The generic city is a]… displacement to the urban periphery, a territory that can no longer be called suburbia, distorted and stretched beyond precedent, big enough for all and with remarkable ingenuity in avoiding urbanistic rules (Koolhaas et al. 1996 p.43).

Urban sprawl is un-tameable, urban designers should not even try, and should ‘run with it and go along for the ride’ (Mehaffy 2002). This position of post urban hopelessness with regard to the urban realm and the retreat into creating of ‘more or less masterful buildings’ seems to be the forerunner to the ‘Starchitect’ phenomena of the late 1990s onwards.

Depressed Starchitects and Avant-garde

‘Starchitect’ is a term given to architects who have risen to a semi-celebrity status and are known by general public for iconic buildings. Among the well known starchitects are Rem Koolhaas, Zaha Hadid, Daniel Libeskind, Greg Lynn and Norman Foster, with perhaps the best known starchitect, the American, Frank O Gehry who has even appeared in the popular television series, The Simpsons, in the episode ‘The Seven-Beer Snitch’. Gehry came to the public’s eye after the completion of the Guggenheim Museum in Bilbao, Spain in 1997, a piece of ‘urban alchemy’, that increased the level of tourism for the city dramatically (Hawthorne 2005). The work of the starchitects such as Gehry and Koolhaas, have received much criticism as they ‘tend rather to operate as “lone geniuses” contributing a monologue - often an urbanistically selfish one’ (Kelbaugh 2001 p.14.5). The buildings are said to be stylistically sensational merely attempting to

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1 During this Simpsons episode, fourteenth episode from the sixteenth season in 2005, Marge writes to Frank Gehry design asking him to design a new cultural centre for Springfield. Gehry screws up the letter throwing it on the ground, then looks at the paper and decides to design the building using the screwed up paper as the building form.
shock or wow the onlooker, and not integrate into the broader urban context (Kelbaugh 2001 p.14.5). The buildings do not attempt to blend with historic local identity believing that ‘identity conceived as this form of sharing the past is a losing proposition…’ (Koolhaas 1997 p.1248). Through S,M,L,XL Rem Koolhaas laid to rest urban theories based upon history, typology, contextualism (Gilbert 2002). Gehry describes his exuberant insertions into the city as ‘examples of open, democratic urbanism’, despite being criticised for ignoring and overpowering any local discourse (Kelbaugh 2000 p.173).

The work of the starchitects, particularly Rem Koolhaas, is full of irony and contradiction. In the same book that Koolhaas announces urbanism to be dead, he puts forward an urban design scheme for the green field new town of Melun-Sénart outside of Paris, where individual buildings are not proposed, but a preservation strategy of ‘negative urban form’ is planned. This demonstrates that the Koolhaas rhetoric does not necessarily match his practice (Grönlund 1997) and suggests that Koolhaas though partly still in the ‘stage of depression’, has also moved on to the next stage, ‘acceptance’ (to be discussed in the next section).

**Skin Jobs.**

A position held by some architects that seems even more ‘depressing’, is one that wallows in the belief that not only have architects lost any shred of control over the urban fabric, they have also lost any control over building programs, or indeed the building form itself. With the fragmentation of the profession, project managers and quantity surveyors now dictate the building use, arrangement and size of rooms, and with the local zoning guidelines, decide the overall building form. The architect who once decided whether a building would have formal expression or be a ‘billboard building’ (Venturi et al. 1977) is relegated to the designer of façades, a ‘Façadcitect’, or even worse, if a specialist façade engineer is on a project, the architect is relegated to the one who chooses the patterns and the colours (but only those patterns or colours that please the council planners). This position is demonstrated in some of the pattern based work of the Swiss architecture firm Herzog and de Meuron, and more explicitly in the work of the Melbourne practice Lyons Architecture, who demonstrate the possibilities of Venturi-esque1 ‘billboard facadism’ (Clark & Walker 2002).

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Techniques and Technology: CAD, BIM, MAX

The techniques used by the ‘depression’ paradigms go well beyond the ‘denial’ and ‘anger’ paradigm’s use of simple 2D GIS or clever viral emailing. Unlike the ‘bargaining’ New Urbanists, the Post Urban, Starchitects and Facaditects are comfortable with cutting edge technology for both design and representation. They accept and express the ‘techno-flow of a global world, both real and virtual, [and are] explorative rather than normative’ (Kelbaugh 2000, para.8). Since the early 1990’s there has been exploration of the possibilities of emerging technologies within the avant-garde architectural stream.

The office of OMA\textsuperscript{1} has been using CAD drafting package AutoCAD\textsuperscript{TM} from Autodesk since the late 1980’s developing office standards for conveying complex building information. They use a ‘switch’ system for their CAD layers\textsuperscript{2} which involves using DOS style ‘switches’ and ‘wildcards’ to describe building elements and description (Little 2000), for example the layer WALL-STUD defines the element (wall) and the material (timber stud), or the layer FLOR-FINI defines the a change in floor finish (See Figure 55). This allows the architect to control a mass of information, for example turning of all the information on the floor to turn a drawing into a reflected ceiling plan by typing the commands: -LAYER\textsuperscript{OFF} *FLOR*

This principle for layering has allowed OMA and other firms to deal with large scale and highly complex buildings with complex layering of information similar to specialised contemporary mapping software – Geographic Information Systems (GIS). The information management has also been hastened by users within the offices by developing simple user customised scripts to automate the process. Repetitive elements are defined as ‘Attributed Blocks’ so that objects such as a toilet can be defined with the plan of the toilet, with other vital information for scheduling such as the make, colour, slab penetration size and cistern style. With an advanced system of CAD drawing overlays using ‘external referencing’ (XREF), these architects have been essentially using what is now commonly referred to as BIM (Building Information Modelling). Though BIM

\textsuperscript{1} OMA is the Office of Metropolitan Architecture. Rem Koolhaas is a partner and founding member.

\textsuperscript{2} AutoCAD uses a system of layers for different information which can be turned on and off.
technology had been around in 1980s in various forms such as Graphisoft’s BIM program ArchiCAD™. The simplicity of the classical element style modelling made the programs extremely limiting for non run of the mill buildings.¹

Figure 55: OMA AutoCAD™ layers example.

Frank O Gehry’s Guggenheim Museum in Bilbao, Spain in 1997 was a pivotal point in the use of high end parametric² BIM technology, when his firm used Dassault’s CATIA™ program, originally developed by Dassault-Aviation as a CAD application for the development of the Mirage fighter plane (Shelden 2002 p.28). This program allowed Gehry to develop a new vocabulary of architectural forms and use the new digital media to present ‘new design intentions communicated in a formally rigorous manner’ (Shelden 2002 p.333).

American architect Greg Lynn is another notable example of an avant-garde practitioner who draws upon digital technologies. Lynn uses animation software and customised ‘plug in’ software

¹ For an example of architecture that has been limited by using BIM technology see www.fkarch.com or www.hayball.com.au.
² Parametric modelling involves modelling geometry with mathematical equations in which alternative scenarios can be tested by changing the values of parameters. Parametric technology allows relationships among geometric elements to be encoded in the model as part of operations on these elements (Shelden 2002 p.91).

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to produce ‘blob buildings’ (Clarke 2006). Like Gehry’s use of aeronautical engineering software, Greg Lynn’s use of animation software is not authored by or for architects, and has its roots in the film industry (Clarke 2006)\(^1\).

\[\text{With current [customisation] technology it is possible for the average computer user to easily author operative techniques as software and turn around and market these ideas (Clarke 2006).}\]

These user-authored techniques or user customisation, adaptation or adoption of other discipline specific software has been occurring in the realm of the avant-garde starchitects and Post Urbanists on individual iconic buildings. It has not been the case for the previously mentioned urban design paradigms such as NIMBY or New Urbanists.

**Three facets**

Unlike the prior three stages of grief, the ‘depression’ stage paradigm has a strong symbiotic relationship between the paradigm and the uptake of design techniques. The strong interest in not only mastering technology, but having a hand in the development of the techniques allows these designers to express architectural ideas that were previously not possible. The ‘depression’ stage does, however, disengage with society’s prevailing urban agenda for sustainable urbanism in that it largely ignores the issues raised in Section 4.2. The diagram below shows the relation ship between the three facets of urbanism for the paradigm in the stage of ‘depression’.

![Diagram showing relationship between three facets of urbanism in the ‘depression’ stage. The design paradigm and design techniques have a strong overlap, whereas the sustainability urban agenda does not.](image)

**4.3.6 Acceptance: ‘It’s Going to be OK. Let’s Get on with Our Lives’ (Post-Post Urbanism, Space Syntax and Smart Growth)**

The final stage of grief is ‘acceptance’. At this point one comes to terms with the loss: recognising that the loss has occurred; recognising that there is no point placing blame; accepting that it is not possible to go back to how things were in the past; deciding not to dwell on that which cannot be

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fixed; and begins to move on focusing on the future and what can be done to make the future better.

**Post-Post Urbanism, ‘Optimistic Koolhaas’**

Despite the Koolhaas nihilistic rhetoric discussed earlier, much of the Koolhaas practice seems quite optimistic and accepting. Koolhaas does not yearn for a rationalized urban order, and ‘leaves all dreams of La Ville Radieuse behind and embraces the chaos of contemporary urbanity, accepting it as given and good’ (Gilbert 2002).

As discussed earlier, the OMA scheme for Melun-Sénart outside of Paris, accepts a level of uncertainty and chaos, whilst strictly enforcing the preservation of key picturesque vistas from and through the site. The scheme lays down where no building should be as a kind of negative figure ground plan.

![OMA scheme for Melun-Sénart outside of Paris showing A voids - uninhabited, and B – inhabited areas.](image)

In a competition scheme for Beijing, Koolhaas proposes a contemporary idea of preservation, retaining the historic city in bands, in a similar to the Melun-Sénart strategy. This project is reminiscent of his seminal competition entry for Parc de la Villette utilising bands of preservation intermixed with bands of uncontrolled, generic development.

...fragmenting world composed of isolated zones of the “other” (e.g. the homeless, gays, communes, militia, prisoners, minorities, etc.) as well as mainstream zones of atomistic consumers, internet surfers, and free-range tourists. Outside the usual ordering systems, these liminal zones of taboo fantasy and commercial zones of unfettered consumption are viewed as liberating because they allow for new forms of knowledge, new hybrid possibilities, new unpredictable forms of freedom (Kelbaugh 2000 p.173).
Koolhaas describes his work as sustainable, but in a different way to most (Ramonds 2007), it is about adaptability and cultural sustainability. For example the CCTV building in Beijing is essentially a Miesian glazed curtain wall tower (not particularly energy efficient) but has a heroic formal complexity that will make the building a cultural icon unlikely to be demolished thereby giving the building a level of permanence, maintaining the embodied energy\(^1\) in the building materials. Whereas buildings covered in sun shades that appear more ‘environmental’ may be less *culturally* sustainable, leading to demolition\(^2\), leading to the loss of the building’s embodied energy.

Other groups that may fall into the Post-Post Urban category are West 8 (landscape architects and urban designers) as well as MVRDV.

**Techniques and Technology: CAD, BIM, MAX**

The techniques and technology used by the Post-Post Urbanists is essentially the same as that of the depressed urban design paradigm. There is use of CAD and animation packages, along with modifications made to these programs to further develop and demonstrate new concepts for urban design. Though these developments represent ideas that do engage with the aspect of cultural sustainability, they only touch on environmental or economic or social sustainability.

**Three Facets**

The ‘acceptance’ paradigm of Post-Post Urbanism has a similar relationship between the paradigm and the techniques of the ‘depression’ stage. The techniques used influence and are influenced by the design paradigm, with a small amount of influence from some aspects of prominent social urban agendas. The relationship is shown in the diagram below (Figure 59).

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1 Embodied energy is the energy that is used to produce and transport materials used in construction.
2 This case has been demonstrated by a lot of modernist social housing that has good thermal mass, a high level of cross ventilation, high density, (some of the key principles of sustainable buildings) are being torn down due being culturally unsustainable. (see www.hnb.dhs.vic.gov.au/ooh).
Spatial Syntax - Proof Based Design as Paradigm and Technique.

Another group in the ‘acceptance’ stage is Space Syntax. Though not generally considered a major urban design paradigm in urban design literature (Kelbaugh 2000), over the two decades a group of forward looking academics/consultants in London have been studying spatial configurations. Space Syntax is a term used to describe a set of theories and techniques for the analysis of spatial configurations. The term was conceived by Professor Bill Hillier and colleagues at School Of Graduate Studies at The Bartlett, University College London in the early 1980s\(^1\) to critique a variety of different spatial configurations on varying scales, published in the document *The Social Logic of Space* (Hillier & Hanson 1984).

The method of critique utilises purpose-built software that attempts to give a numeric basis to the analysis of urban qualities and predict the social effects of changes in spatial configurations.

> *Space Syntax provides a unique, evidence based approach to the planning and design of buildings and cities. Our focus is the creation of environments which are socially and economically successful.*\(^2\)

There are three basic conceptions in Space Syntax Analysis (Klarqvist 1993 pp.11-12):

- ‘Convex space’ is a space where no line between any two of its points crosses the perimeter.
- ‘Axial space’ or an axial line is a straight line (“sight line”), possible to follow on foot.
- ‘Isovist space’ is the total area that can be viewed from a point.


The main concept is that pedestrians move along ‘sight lines’ generally taking the simplest straight line routes with as few turns as possible. The more changes in direction, the more complex the system, the less well connected and intelligible the spaces (Barker 2001 para.4). Using these concepts three types of mapping can be produced: ‘Depth mapping’ (depth between two spaces); ‘Justified graphs/axial graphs’ (visual picture of the overall depth of a lay-out seen from one of its points (tree-like)); and ‘Visual Graph Analysis’ a summation of Isovist spaces form all conceivable positions.

The graphs can then be used to judge statistically the connectivity (number of immediate neighbours that are directly connected) and integration (average depth of a space to all other spaces). In Hillier’s seminal opus _Space is the Machine: A Configurational Theory of Architecture_ (1996) he describes the process of mapping and analysis involving the assessment of readability of spaces with the use of specifically developed software. Though he does not mention Kevin Lynch’s theories on ‘way-finding’ (1960 pp.3, 4, 125), his analysis has obvious similarities with that of Lynch, though perhaps in a more mathematically rigorous way.

_Intelligibility is a challenging property in an urban system. Since by definition urban space at ground level cannot be seen and experienced all at once, but requires the observer to move around the system building up a picture of it piece by piece, we might suspect that intelligibility has something to do with the way in which a picture of the whole urban system can be built up from its parts. ‘Connectivity’ is clearly a property that can be seen from each space, in that it sums up the depth of that space from all others, most of which cannot be seen from that space. The property of ‘intelligibility’ in a deformed grid means the degree to which what we can see from the spaces that make up the system – that is how many other spaces are connected to – is a good guide to what we cannot see, that is the integration of each space into the system as a whole_ (Hillier 1996 p.94).

Hillier suggest that street layout and configuration is a key determinant of pedestrian movement. He calls this the ‘principles for natural movement’ (Hillier 1996 p.101). Hillier’s hypothesis is that a type of axial map can be used to test a spatial configuration’s influence on patterns of movement in space. Hillier tests the hypothesis using axial map comparison with manually collected data (groups of students using ‘clickers’) concluding that ‘movement is not only largely determined by configuration, but also by configuration on a fairly large scale’ (Hillier 1996 p.123).

Through the 1980s and early 1990s the group was involved in minor consulting work and published various academic papers, but it was not until 1996 that they received their high profile commission from Westminster City Council to work with Foster & Partners for a pedestrian movement and ‘pedestrian impact assessment’ study of the Trafalgar Square project in London. The Foster team used the Space Syntax movement analysis to inform their design scheme for the...
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job. The project has been heralded ‘a huge success, with levels of pedestrian movement in the square increasing by thirteen times.’

Figure 60: ‘Pedestrian impact assessment’ study for the Trafalgar Square project in London

A number of key contributors in the research field of spatial modelling and analysis have come out of the UCL Space Syntax group such as Michael Batty who heads up The Centre for Advanced Spatial Analysis (CASA); Paul M. Torrens head of Geosimulation Labs; Jake Desyllas heading up Intelligent-Space, all of whom are utilising customised CAD and GIS systems.

Though councils and statutory planners believe that Space Syntax analysis is ‘light years ahead of everybody else’ (Spacesyntax 2008 p.6) it comes at a prohibitively high cost. Councillor John Jowers, Colchester Borough Council said, ‘At first I questioned the amount of money as it was about twice as high as some of the others’ (Spacesyntax 2008 p.6). This sentiment was shared by Mark Allan of Vic Urban who said that ‘it all looks very convincing, but only if they could do it at half the cost’. The issue of cost of specialist input is an important one in the context of this thesis and will be discussed further in later chapters.

**Three Facets**

In the case of Space Syntax, the relationship between the urban agenda for sustainable urbanism and design techniques is strong. The basis for much of the Space Syntax Group’s work is to do with pedestrian movements, which clearly reflects agendas stated in Section 4.2. The techniques and the agendas do not however, necessarily manifest themselves into an approach for synthesising urban design. Therefore in the Figure 61 diagram I show the paradigm to just touch on the agendas and techniques, whilst showing a strong crossover between agendas and techniques.

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2 Mark Allan (Vic Urban), 0003-Minutes from focus group meeting conducted 10th Feb 2006 at MGS Architects 12-20 Manton Lane Melbourne. (see Appendix 10.14.2).
**Smart Growth USA**

Another approach that I believe fits into the category of ‘acceptance’ is the urban planning and transportation theory *Smart Growth* that concentrates urban growth within ‘growth boundaries’ in strategic areas particularly around transit nodes. It has roots in growth management strategies from the post 1973 United States particularly Portland Oregon, and some Scandinavian cities (Montague 2006). Smart Growth focuses on restoring existing urban centres, concentrating new development in transit and pedestrian oriented nodes and limiting suburban expansion especially into fertile farmland or sensitive ecosystem areas.

The Smart Growth approach is perceived to result in more compact cities resulting in lower CO₂ emissions. The United Nations and the European Union have moved in favour of the Smart Growth compact city, embracing the position ‘supported by research that more dense cities consume the least amount of energy for transport’ (Batty 2004).

More than 210 US mayors have signed carbon emissions agreement in response to US federal government’s refusal to sign the United Nations’ Kyoto Protocol agreement on addressing climate change (Barker 2006). The various jurisdictions will change their policies towards Smart Growth with increased density and improved public transport as part of their aim to meet Kyoto Protocol targets.

Smart growth shares many similar objectives (*agendas*) with New Urbanism. *Smart Growth America* (SGA) list walkability, mixed use, transport oriented development and preservation of open space as key principles, almost identical to some of the principles from the New Urbanist Charter. And like the New Urbanist movement, Smart Growth America has a charter/list of principles that designers and policy makers can use as a guide for decision making (see Table 1).
The key difference between the New Urbanist Charter and that of Smart Growth seems to be that Smart Growth has less emphasis on ‘traditional design’ particularly in the aesthetics. Smart Growth’s point number 5 ‘distinctive, attractive communities with a strong sense of place’ does not restrict contemporary or experimental architectural languages, though this term is also fairly vague and subjective.

1. Mix land-uses
2. Take advantage of compact building design
3. A range of housing opportunities and choices
4. Create walkable neighbourhoods
5. Foster distinctive, attractive communities with a strong sense of place
6. Preserve open space, farmland, natural beauty, and critical environmental areas
7. Strengthen and direct development towards existing communities
8. Provide a variety of transportation choices
9. Make development decisions predictable, fair and cost effective
10. Encourage community and stakeholder collaboration in development decisions

Table 1: The 10 points of smart growth (Smart Growth.org 2002).

Along with sharing many of the ideas of New Urbanism, Smart Growth has shared some of the same criticisms from the same anti consolidation critics. Wendell Cox suggests that greater population density leads to more congested roads and therefore more pollution from cars (Cox 2003). Robert Bruegmann (2005) and Randal O’Toole (2001) both maintain that, according to their research, Smart Growth goes against the wishes of the general public, as people prefer to live in low density areas. This is contrary to studies conducted by ‘Fannie Mae’, which found that the majority of Americans say ‘they personally find very appealing many aspects of city life, such as the convenience of having shopping, schools, and public transportation within five to ten minutes of home (59% find that “very” or “extremely appealing”); (Fannie May 1997 p.19). The Smart Growth movement also garners support from expert researchers from the Space Syntax group:

*We conclude not with a plea that cities should be compacted and all automobile traffic removed but that we should engage in policies for ‘smart growth’ such as those being adopted in North America… [to] increase urban sustainability through instruments which do not aim to stop growth but to control it in intelligent ways* (Batty et al, 2003 p.3).

Smart Growth also draws heavily from the principles of Transit Oriented Development (TOD), which involves emphasising expenditure on public transport particularly rail over road infrastructure and increased density within walking distance from transport interchange nodes.
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(see Figure 62) ‘reverse the normal parking rules’ (Liedstrand 2005)\(^1\) where maximum carparking numbers are legislated instead of minimum. TOD theory aims to address a number of the agendas discussed in Section 4.2 but also appeals to financial imperatives with ‘financial return’ and ‘value capture’ (Table 2) being key points relating to increasing land value and funding public transport (Liedstrand 2005).

1. Locality efficiency
2. Value capture
3. Liveability
4. Financial return
5. Choice
6. Efficient regional land-use patterns

Table 2: Six deterministic performance areas for Transit Oriented Development (Belzer & Autler 2002).

Smart Growth deploys descriptive principles for designers and policy makers to draw on more than setting out strict design rules like the New Urbanists do. Smart Growth operates at a regional scaled level, not necessarily dealing with medium scaled city grain (urbanism) and such Smart Growth is ideally suited to utilising GIS analysis technologies – using the kind of regional scaled statistical analysis - what GIS does best (Sipes 2006).

**Smart Growth Scandinavia**

Smart Growth concepts are also currently under discussion in Scandinavia. In September 2007, at the IFHP-World Congress in Copenhagen, the Danish Foundation Realdania announced the summary of a Scandinavian think-tank with input from 50 global experts to develop a series of principles for creating a sustainable city. It stated that ‘over half the world’s population – more

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that 3 billion people – now live in urban environments, making our cities the key to a sustainable future (Realdania 2007 p.16). This demands new approaches to how we understand, plan, build and use our cities, so that we can give city users better access to a sustainable lifestyle. The think tank concluded with 10 principles (Table 3) similar to the performance for Smart Growth America (see Table 2).

1. Rediscover the city
2. Redefine city value
3. Involve everyday experts
4. Break down silos
5. Redistribute urban decision-making
6. De-design urban planning
7. Promote corporate responsibility
8. Go global
9. Embrace chaos, crisis and change
10. Encourage passion in urban leadership

Table 3: ‘Copenhagen Agenda for Sustainable Cities’, Scandinavian think-tank concluding principles for sustainable cities.

Though the principles are similar to Smart Growth with a focus on urban consolidation (principles 1 and 2), there are some differences.

Where Smart Growth principle 10 states ‘Encourage community and stakeholder collaboration in development decisions’, in the Scandinavian think-tank principles, the objective is more specific, and recognises the potential weakness in citizen participation. They state that citizen participation risks:

…being overrun by “the usual suspects” – activists who do not really represent the majority in all its diversity. Citizen participation must still involve these “active citizens”, but also reach out to people who would not normally take part of their own accord (Realdania 2007 p.8).

This point is particularly relevant in light of the discussion in section 4.3.3 (p.75).

Another difference between the Copenhagen Agenda list and that of Smart Growth or New Urbanism is point 9: Embrace Chaos, Crisis and Change. The report states that ‘flexible governance and an innovative mindset to overcome crisis is vital’. This is more in line with the position of Koolhaas than with US Smart Growth or New Urbanism, with sensitivity towards the changing demands of city users and the unpredictable nature of development. On one hand they allow for determinant visionary master planning, but on the other hand insist on a looseness of form,

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1 For the full documentation of the think tank principles, see mm.dk/filer/10principles.pdf.
…sustainability strategies need to be flexible in order to deal with the changing needs and demands of city users… long-term visions and master plans are critical, and should be combined with flexibility, so that these plans become easier to implement in the long run (Realdania 2007 p.14).

The other crucial point of difference between the Copenhagen Agenda list and that of Smart Growth is in recognising the difficulty in implementing sustainable urbanism strategies within a context where disciplines are fragmented. Point 4 - ‘Break down silos’, which states: ‘sustainable city planning is inherently multidisciplinary. Therefore, old administrative structures should be abandoned in favour of innovative, cross-sector cooperation… the awareness of the need for cross-disciplinary thinking is growing and that the fragmentation of disciplines over time has led to less sustainable cities (Realdania 2007 p.3). This point is particularly relevant in the context of this thesis as it is very much inline with my hypothesis stated in Section 2.2 (p.17). If the fragmentation of disciplines leads to less sustainable cities, it would be reasonable to suppose that a defragmentation of disciplines would lead to more sustainable cities.

Techniques and Technology: Large Scale Growth Management Strategies

The Smart Growth paradigm uses a variety of techniques that are directed at regional scaled change. They take the form of Urban Growth Boundaries, and Euclidian style zoning using GIS, but in a different way to those discussed in the ‘denial’ stage. Instead of separating land-uses with single use (eg. single family residential zone), Smart Growth encourages ‘mixed-use’ zoning where residential, commercial and retail co-exist, and uses separation for environmental protection of ecologically sensitive areas allocating land for fauna and flora and encouraging brown field (reuse or redevelopment of derelict sites) over green field city expansion. There is also web based campaigning in perhaps a less aggressive manner to the ‘angry’ paradigm, using lists of written objectives on the urban agenda similar to the New Urbanists. There is little in the way of engagement with 3D digital modelling possibilities used by the Post Urbanists, opting for 2D plan and sectional guidelines for building setbacks, roof forms, height limits in a similar way to New Urbanists but with greater emphasis on growth containment and environmental protection.

Three Facets

The diagram below illustrates the relationship between the three facets of urbanism in the case of Smart Growth. The urban design paradigm relates strongly to society’s prevailing urban agenda for sustainability, but has limited overlap with possibilities of contemporary techniques with some engagement with 2D and 2.5D (2D with height attributes) but little use of 3D digital modelling techniques.
4.4 Conclusion

4.4.1 Summary

In the previous chapter I established a strong relationship existed in key moments in history between society’s prevailing urban agendas and urban design through a review of the relationship between the agendas with design techniques and urban design paradigms – the three facets of urbanism. In this chapter I set out to demonstrate that a gulf has occurred. There is currently not a symbiotic relationship between the three facets urbanism. I have done this by reviewing my three facets in contemporary society.

In this chapter I have discussed prevailing contemporary urban agendas of society, urban design paradigms and design techniques in the light of the previous chapter’s discussion on this relationship. In section 4.2 (pp.59-69) of this chapter I examined some of the urban agendas that are considered to be of major significance in contemporary society:

- Fear for peak oil – loss of cheap fuel
- Climate change – loss of environmental stability
- Long commutes – loss of time
- Social segregation – loss of diversity
- The obesity epidemic – loss of health; and a fear of amenity loss.

This section highlighted a general sense of a fear of loss in much of contemporary society. It also illustrated that the overwhelming majority of the academic literature is in support of the concept of sustainable development and urban consolidation. Continuing, uncoordinated growth, and continuing car dependency is seen as unsustainable, and suggest that the logical effect this should have on urban design is managing growth by concentrating new development and redevelopment adjacent existing or new rail or light rail infrastructure. I discussed the concept of sustainability as an overarching theme bringing together a number of contemporary urban agendas.
Section 4.3 (pp.69-102) analysed contemporary urban design paradigms and their use of various techniques and technologies in response to the urban agendas highlighted in section 4.2 of the chapter. The section uses the somewhat sardonic analogy of Kübler-Ross’s five stages of grief. This construct proved to be useful as a narrative device allowing me to group and analyse the major urban design paradigms in a way that has shed new light on where these paradigms sit in the context of contemporary urban issues. The metaphor is also useful in suggesting the most positive, forward looking future direction for urban design in a post optimistic world.

Section 4.3.2 (pp.70-74) explored the first stage of grief – ‘denial’. Advocates for urban sprawl and those who continue to build on outer fringe properties are in ‘denial’, believing that peak oil and global warming are not real problems and take a ‘business as usual’ approach to urban design.

Section 4.3.3 (pp.75-80) discussed the ‘angry’ position of NIMBY & BANANA groups paying particular attention to national lobby group SOS in Australia. Though, on the surface, it would seem that the position of these groups is rooted in prejudice and fear of change, there seems to also be some grounding in an historical stigma associated with dense industrial cities, where increased density did indeed lead to decreased amenity. Though the likelihood of an outbreak of cholera or the plague is low in the Melbourne suburb of Camberwell, it would be fair to say that some level of protection to urban amenity is necessary in areas designated for increased density.

Section 4.3.4 (pp.80-87) discussed the ‘bargaining stage’ - New Urbanism. The New Urbanism movement represents a vain hope that the bad news is reversible with a nostalgic take on urban design, attempting to turn back the clock by building a ‘new historic’ urbanism. The section described the movement’s main criticisms, as well as some of the more successful and relevant principles. Key criticisms described were that the movement’s strict traditionalist aesthetic controls are too restrictive, that the movement borders on social engineering and that the New Urbanist developments result in exclusivity. Many aspects however are in line with key social concerns such as pedestrian connectivity and emphasis on public transport.

Section 4.3.5 (pp.87-92) the urban design position of ‘depression’ was discussed making reference to Post Urban, ‘Starchitects’ and avant-garde architects who have all but forsaken the urban design discussion. This group is at the cutting edge of technology and representation, utilising parametric modelling, 2D and 3D BIM, along with 4D animation software. In the light of the previous chapter, these designers are continuing the relationship between design and technology and techniques, but are disconnected to society’s urban agendas. This is significant in the context
of my thesis as their use of technology begs the question – what if this technology was directed towards society’s prevailing urban agenda instead of expressive form making?

Section 4.3.6 (pp.92-102) dealt with urban design paradigms that are forward looking. The fifth stage of grief, ‘acceptance’ encompasses the more optimistic work of Rem Koolhaas and OMA, as well as the Space Syntax group, and various incarnations of Smart Growth. The relationship between the three facets was shown to be stronger for these groups than the previous paradigms.

| Stage 1: ‘denial’ (Euclidian Zoning – business as usual) |
| Stage 2: ‘Anger’ (NIMBY & BANANA) |
| Stage 3: ‘Bargaining’ (New Urbanism) |
| Stage 4: ‘Depression’ (Post Urbanism, Starchitects & Avant-garde) |
| Stage 5: ‘Acceptance’ (Post-Post Urbanism). |
| Stage 5: ‘Acceptance’ (Space Syntax). |
| Stage 5: ‘Acceptance’ (Smart Growth). |

![Image of diagrams]

Table 4: Summary of the three facet diagrams for each of the urban design paradigms in the five stages of grief.

### 4.4.2 Discussion

Of the five urban design paradigms, ‘denial’ and ‘anger’ seem to be the least representative of the greater contemporary urban agendas, or technological advancements. Other than identifying the valid concerns for preserving heritage and urban amenity, and the strategic use of ‘viral marketing’ internet campaigning, these paradigms seem to have little to offer the concept of sustainable urbanism.

‘Bargaining’ (New Urbanism) reflects some key urban agendas, but does not engage with the unpredictable chaos aspects of contemporary society, or the contemporary technology aspects, using instead regressive design techniques. The ‘depression urbanism’ engages heavily with technology and techniques, has a heavy commitment to contemporary cultural aspirations and...
reflects the ‘information age’ within its expressive forms, but has limited engagement with broader urban agenda of sustainable urbanism.

Within the ‘acceptance’ paradigm, the Space Syntax group also engages with technology in a sophisticated manner, as well as the social aspirations identified earlier, but does not concern itself particularly with cultural/artistic aspirations of urbanism. Space Syntax takes advantage of technological possibilities for analysis and design, with an approach that is more scientific than the other paradigms, but consultancy can be prohibitively expensive and is generally a sub-discipline, offering ‘evidence-based planning and design advice’1 to urban designers, as opposed to offering integrated analysis and design work. Conversely the ‘Post-Post Urbanism’ or ‘optimistic Koolhaas’ work responds to contemporary culture, use of 3D and 2D BIM, and offers fresh approaches to thinking about heritage, landscape and locality not present in other paradigms. Though this work of Koolhaas is perhaps less overtly directed at environmental sustainability principles, has offered useful propositions for economic and cultural sustainability. The most environmentally conscious paradigm would seem to be Smart Growth. Smart Growth encompasses the many recommendations for urban consolidation discussed in section 4.2 such as minimising car dependence, restricting peripheral urban growth, pedestrian connectivity and transport oriented development. If New Urbanism is too prescriptive and descriptive for urban form, it may be suggested that Smart Growth is not prescriptive enough, relying on written policy principles as opposed to hard lined plans or models. When plans are made, they are utilise GIS software to great effect to implement large scale ecological protection strategies, but generally does not go into a fine level of detailed.

4.4.3 Conclusion

In this chapter I identified disparities between society’s contemporary prevailing urban agendas, current urban design paradigms and design techniques, which were not the case in important historic precedents discussed in the previous chapter. I have found that design approaches of the ‘acceptance’ paradigm showed a strong crossover between two, but not all three of the facets, confirming the assumption in my hypothesis that a gulf has occurred between prevailing urban agendas of society and urban design.

The arguments I put forward in this chapter suggest that the most important contemporary urban agendas of society relate to sustainable urbanism. The bulk of the literature I have addressed argues that sustainable urbanism requires people to live more densely to improve their health, reduce their reliance on oil, reduce time wasted in commuting, allow for social diversity,

and reduce carbon emissions. Population density needs to be increased, and this should be done with increasing pedestrian connectivity; in a financially viable manner, but should not be at the expense of amenity.

Of the current urban design positions, the findings in this chapter suggests that those positions that concentrate on urban consolidation are best suited to the urban agenda of environmental sustainability. The findings imply that more attention is given to the very vocal minority who oppose increased density, and though they raise some relevant concerns, should generally be dismissed as less relevant to the social aim of sustainability. The argument put forward in this chapter indicates that the contemporary cultural and artistic aspects of sustainability are best served by the Post Urbanist and avant-garde positions.

The current design techniques used in practice by the different urban design positions demonstrate a range of levels of engagement with the technology that is currently available. Regional scaled planning such as Smart Growth in some cases has been utilising GIS software; avant-garde architects have been utilising a range of technologies such as BIM systems, animation software, parametric modelling software, and customisation of software; other positions use internet sites and viral marketing. If the question was asked ‘what is the contemporary equivalent to Renaissance perspective?’ it would be difficult to give a single answer, but it would likely be one or a blend of multiple techniques being employed by the avant-garde ‘depressed starchitects’.

Of the urban design positions analysed in this chapter, none have the kind of synergistic relationship between all three aspects of design – urban agendas, design approach and techniques – discussed in the previous chapter. The arguments in this chapter suggest that the design position that would be best suited to addressing current social aspirations would perhaps be a combination of elements from the different ‘acceptance’ approaches. Perhaps a mix of the environmental aspects of Smart Growth, with the cultural inventiveness of ‘Post-Post Urbanism’, the artistic interrogation and use of cutting edge technology of the Post-Post Urban and avant-garde, with the scientific / forensic analysis of Space Syntax. For this new design position to be effective, it would need to address the current dilemma of the fragmentation of the disciplines, limited design budgets (financial and time), and utilise cutting edge technologies for representation and analysis. It should reinstate the synergistic relationship between urban agendas, design paradigms and design techniques illustrated in the previous chapter, ideally maximising the overlap between the three facets of urbanism (Figure 64).
Physically, cities are stocks of buildings linked by space and infrastructure. Functionally, they support economic, social, cultural and environmental processes. In effect, they are a means-ends system in which the means are physical and the ends are functional. Our most critical area of ignorance is the relation of means to ends that is of the physical city to the functional city. The fact that sustainability is about ends and the controls largely about the means has exposed our ignorance in this critical area. One reason for this ignorance is the compartmentalisation that has developed over the past quarter of a century among the disciplines concerned with the city. There is now a deep split between those who are preoccupied with analysis and control of the social and economic process which animate the city, and who for the most part call themselves planners, and those concerned with physical and spatial synthesis in the city, who call themselves urban designers. This split is now, in effect, a split between understanding and design, between thought and action (Hillier 1996 p.111).
Chapter 5. Local Context – Melbourne 2030

5.1 Introduction

In the previous chapter I discussed key urban agendas of society in a contemporary international context. I argued by way of metaphor that the prevalent urban design paradigms in that context can be categorised into five stages of grief. I also examined the various design techniques used by each of the paradigms. I concluded that the design techniques and approaches failed to express the symbiotic relationship between the three facets of urbanism that was the case in the key moments in urban design history explored in Chapter 3, confirming the assumption in my hypothesis; that a gulf between contemporary society’s prevailing urban agendas and urban design has emerged.

The aim of this chapter is to establish where Melbourne, Australia sits in the context of the international discussion of sustainable urbanism. What are the prevailing urban agendas? What are the predominant planning approaches or paradigms? And what are the techniques that are currently being used in the implementation of that approach? I set out to answer these questions by examining the current local planning policy document *Melbourne 2030 Planning for Sustainable Growth* (DOI 2002) in the light of the findings of previous chapters. Once again I will use the three facets of urbanism to question the document, and ascertain where improvements could be made in the practical implementation of the document’s objectives.

5.2 Melbourne’s prevailing urban agendas

5.2.1 Where Does Melbourne sit in an International Context of Society’s Broad Urban Agendas?

In 2002 the Victorian State Government released the strategic planning policy document *Melbourne 2030 Planning for Sustainable Growth* (DOI 2002). The document is a metropolitan consolidated growth strategy for the area of Greater Melbourne intended to cover the period 2002-2030. The document has been informed by the ‘Melbourne Principles for Sustainable Cities’ written in Melbourne at a United Nations-sponsored workshop, tabled at the 2002 Earth Summit in Johannesburg, South Africa. The *Melbourne 2030* document describes the projected increase in

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2 The principles are available at www.dse.vic.gov.au.
of the population the Melbourne by one million people (currently just under four million), and outlines the proposed areas to accommodate this growth (DOI 2002 p.14) with the aim to limit sprawl.

*Melbourne 2030* states the broad agenda of planning for sustainable growth in the document title and then distils a broad range of agendas into nine ‘directions’ (see Figure 65). There are similarities between these directions and those urban agendas I stated in Section 4.2 (pp.59-68), though this is not necessarily immediately apparent.

Though the document *Melbourne 2030* does not refer to peak-oil, the Directions 1 – ‘A more compact city’ and 2 – ‘Better management of metropolitan growth’ have strong similarities to the oil reliance minimisation agenda of Portland Oregon in the US or Copenhagen Denmark from the 1970s onwards.

Directions 1 & 2 along with Direction 7 – ‘A greener city’, and Direction 8 – ‘Better transport links’ could be considered to be aimed at a climate change agenda. In particular, Policy 7 states that ‘new rules for energy efficiency in commercial and residential buildings, the shift to public transport, and increased recycling of non-domestic wastes will make the city less wasteful of energy, cut greenhouse gas emissions, improve air quality and make Melbourne a “greener city” (policies 7.1 – 7.9)’ (DOI 2002 p.10).

![Policies and initiatives](image)

Though commute times are not discussed in the document, there is specific mention of accessibility to public transport. Policy 8.3 states: ‘plan urban development to make jobs and community services more accessible’ (DOI 2002 p.5). The policy also states that it ‘must offer viable alternatives for travellers’ (DOI 2002 p.24) with reference to a study originally conducted
by the Australian Bureau of Statistics (Figure 66), which shows that only a small percentage of people are able to get to their place of work within 40 minutes using public transport.

![Access by car](image1.png) ![Access by public transport](image2.png)

Figure 66: Percentage of jobs accessible within 40 minutes travel (by car and public transport) (DOI 2002 p.24).

Though a clear position on single land-use zoning is not made explicit in *Melbourne 2030*, a clear desire for social diversity and housing affordability is stated.

*There will be a focus on encouraging a wider range of housing types and more affordable housing (Initiatives 1.3.4, 6.1.1, 6.1.2) (DOI 2002 p.91).*

No strategy for removing strict single land-use zoning is made other than within specific designated areas. ‘The Principal and Major Activity Centres will be the preferred locations for future higher-density residential and mixed-use developments’ (p.8), ‘encouraging more mixed-use development in appropriately located centres’ (DOI 2002 p.47).

Attempting to address the tendency towards obesity is also not discussed, though there is an emphasis on walkability stated under Direction 5.5: ‘Promote excellent neighbourhood design to create attractive, walkable and diverse communities’ (DOI 2002 p.91). Direction 8.8 suggests giving ‘more priority to cycling and walking’ (DOI 2002 p.91) though it is rather light on detail as to how this would occur.

Fear of amenity loss is touched on in *Melbourne 2030* where the ‘protection of existing suburbs’ is stated amongst the policy objectives (DOI 2002 p.9) with ‘land-use and activity patterns to minimise impacts on the amenity of residential and commercial areas’ (DOI 2002 p.153). The document suggests ‘increased densities will not be achieved at the expense of existing amenity’ (DOI 2002 p.9). Though policies 1.3.4, 6.1.1 and 6.1.2 mention possible locations of high density
housing, these policies are also short on detail, leaving the actual locations to local councils to
decide (Policy 1.1.1, DOI 2002 p.54).

As suggested in the document title Melbourne 2030 Planning for Sustainable Growth, an overriding
theme is sustainability. Then State Premier, Steve Bracks, used sustainability rhetoric to introduce
the document.

Melbourne 2030 is part of our Growing Victoria Together vision that balances economic, social
and environmental goals, so that our children will enjoy an even better quality of life
(DOI 2002 p.ii)

This general aim has been widely accepted across political parties with the Leader of the State
Opposition who praised the intent of the document if not the specific policies1. The general
acceptance of the premise of sustainability on both sides of politics reflects the theme’s broad
appeal to the voting constituent and thus its importance as the prominent urban agenda of
society within the State of Victoria.

5.2.2 Conflicting Agendas – Appealing to Interest Groups

Though the sustainability urban agenda is greatly supported, the implementation policies have
been widely criticized (Birrell & O’Connor 2005). ‘The core of Melbourne 2030 is nine “directions”
– or desired results – whose achievement over time depends on putting into effect specific,
carefully framed policies’ (DOI 2002 p.2). The specificity is, however, left open to interpretation
by local councils. The interpretation of Melbourne 2030 agendas is not as straightforward as a
superficial reading of the document would suggest. Underneath the nine alluringly titled
‘directions’, is a series of under current agendas, not explicitly expressed but present in the
subtext.

…while praiseworthy in its vision, 2030 is vague, even misleading, in detail (The Age
Newspaper 2003)

There are a number of smaller interest groups that the document aims to appease: private
developer interests, resident action groups, the road lobby, hard-line environmentalists, Public
Transport Users Association (PTUA) and many others, each with their own urban agendas. It is
suggested that there is a happy collaborative environment with these often diametrically opposed
interest groups (see Figure 67), though it might be more realistic if the central word ‘partnership’

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102.7 FM, RRR radio program, 31st Oct, Melbourne, Victoria, Australia.
were replaced with the word ‘opposition’ where the various interest groups push their own respective agendas against those of other interest groups.

![Diagram of partnerships between levels of government, community, private sector, and not-for-profit sector](image)

Figure 67: Diagram to illustrate the ‘client group’ partnership between all levels of government, the community, the private sector and interest groups (DOI 2002 p.165).

One specific agenda that conflicts with many of the overtly stated agendas in *Melbourne 2030* is that of the road lobby. As I have discussed in the previous chapter, there are compelling arguments for urban consolidation over sprawl, government spending on public transport over road building, and prioritising transport networks for pedestrian and cycling over street hierarchy, yet *Melbourne 2030* states:

*The road system will remain the key element in the region’s transport systems… roads will continue to be needed for the region’s ongoing development* (DOI 2002 p.155).

Under the same Direction title as 8.8 – ‘Promote the use of sustainable personal transport options’, the document suggests that continuing spending on:

*…selected expansion and upgrading of the road network will continue* (DOI 2002 p.155).

This statement leaves the State Government free to continue to spend money on freeway development at their discretion which may be due to the influence of VicRoads.

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1 VicRoads (Roads Corporation Victoria) is the State of Victoria’s road and traffic authority in Victoria, Australia. Since 1983 (after the dissolution of the Melbourne and Metropolitan Board of Works) the strategic development of Melbourne ‘has been controlled by the road engineers who run VicRoads and dominate the Department of Infrastructure’ (Davidson 2002). In 2002 Writer for *The Age Newspaper*, Kenneth Davidson, reported that VicRoads has been pushing for an “edge city” Los Angeles style road network reflecting the sentiment of the road lobby since the 1960s. He noted that in the unpublished draft *Melbourne 2030* that continuing road construction was more clearly stated with ‘the need to complete the Metropolitan Ring Road must be resolved. Construction of the ring road will not occur through the Eltham area and therefore an alternative route must be found’ (DOI 2002 October draft p.95), though this language was toned down for political reasons in the publicly released document (Davidson 2002).
VicRoads is the public face of the incredibly powerful road lobby that derives its power from the anger and frustration of ordinary motorists who can’t see beyond the car in front of them (Davidson 2005).

Then the minister for transport, Peter Batchelor, has been heavily criticised. ‘Batchelor, is the marionette for VicRoads’ (Davidson 2005). This claim is evidenced by the actions of the Victorian Government since the release of Melbourne 2030, where the State has commenced construction of the 45 kilometre East-Link tollway; Pakenham Bypass; Craigieburn Bypass; upgrading the Monash Freeway and West Gate Freeway.

Another seemingly conflicting urban agenda present in the document is that of the anti development NIMBY groups. As I discussed in the previous chapter, the NIMBY agenda is at odds with the principle objectives of urban consolidation, the basis for the principles of Melbourne 2030. Middle and inner Melbourne suburbs are designated for consolidated growth due to these areas being so highly serviced with public transport. These areas are also the same areas that middle upper class wish to maintain exclusivity and single detached dwelling character (as discussed in section 4.3.3). Melbourne 2030 does not explicitly state this as an objective, instead it omits detailed information as to how and exactly where density is to be increased and how high the development can go. The detail is left to local councils and communities to negotiate (DOI 2006 p.166).

Policy 5.4 ‘Protect heritage places and values,’ is left open ended with both terms ‘heritage’ and ‘values’ being subjective terms open for interpretation. Policy 5.4.4 ‘ensure that planning schemes reflect the full extent of heritage values in each municipality’ (DOI 2002 p.99). This allows councils, who are under pressure from resident groups, to put buildings and whole areas of suburbs under heritage overlay restrictions, where new development proposals can be refused if they do not meet the heritage overlay requirements in the planning scheme. Once again these requirements are subjective and left to the discretion of council planners, for example, Ordinance number 43.01-4 of the Moreland City Council can refuse an application based on whether ‘the location, bulk, form or appearance of the proposed building will adversely affect the significance of the heritage place’ (DOI 2006 p.3).

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1 Another anti-road lobby article by Kenneth Davidson titled ‘Tunnel Vision: A Victory for the Road Lobby’, written for The Age Newspaper.
2 Peter Batchelor was the transport minister for Victoria and is Victoria’s longest-serving transport minister.
3 The Not In My Back Yard groups such as Save Our Suburbs that were discussed in the previous chapter under the ‘anger’ stage of grief.
Another example of where the NIMBY agenda is covertly present in *Melbourne 2030* is Policy 5.1 that refers to ‘neighbourhood character’ (DOI 2002 p.95). This policy states that ‘ResCode and other planning requirements will be used to ensure protection of existing valued urban and neighbourhood character’ (DOI 2002 p.95). Under ResCode\(^1\) (Section 4.10b Building Height), the maximum building height is nine metres, which essentially limits development to 2-3 levels. This appears to be contrary to the spirit of urban consolidation present in the rest of *Melbourne 2030*.

There are a number of other of interest group’s agendas present in *Melbourne 2030* that appear to be conflicting, for example the National Trust\(^2\) and private developer’s interests, environmental groups and the road lobby, Public Transport Users Association and the road lobby, Cycling Victoria and Traders Associations\(^3\).

**5.2.3 Critique of Melbourne 2030’s Urban Agendas**

As the broad policy agendas are essentially in line with American Smart Growth, *Melbourne 2030* consequentially receives much of the same anti-consolidation criticism from NIMBY groups and pro-sprawl advocates.

*The hallmark of Melbourne suburbia, much loved by its residents, is the combination of low-slung houses and canopy shrubs and trees. Look down the standard street and all one sees is greenery. This streetscape does not survive infill. The green canopy goes, to be replaced by huge - usually boxlike - units or apartments (Birrell & O’Connor 2005).*

Bob Birrell and Kevin O’Connor argue against the urban consolidation agenda of *Melbourne 2030* suggesting that people do not want to:

*…downsize from their detached house and garden and move into apartment living (Birrell & O’Connor 2005).*

Birrell and O’Connor claim that younger people (in their early 30s) want to live in the outer suburbs as they are not ‘as interested in apartment living because they are entering the family-building stage’ (Birrell & O’Connor 2005). This is contrary to a study by the Australian Bureau of Statistics for Housing for Young Adult Households 2003–04, which conclude that over 30% of

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\(^1\) ResCode was the residential code of for Victoria ‘Building (Single Dwellings) Regulations’ (Thwaites & Doye 2001).

\(^2\) National Trust of Australia (Victoria) is a powerful heritage preservation lobby group set up in 1956. The Trust acts independently from the State Government lobbying for building preservation.

\(^3\) Trader Associations are insistent on retaining carparking on the area of road in front of their shops, the same area that is desirable for locating dedicated bike lanes.
young adults (18-35) choose to live in medium density housing, and that the number of single person households has risen by around 5% between 1994-95 and 2002-04. Of these single person households 53% choose to live in units and apartments and 18% in semi-detached, row or town houses. Jano Gibson from Domain, tells of the rental market ‘jumping 25 per cent for two-bedroom flats’ in some areas’ (Gibson 2008). Contrary to Birrell & O’Connor’s beliefs that young people want to live in detached housing on the fringe of the suburbs, Gibson suggests that well serviced inner suburb units and flats are so scarce that ‘bidding wars are bumping up asking prices, and keen home hunters are giving three to six months rent in advance’ (Gibson 2008). This shortage of small home supply has perhaps unsurprisingly resulted in figures for homelessness for 2005-06 that show 36,600 people in Victoria used homeless assistance services for that period (Gough 2008), a situation that is in conflict with society’s urban agenda for social sustainability.

5.3 Implementation – in which stage of grief is Melbourne?

5.3.1 Tiered Implementation Approach

*The major problem with Melbourne 2030 was that they didn’t have the implementation program in place when they introduced the policy* (McGauran 2008 Appendix 10.13.2 p.325).

As the urban agendas of Melbourne 2030 are complex and at times seem contradictory, the implementation of Melbourne 2030 policy is equally complex. The implementation of Melbourne 2030 relies on local councils maintain a dialogue between State Government and local government where they are to work together to produce ‘structure plans’ that provide for growth and change at Principal and Major Activity Centres in terms of development, land-use, higher density housing, roads and public transport, services and community infrastructure’ (DOI 2002 p.54) and planning schemes, that provide specific written requirements for developments. The

1 [www.abs.gov.au/AUSSTATS/abs@.nsf/bb8db737e2af84b8ca2571780015701e/a428496a0ccd9af8ca2571b000164d8!OpenDocument#foot%201.](www.abs.gov.au/AUSSTATS/abs@.nsf/bb8db737e2af84b8ca2571780015701e/a428496a0ccd9af8ca2571b000164d8!OpenDocument#foot%201.)
2 [www.abs.gov.au ref. 8DD7826E7F7235D8CA25732C0020820B.](www.abs.gov.au ref. 8DD7826E7F7235D8CA25732C0020820B.)
3 This is also contrary to my personal experience, being under 35, with a young family, my partner and I, like most of our friends, choose to live close to live in the inner Melbourne city of Brunswick renting a flat because we prefer to live within walking or cycling distance to work, shops and schools.
4 Domain is the real-estate section of *The Age Newspaper*.
5 A ‘structure plan’ is a planning document ‘that sets out an integrated vision for the desired future development of a place, and establish a planning and management framework to guide development and land-use change in order to achieve stated environmental, social and economic objectives’, (DOI 2002 p.184).
problem with this strategy is that local government (Councils) are subject to low level politics, where NIMBY resident group agendas have a great deal of sway with local policy. The result is a mismatch of agendas between State and local policies. Consequentially, after more than 5 years since the release of the *Melbourne 2030*, many councils still do not have structure plans in place which has led to many disputes.\(^1\) The then State Planning Minister Mary Delahunty placed the blame with the councils saying they have not acted quickly enough to realise the new plan’s potential.

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\text{No doubt there’s a need for more certainty, [But] details of Melbourne 2030 are in the hands of local councils (The Age 2003).}
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The ‘hands of the local councils’ are required to dip into their own pockets to make up any additional funding as State Government provides minimal funding for councils to produce Structure Plans for their municipalities (The Age 2003). Local councils are expected to respond to the *Melbourne 2030* report in the form of ‘Urban Design Frameworks’ and ‘Structure Plan’ documents, on a budget for consulting fees less than that which an architect might expect for one medium scaled apartment building (The Age 2003).

The structure plans are used to set up the planning rules within which new construction must abide. These documents are produced by planners, stake holders, user groups, traffic engineers, landscape architects and architects. They set out zoning plans for future development allocating programs such as ‘Retail Zone’ and ‘Entertainment Precinct’, which suggest preferred visual character, possible urban interventions, set height limits for different areas with the intention of addressing each of the nine objectives of *Melbourne 2030* (Figure 65) achieving both an increased density and retaining amenity.

\[\text{[There] is [an] inability, particularly in the middle ring for local governments to understand their regional role in providing density, Camberwell being an obvious example. But they are not alone in that, and as a result of that are pushing densities down where they should be pushing them up, often on the basis of a neighbourhood character that is defined by the smallest element in the street rather than the unseenly 1960s residential block intervention or what ever might have occurred. The Save Our Suburbs / NIMBY push back from local communities who value the character of the free standing family home irrespective of whether they are planning for future residential communities or are well matched with that form of housing… \ldots I think it is a concern about the unknown and a concern about change and a concern about the loss of their culture or their sub-culture that they individually value. The problem is that often the major advocates to stopping change are in themselves older, rather than younger, but not so old that they are needing support facilities, and they are usually disinterested in the broader city as a whole and their role in the city as a whole, and much more concerned with their place as a microcosm (McGauran 2008 Appendix 10.13.2 p.325).}\]

\(^1\) For a well documented account of the Camberwell Station controversy see: www.griffith.edu.au/conference/soac2005/published_papers/city_structures/str09a.pdf.
5.3.2 Broadly a Position of ‘Acceptance’ – US Smart Growth

The broad approach of the *Melbourne 2030* has clear similarities with the approach of American Smart Growth and Transit Oriented Development (TOD), with the nine Directions (see Figure 65) similar in nature to the directives of Smart Growth or TODs. This similarity would suggest that the broad approach to implementation, at least explicitly stated by the State Government, accepts the global challenge of climate change and sustainable urbanism.

*In new urban development, transit-oriented development and smart growth principles will reinforce the focus on sustainability by promoting walking, cycling and public transport instead of cars, and by reducing the amount of land and resources required for buildings (DOI 2006 p.126).*

The *Melbourne 2030* document sets the target of reducing the annual construction of low density development on fringes from about 60% to 40%, redirecting growth towards the well serviced inner and middle suburbs in designated ‘activity centres’¹, and initiating a legislated urban growth boundary to contain further sprawl². The policy emphasises public transport serviced suburbs over car-dependent suburbs. It sets out the aim for street networks that are ‘better connected’ for walking and access to public transport (DOI 2006 p.10) in a manner similar to Smart Growth.

5.3.3 Diluted with ‘Denial’, ‘Anger’ and ‘Bargaining’

There are, however, many local factors in play in the implementation of this document that mean that the overall approach is not purely *Smart Growth*. The input of different levels of government and powerful lobby groups has resulted in local planning policy that is a diluted mix of ‘acceptance’ along with ‘denial’, ‘anger’ and ‘bargaining’ stages of grief.³

As I touched on above, the road lobby agenda for continuing ‘expansion and upgrading of the road network’ (DOI 2006 p.155) suggests the stage of ‘denial’ is present within the *Melbourne 2030* document as an undercurrent. Although at no point does the document suggest that there is no such thing as global warming, or that peak oil is a myth, the document does not put any limitations on road construction, and is not definitive about the *Urban Growth Boundary* (UBD). The local planning schemes continue with their ‘business as usual’ planning using Euclidian

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¹ The ‘Activity Centres’ are essentially TODs by another name.
² In a similar vain to current Smart Growth policies in the US, and growth polices in Copenhagen since the 1970s.
³ Note: the ‘depression’ stage has had little influence on local planning policy (discussed on the following pages); architects and urban designers have had little involvement in the process of developing the Melbourne 2030 document.
Zoning in most areas with predominantly single program land-use separating residential (ZONE1 RESIDENTIAL) from most other types of land-use.

The urban design position of ‘anger’ is also present. By omitting detailed information on where and how density is to be increased, the NIMBY agenda has also impacted on the implementation strategies at local council level. A process of ‘community consultation’ has been used for negotiation with councils and residents (DOI 2006 p.166) meaning that density levels are not being kept low even in areas close to public transport interchanges.

The ‘bargaining’ stage (New Urbanism) is present in elements of some structure plans. An attempt is made to set out ‘heritage values’ (Policy 5.4) with descriptive instructions on permissible building heights and preferred design ‘character’. The result are guidelines that reflect a ‘desire to protect an urban character… producing a proliferation of mock-historic styles’ (Dovey et al, 2005 p.1). In an approach that is reminiscent of New Urbanist aesthetic strategies, ‘planning codes and consultant’s studies generally try to reduce character to a set of formal elements’ (Dovey et al, 2005 p.14). The structure plan drawings, both 2D plans and 3D perspective sketches draw from a similar set of techniques, as I will discuss in the next section.

The ‘depression’ stage is not represented in the implementation of Melbourne 2030. Those Melbourne architects who may be identified as the ‘Post Urban’, ‘Starchitect’ or ‘Avant-garde’ have had little involvement in the development of Melbourne 2030, structure plans, or local planning policy saying they were unable to participate in the process due towards the State Government’s attitude to architects.

If things were cold in Labor’s early days in Government, they deteriorated even further when Mary Delahunty took the reins as planning minister in early 2002. For two long years the [Architect’s] institute tried unsuccessfully to get an audience with Delahunty. In that time, the Government introduced Melbourne 2030. It appointed a large advisory group to help implement it. Around the table [sat] representatives of business, local government and community groups - everyone from developers to Save Our Suburbs. Noticeably absent [were] the architects (Millar 2005 para.30).

Apart from the broad Smart Growth policy, other ‘acceptance’ stage urban design paradigms are not present in Melbourne. Little has eventuated from efforts by the Spatial Syntax group to obtain consultation work in Melbourne\textsuperscript{1} (Appendix 10.14 p.332) and there is no local equivalent for ‘proof based’ analysis and design. Other than the Melbourne Docklands master plan undertaken by ideas based design firm, or Post-Post Urbanist, Ashton Raggatt McDougall, and

\textsuperscript{1} Space Syntax has conducted a small study of the Yarra River Precinct in Melbourne, (2.5km\textsuperscript{2} of private and public developments, for the Victoria State Department of Infrastructure).
NH Architecture’s master plans for the Queen Victoria and CUB\textsuperscript{1} site in the Melbourne city, there has been little influence of architectural discourse upon the *Melbourne 2030* implementation.

### 5.3.4 Fragmented Disciplines Approach

The implementation approach (paradigm) for *Melbourne 2030* is one that is geared towards a post WWII fragmented discipline structure as was discussed in Section 1.6 (p.10), but in the current implementation condition there is neither the budget nor the time to use specialists as effectively as may once have been possible.

Victorian Government planning departments do not direct the necessary resources to produce urban design frameworks, structure plans or master plans for themselves; they rely on production by various consultants.

> Those who analyse urban function cannot conceptualise design, whilst those who can conceptualise design guess about function (Hillier 1996 p.111).

The consultants that are engaged are urban designers who are often architects or landscape architects with the capacity to engage with large scale development. The urban designers then rely on input from other specialist disciplines ‘sub-consultants’ such as traffic engineers, civil engineers and landscape architects. These sub-consultants may then use their own sub-consultants, or ‘sub-sub-consultants’, for example landscape architects may engage specialist horticulturists.

The fragmentation of the disciplines or ‘disciplinary apartheid’ (Hillier 1996 p.111) along with the restrictive budget and limited consultant involvement in the early stages of design has resulted in a system whereby consultants may need to work sequentially on a project with limited chances to revisit and refine work, missing opportunities to form synergies between consultants. Frugal budgets and time frames also means those specialised techniques (discussed in later sections), for 3D and 4D modelling to analysis for elements such as lighting, wind (computational fluid dynamics), and pedestrian connectivity analysis are either too costly to be included in the process, or if included, feedback from consultants on design iterations can take days and sometimes weeks\textsuperscript{2}. This situation limits the number of design iterations possible and also means that the analysis happens in isolation – the person carrying out solar access does not see the results of traffic studies. Or, just as problematic, the traffic analysis has to be done first with no chance to

\footnote{\textsuperscript{1} The CUB site is the derelict Carlton and United Breweries on the corner of Swanston Street and Victoria Street.}

\footnote{\textsuperscript{2} This point was informally discussed with the director of MGS and also reflects my own experience in practice. For an example of the consultant feedback time delay, see Section 7.3 (p.214).}
revisit decisions made. In this sequential scenario, the traffic consultant does traffic flow analysis and proposes road layout, which is then ‘locked in’, the next consultant does their analysis and then the next. This is problematic as it leads to a similar situation to that described by Camillo Sitte over one hundred years ago:

…a system that, relentlessly condemning all artistic traditions, has restricted itself exclusively to questions of traffic (Sitte 1889 p.5).

…for in their [consultants] veins pulses not a single drop of artistic blood… concerned exclusively with the arrangement of street patterns, and hence their intention is from the very start a purely technical one. Only that which a spectator can hold in view, what can be seen, is of artistic importance (Sitte 1889 p.1).

Whilst there might be some artistic traffic engineers, they rarely consider visual composition, traffic engineers are also less likely to consider pedestrian movement (Desyllas et al. 2003 p.3), just as lighting engineers are unlikely to be concerned with traffic flow, and architects may be accused of considering absolutely nothing but aesthetics.

Figure 68: Example of problems caused by fragmentation of disciplines in College Station, Texas, USA. The photos clearly illustrate fragmentation of the work of specialist disciplines. Civil engineer’s drainage, traffic engineer’s drive way entry, and the footpath are poorly integrated (White 2007b).

5.3.5 Budget and Time Constraints Undermining Effectiveness of Fragmented Approach

Within the many disciplines there is an increasing desire to include all of the consultants for the project ‘up front’ for a truly ‘collaborative environment, moving the design curve’ (Guttman et al. 2007 p.1). This concept sounds ideal for the implementation of Melbourne 2030 in many ways, but does not reflect some of the realities of the architecture and urban design industry, that only a small percentage of initial ‘sketch designs’ continue through the whole process to become built1.

Therefore an architect or urban designer pushing a client or council to engage and pay fees for all consultants from the outset is exposing the client to unnecessary financial risk. As a consequence, the majority of projects involve consultants being engaged only at critical points in the project.

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1 There are a seemingly infinite number of cases where designs ‘never get off the ground’ as evidenced in nearly 100 entries in a recent competition held by Architecture Australia called AA Unbuilt www.archmedia.com.au/unbuilt/results/.
(see Appendix 10.2.2 p.284 for an example of consultant engagement). In the case of structure plans and urban design frameworks, there is a possibility that a change of State Government will result in the scrapping or revisiting of Melbourne 2030 policy (Baillieu 2007), which could result in scrapping the work done for the council.

As I pointed out earlier, budgets for consulting fees to produce structure plans can be less than that which an architect would expect for one apartment building. As a result of this tight budget and the limited access to specialist consultants, the urban design tends to predominantly be done within the urban design practice with minimal input from other consultants. The ‘collaborative urban design environment’ though desirable seems elusive.

5.4 Urban Design Techniques for implementation

5.4.1 Fragmented Techniques

This fragmented discipline approach is also present within individual urban design practices. In the urban design practice in which much of my research has been conducted (MGS), there are staff who are designated as administration staff, interior designers, 3D modellers, architects and urban designers. The fragmentation goes even deeper, to the level of the software packages used, where different programs are used by different staff members, with very poor information flow between the software (See Figure 69).

Figure 69: Diagram showing a study of the fragmented working methods of a prominent urban design practice in Melbourne. Note: the information is embedded instead of linked, which means that the information is not updated when design changes occur unless manually updated (for more detail see Appendix 10.2 p.283).
The process of producing the illustrative plans predominantly involves a series of steps using various industry standard software programs. The process outlined in Figure 69 shows an example of the relatively advanced\(^1\) urban design practice of MGS. The numerous steps from the translation of cadastral mapping provided by council’s CAD or Geographic Information System (GIS) bases, to the architectural drawing software AutoCAD™. Here the design work is done, including measurement of areas, proposed alterations to existing urban fabric, proposed new Euclidian zoning, and so forth. The CAD plan is then exported to (in this case) to Adobe Illustrator™, where it is coloured up, and movement arrows and labels added. This is then laid out with title blocks and then recompiled into an Adobe™ PDF document for submission back to council. This linear design and representational process reflects the fragmented nature of the input of the other consultants. In this particular case for MGS, they have found this to be too inflexible and changes to design took too long (See Appendix 10.2 p.283).

### 5.4.2 Urban Designers ‘Don’t Have the Tools’

A study produced by Monash University on *Melbourne 2030* concluded that there are: ‘…too few tools to ensure that the strategy is implemented’ (Birrell et al, 2005 p.02-1). This is in line with comments of from strategic planners for Stonnington Council that suggest that neither architects, nor planners currently possess the tools to deal adequately with the *Melbourne 2030* directions within the time and fee constraints\(^2\). The SOS NIMBY group also suggests that there are problems with the ‘selection techniques for determining which are the best areas to direct higher density development’ (SOS 2003).

A number of the structure plans in response to *Melbourne 2030* have been completed for example Brimbank Structure Plan, Central Coburg 2020 Structure Plan, South Melbourne Central Urban Design Framework and Darebin City Council Preston Central Project\(^3\). These structure plans generally restate the prevailing urban agendas of *Melbourne 2030* within the text of the documents, and use a limited repertoire of planning design techniques essentially using survey-analysis design (SAD) plans, discussed earlier, and ‘denial’ 2D Euclidian zoning with the slight variation of small areas zoned ‘mixed use’ (Smart Growth – ‘acceptance’). As mentioned above, the design techniques have a similar aesthetic to ‘bargaining’ New Urbanists and use either hand sketch

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\(^1\) Unlike some other urban design practices, there is the use of some 3D modeling.

\(^2\) Stonnington City Council Planning Department, 2006, pers. comm., 8th November, Focus groups: Minutes: 0006-MINU-Stonnington (see appendix 10.14.4).

\(^3\) These documents area available to down load from:
plans or use two dimensional (2D) vectors software, usually Adobe Illustrator™ or Adobe Freehand™ (formerly Macromedia Freehand™). This allows for colourful diagrammatic plans that express movement in the form of sinuous arrows and has a level of impreciseness that match the ambiguity of the written descriptions, open to a level of interpretation.

Figure 70: Plan drawing/diagram from the Preston Central Project structure plan, typically using 2D vectors software, either Adobe Illustrator™ or Adobe Freehand™ (formerly Macromedia Freehand™).

As pointed out above, the structure plans are generally limited to this kind of 2D diagrammatic plan representation, with three dimensional representations used very occasionally, and at a very unsophisticated level (see Figure 71), drawing by hand, or by using Google SketchUp™.

The techniques used do not utilise the possibilities of digital techniques discussed in the previous chapter used by the Starchitects, Post Urbanists, Avant-garde or the Space Syntax group.

Figure 71: 3D model from the Preston Central Project structure plan using Google SketchUp™ software. Note corners of building masses include overlapping lines to give ‘hand drawn look’.
5.5 Conclusion: The need to re-establish symbiotic relationship between the three facets of urbanism.

5.5.1 Summary
In this chapter I have discussed the local context of Melbourne, Australia with respect to prevailing urban agendas of society, the urban growth strategy (paradigm) Melbourne 2030, and the implementation techniques to establish where Melbourne sits in the contemporary international context of urban design discussed in the previous chapter. In section 5.2 (pp.125-127), I discussed the urban agendas of Melbourne 2030 in terms of explicitly stated aims and their similarities to the international urban agendas of society stated in the previous chapter. I also touched on the less clearly expressed agendas present within the document that reflect various lobby group interests, in conflict with the over-arching agenda for sustainable urbanism.

In section 5.3 (pp.116-122), I touched on the tiered implementation approach involving State Government policy, local council structure plans and local planning schemes. I discussed the approaches to implementation strategies with respect to the five stages of grief, locating the current planning milieu broadly as ‘acceptance’, with under-currents of ‘denial’, ‘anger’ and ‘bargaining’. I then explained the fragmented implementation process where time and budget constraints have a negative effect on the integration of discipline input and quality of design response.

In section 5.4 (p.122), I refer to the fragmentation of the working methods within a specific urban design practice, where the separation of tasks has led to inefficient information transfer and coordination. I explored the design techniques in urban design practice, currently used to inform the implementation of Melbourne 2030, concluding that the techniques used are not taking advantage of the potential for digital technology illustrated by the ‘denial’ urban design paradigm (Starchitects, Post Urbanists, Avant-garde), or ‘acceptance’ (Space Syntax).

5.5.2 The Need to Re-Establish Symbiotic Relationship Between Three Facets of Urbanism
In Chapter 3, I illustrated the symbiotic relationship between my three facets of urbanism—society’s prevailing urban agendas, urban design paradigms and urban design techniques at key points in history where important changes were needed in urban design practice to meet the challenges of their times. Now, Melbourne faces the great challenge of accommodating growth more sustainably and the current position, much like those of the five paradigms outlined in
Section 4.3 throughout the world, is not fostering the symbiotic relationship between the three facets. As suggested in my hypothesis (Section 2.2), there is a gulf between urban agendas and the fragmented urban design practice.

The conclusion of this chapter and the previous two chapters however, suggests how this gulf might be reduced with what I call a ‘rapid-defragmented analysis and design’ approach which I will discuss in detail in the next two chapters. The rapid-defragmented approach aims to reinvigorate the symbiotic relationship between the three facets of urbanism in a number of ways by:

- Mixing ‘acceptance’ paradigms, of Post-Post Urbanism (or Optimistic Koolhaas) and Smart Growth (US and Scandinavian) with the impetus on digital techniques and technologies of Space Syntax and the Starchitect avant-garde.

- Embracing chaos, as suggested in Scandinavian Smart Growth objectives.

- Considering the three pillars of sustainability – social, environmental and economic sustainability (WSSD 2002 p.80) along with a fourth pillar cultural sustainability making up the prevailing contemporary urban agenda of society.

- Identifying particular agendas in a specific, but not isolated manner and interrogating the way we approach analysis and design.

- Re-engaging with the techniques and technology that are available or possible. And, if techniques and technology are not suitable for dealing with urban agendas, taking on the responsibility for their development (as was the case in the distant past eg. Renaissance perspective).

- Recognising the covert urban agendas of interest groups as a reality and considering them when developing new techniques.

- Breaking down discipline silos – developing techniques that engage directly with paradigms and agendas that go beyond the accepted boundaries of the urban design discipline and used in a less fragmented way than is now the case, allowing a more iterative design process.

- Developing practice methods that are feasible within the means of urban designers and councils, continuing to meet time programs and fee budgets.

- Not stifle innovation with aesthetic controls based on nostalgic yearning for the past.
Informing an Integrated and Sustainable Urbanism through Rapid, Defragmented Analysis and Design.

Volume 2
Chapter 6 – Chapter 8

A thesis submitted in fulfilment of RMIT University requirements for the degree of
Doctor of Philosophy

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Chapter 6. The Design Approach and the Techniques

6.1 Introduction

In the previous three chapters I have illustrated that a gulf has occurred between three important facets of urbanism – that society’s prevailing urban agendas, urban design paradigms and urban design techniques are no longer in a symbiotic relationship. I demonstrated that the fragmented working methods of urban design practices, particularly their lack of engagement with new digital modelling techniques, has had a negative impact on the implementation of the Melbourne 2030 Planning for Sustainable Growth policy.

The conclusions to the previous three chapters, however, suggest that this gulf between the three facets might be reduced with a new design approach – an approach that ‘breaks down silos’ by blurring the boundaries between disciplines, by re-engaging with the development of design techniques and technology, by identifying specific urban agendas of society and interrogating them in a targeted but holistic, transdisciplinary way.

The purpose of this chapter is to propose and test an approach which I call ‘rapid-defragmented analysis and design’. This approach involves the identification of key urban agendas in Melbourne, interrogating the current techniques directed at these agendas, proposing new digital techniques and testing them on simple models and design case studies. Though it is not intended that the new techniques be used in isolation, for clarity, in this chapter the techniques will be discussed individually as stand alone procedures, responding to specific issues, applied on specific case studies. The holistic application of multiple techniques applied simultaneously will be explored in the next chapter (Chapter 7).

The first techniques that will be discussed in this chapter fall under the category of Pedestrian Connectivity: Walkability and Accessibility which involves gradient analysis and pedestrian catchment analysis. The second category is Daylight Amenity Assessment; surface daylight hours analysis; parametric over shadowing analysis; and a subtractive shadow technique. Thirdly, Visual Impact, which is discussed involving urban form visualisation; generation and composition; rapid urban modelling techniques, parametric composition techniques; contemporary heritage preservation techniques; and visual connectivity. The final category is Feasibility modelling and yield analysis, where I discuss techniques for density distribution modelling, area and volume measurement and data harvesting.
6.2 Pedestrian Networks: Connectivity, Walkability and Accessibility

As discussed in Sections 4.2 (p.66), 4.2.7 (p.68) and 4.3.6 (p. 98), pedestrian connectivity is an essential part of sustainable urbanism. Transit Oriented Developments (TOD) encourage less carbon emissions, foster healthier and more active citizens, and give opportunities for employment to people a variety of socio economic backgrounds. Of the *Melbourne 2030* directions, Direction 1 – A more compact city; Direction 2 – Better management of metropolitan growth; Direction 6 – A fairer city; Direction 7 – A greener city; and Direction 8 – Better transport links; all relate to pedestrian connectivity to public transport nodes.

6.2.1 ‘The Gradiator’ - Access for All

The Urban Agenda

Improving wheel chair access (DOI 2002 p.158) and catering for a rapidly aging demographic (Murray 2006) have both been identified within the objectives of *Melbourne 2030*. In the case of residential developments catering for the elderly, it is desirable that these projects be located close to public transport and for topography to be considered during initial siting. Topography is also important when considering upgrading transport facilities – for example, the introduction of wheelchair friendly train & bus stops. Another important objective within *Melbourne 2030* is for affordable housing. Land gradient can impact dramatically on building costs and erosion impact:

*The cost of development increases considerably on slopes steeper than 30%, and the potential negative environmental impacts from erosion and surface runoff go up significantly as well. The best solution would be to restrict building development to land with slopes less than 30%* (Sipes 2006 para.6).

Existing Method and their Shortcomings

Within traditional drafting packages, 2D sections of contour drawings can be produced and used to analyse gradients along the section cut line. However, this traditional manual 2D section is time consuming and only allows assessment of that which is actually cut by the section plane.

There is a plug-in available as addition to the ‘3D Analyst add-on’ for ESRI GIS™, which allows contours lines with height attributes to be used for gradient analysis. McNeel’s Rhinoceros 3D™ program has change of gradient analysis capability with the <curvature> command which can be used on topographic 3D meshes, although Rhino itself does not have built-in terrain mesh creation capabilities (Figure 72). Landscape architecture programs such as the ‘vertical application’ (discipline specific add-on package) Land-CAD™ (add-on for AutoCAD™) can be added to with the purchase of Eagle Point™ (Figure 73).
These methods are far more useful than a simple section, but require a topographic mesh to be created from 3D contour lines using one program, then imported, converted into an appropriate format and then analysed, which takes time and relies on investing in multiple software packages. Also, once the surface is analysed, changes to the topography must come from the original source, be re-imported, re-converted then re-analysed.

Constraints

The speed of analysis is seen to be a key constraint in this process. The 3D terrain creation and manipulation as well as slope analysis must be fast enough to analyse existing topography, but in the case of new developments also be quick to test alternate topographic manipulations.

The Technique

Firstly I isolated the problem of gradient analysis on one polygon (triangular mesh face) Cartesian space. To analyse the gradient of a single polygon, the angle of the polygon with respect to the Z axis is measured by taking a line perpendicular to the centre of the polygon surface (face normal) and measuring this line’s angle from the Z axis subtracted from 90deg, (the XY plane could also be used for this calculation). This process is relatively simple to do on one polygon, but tiresome on more than one. I then investigated the possibility of scripting the process and discovered similarities in gradient analysis to techniques I found to produce transparency special effects which use a similar process but instead of using the Z axis, they use the camera position (Figure 74). I then reconfigured this technique with a small amount of scripting to create the gradient analysis technique I call the ‘Gradiator’.

There are two steps to the process for using the Gradiator, firstly 3D contours lines are turned into a surface using the 3D Studio Max™ inbuilt ‘Terrain’ ‘Compound object’ command. This is followed by running my Gradiator script (based on a ‘spooky transparency’ technique Figure 74),
which assesses each polygon’s normal in relation to the Z axis and applies a material colour (fall off map) according to the user-defined key (Figure 76). The key by default is set to show equal access areas (relatively flat areas accessible by an unassisted wheelchair) as blue, fading from blue to red as the gradient gets steeper (Figure 75). The Gradiator technique can be applied on any size topography, even large scale areas as big as whole cities can be calculated in seconds.

Figure 74: ‘Spooky transparency’ material effect using mesh face normal angles in relation to camera position to alter level of transparency.

Figure 75: Gradient analysis using simple terrain surface.

Figure 76: Gradient legend used to describe different surface angles.

Case Studies

The two case studies shown here illustrate the use of the Gradiator to help the decision making process in urban scale designs. The first project analyses two entire suburbs for wheelchair access which enables the urban design practice to propose where elderly/respite housing and similar should optimally be located to ensure maximum mobility and limit isolation (Figure 77). The entire area of the City of Stonnington (in Greater Melbourne), was analysed by terrain surfacing 3D contours lines with height information (produced by MGS staff member Jocelyn Chiew), then running the Gradiator script. This produced a renderable surface with gradient legend that could be used to assess the suburb for wheelchair access.
The second case study was a fast-tracked collaboration between myself and a Melbourne landscape architect - Nano Langenheim (from Oculus Landscape Architects), involved in the master planning of a residential subdivision in rural Victoria. A 3D topographical model was emailed to me; I applied the Gradiator to the surface and the file was emailed back to the landscape architect within 45 minutes. This gradient analysis of the large subdivision was then used to help locate new housing to minimise the cost of site cut and fill, in an attempt to keep the housing affordable (Figure 78), and locating recreational parks into areas where steeper gradients where actually desirable for creating visual interest and feel of a natural setting.

Figure 77: Gradiator applied to an area in Prahran / South Yarra in Melbourne. Analysis of non-accessible areas of suburb made in 140 seconds.

Figure 78: Gradiator applied the town of Hamilton in rural Victoria for Oculus Landscape Architects.

Results – Speed, Accuracy, Level of Abstraction

The Gradiator can be applied to a terrain mesh in seconds. The level of accuracy is as high as the topographic information put into the terrain model. It can use one metre contours, or 100 millimetre contours. The model can be progressively refined as more data is gathered and these updates are reflected in the analysis.

This technique allows a designer to know where a retirement village should be optimally located and where special wheelchair friendly bus or tram stops may be ineffective due to surrounding topography. It can also be used in conjunction with pedestrian catchment analysis in cases which may be greatly influenced by steep terrain. One unforseen use for the technique pointed out by the landscape architect Nano Langenheim was for the analysis of surface gradients with respect
to turf planting and drainage. Due to the dry climate in Australia, grass will not grow well on angles that are more than 1:6 (to 1:3 depending on soil type) without the need for excessive watering and additional soil stabilisation.

The Gradiator technique can also be ‘tweaked’ to measure building heights so that surfaces change colour the higher their elevation (Figure 82). This technique is called ‘digital elevation model’, a technique often used by Italian architect and urban researcher Carlo Ratti. This technique has potential use in assessment of existing urban areas to demonstrate height patterns and legitimize height limit proposals.

![Figure 79: (LHS) Simulated urban from. Digital Elevation Model (Height map) (RHS).](image)

### 6.2.2 ‘Ped-Catch’ - Pedestrian Connectivity

**The Urban Agenda**

As discussed in section 4.3 Acceptance: ‘It’s Going to be OK. Let’s Get on with Our Lives’ (Post-Post Urbanism, Space Syntax and Smart Growth), transit oriented development (TOD) is essential for the combat of urban sprawl (Section 3.5.4, Growth Boundaries – In North America) and carbon emissions from transport (Section 4.2.2). The TOD strategy also future proofs communities against the catastrophic implications of Peak Oil (Section 3.5.1). An over-arching theme of Melbourne 2030 is urban consolidation through improved access to public transport. The report emphasises that this consolidation can be achieved by increasing density within existing transport node catchments (walking distance from railway stations).

Though human movement is extremely difficult to predict and studies have shown that within cities movement generally occurs from everywhere to everywhere else (Hillier 1996 p.120), at the core of TOD theory is that the transport node is the key location for consideration. Calculations of catchments do not predict movement, but assess the potential for movement to transport
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Nodes. In the United States, a 1990 Nationwide Personal Transportation Survey was conducted measuring distances walked by transport users, resulting in a 'smooth frequency curve, the median walking distance to and from transit stops is almost exactly a quarter mile [400m]' (Ewing 1999, p.5).

Existing Methods and their Shortcomings
This idea of catchment has been considered important since the 1930’s particularly after the housing shortage towards the end of the Second World War (Barnett, et al. 1944, pp.55, 81). The technique for establishing this catchment has remained unchanged since then.

The Circular catchment method: The analysis technique adopted for assessing transport catchments uses a 2D plan and simplifies pedestrian movement from a central node (eg a railway station) to an ‘as the crow flies’ radial catchment (see Figure 81). Radii commonly used are 400m and 800m, which represent five and ten minutes walking distance at average walking speed of 1.33 meters per second, the amounts of time people are willing to walk to shops and transport respectively (Pushkarev & Zupan 1975 pp.25, 47).

Shortcomings: This modelling technique is very quick but has very low accuracy as it fails to allow for discrepancies in street grid layout, busy roads and crossings. The circular catchment method also ignores ‘aspects of the physical environment that may influence walking distances, such as gradient, perceptions of safety, destination type and climate’ (Pikora et al. 2001 pp.28-30). This is a 2D abstraction of what is essentially a 4D problem. Consequentially the technique is only accurate when the topography is flat, the street grid is radial and no time is spent waiting at lights.

Figure 80: Diagram from We Must Go On (1944) showing five minutes walking distance catchment measured from centre of transport interchanges.
Pedestrian Route Directness: Research by Dr Jennifer Dill at Portland State University into other GIS based methods of measuring pedestrian connectivity compared methods such as Block Length Ratio (BLR) block density, street density, Pedestrian Route Directness (PRD) and Link Node Ratio (LNR) concluded that by far the most effective method of measurement is Pedestrian Route Directness (PRD) (Dill, 2004 p.3). PRD measures the distance between two nodes and expresses this as the ‘ratio of route distance to straight-line distance for two selected points’ (Dill, 2004), for example the distance between railway station and a supermarket are measured both ‘as the crow flies’ and also by navigating through the block layout and these distances are expressed as a ratio (see Figure 83).

Figure 81: Diagram from Melbourne 2030 (2002) showing five minutes walking distance catchment measured from centre of transport interchanges.

Figure 82: Alexander: Pattern language point - 31 PROMENADE (Alexander 1977).

Figure 83: Measuring Pedestrian Route Directness (PDR) (Dill, 2004). LHS example of high connectivity, RHS example of low connectivity.
**Shortcomings:** Although accurate, PRD is difficult and time consuming to calculate for more than one destination. For PRD to be used as an effective catchment technique, it would need to calculate all possible routes in a similar way to the Alexander’s Pattern number 31, where ‘main activity nodes’ are placed centrally, so that each point in the community is within ‘10 minutes walk of it’ (Alexander 1977) (see Figure 82). Unfortunately Alexander does not specify a technique to implement his sketch of catchments. The method used when this calculation is performed, is the manual pedestrian catchment area (PCA) method, or sometimes this is referred to as the Manhattan method, or Taxicab method\(^1\) (Stevens 2005 p.12). This involves manually tracing all conceivable paths from a central point outward (see example Figure 84). This complexity renders it difficult to use for policy making and consequently it is rarely employed by planners (Dill 2004). The technique also doesn’t consider aspects of 3 and 4 dimensional environments, such as topography and busy roads.

![Pedestrian catchment area](image)

**Figure 84:** Pedestrian catchment area used in Melbourne to assess moving a tram stop to middle of block. (LHS) pedestrian catchment area is 65%. (RHS) Pedestrian catchment area of 57%. Relocation of a tram stop leads to a reduction in ‘walkability’ by 12 per cent in relative terms.\(^2\)

**Visual Graph Analysis (VGA) and Depth mapping:** The Space Syntax methods of analysis developed at UCL can be used for pedestrian connectivity using Visibility Graph Analysis (VGA) and depth mapping. These methods have shown to have a direct link to pedestrian movement (Hillier 1996 pp.99, 113, 119, 123) in studies conducted in London. The work of Dr. Jake Desyllas from Intelligent Space London also uses VGA as well as many other factors such as footpath width, along with empirical studies of an area, with the use of multi regression analysis (MRA).

**Shortcomings:** Whilst these methods have been shown to be a successful method of analysis in London (Desyllas et al. 2006), London is a very particular form of urban fabric. For those people having walked around Brasilia (a city with very high levels of VGA), few would argue that the city has high levels of pedestrian connectivity. There are many other factors that must come into

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1 Manhattan or Taxicab geometry, considered by Hermann Minkowski in the 19th century, measures geometry by the absolute distance between two points as the sum of the differences instead of the usual direct, shortest distance between the points (Poore 2006).

account such as street program (retail, blank carpark walls), and shade. These factors are taken into account with the MRA method, but the method requires a great deal of data collection, and, to have the analysis performed, one must appoint the specialist consultants Intelligent Space (London based spatial consultants).

**Agent-based analysis:** The use of artificial intelligence (AI) for an agent-based pedestrian analysis technique utilises advancements in crowd animation. These use large numbers of ‘agents’ that are capable of being programmed to make basic decisions, move at human walking speeds, be attracted or repelled by other elements with in a 3D model and slow down as they travel uphill.

**Shortcomings:** The main pitfalls of agent-based analysis are their prohibitive cost and the fact that the programs used are specialised and require training to use. Though originally designed for crowds escaping from burning buildings, agent-based evacuation software such as Legion™ and Ped-Sim™ (Daamen 2004 pp.49, 50) could be reconfigured and used to determine pedestrian catchment, but these programs are quite specialist and expensive and require the translation of all data into another program.

**What is Needed**
A technique is needed which allows analysis of a single destination – such as a railway station – and all destinations within ten minutes walking distance. A 4D analysis technique should use CAD with a 3D animation software package commonly used within architectural practice to not only compare agents’ walking distances versus the ‘as the crow flies’ distance, but also allow the comparisons of various proposed urban interventions whilst still managing to meet the practice deadlines.

**The Technique**
Pedestrian movement is often referred to as ‘pedestrian flows’ in a similar way to traffic engineers use the term ‘traffic flows’ for car and truck movement. The term ‘a sea of people’ is also used to describe the seemingly fluid nature of people and crowd movement.

*Literature on the fluid/pedestrian analogy is mixed. Modelling of pedestrian movements is inconsistent with the observations and has been dismissed by engineers studying egress analysis as people do not follow laws of physics (Still 2000 pp.14, 15).*

This makes some sense in the context of modelling peoples egress movements in a fire situation as this is a matter of life and death. In the case of pedestrian catchments for use in TOD planning, the accuracy level is less demanding, and worth further consideration.
I initially made attempts to simulate people movement based on the concept of pedestrians ‘flowing’ like liquid. I sourced a cheap computational fluid dynamics (CFD) modelling plug-in ‘Glu3D V1.3’ (by 3D Aliens software™) for 3D Studio Max™ to test the theory.

Despite having a great number of CFD modelling parameters to adjust making it possible to match average human walking speeds, problems occur due to viscosity of liquid not translating well to pedestrian movements. Pressure build-ups occurred at narrow streets causing the liquid to speed-up which is counter to what one would expect and distorted the catchment dramatically. This confirmed the fluid analogy to be untenable in an urban design scenario, and consequently this analogy was dropped from my inquiry.1

I then investigated a simplified version of the high end egress software (such as Legion an Ped Sim) by using newly available artificial intelligence (AI) in the form of Crowds and Particle Flow which have recently been built into the relatively cheap modelling and rendering package commonly used in architectural practices, 3D Studio Max™ (Hobbs 2006 para.9).

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1 This technology did however begin an inquiry into CFD used for wind analysis, but due to time restrictions, did not evolve into a practical design technique.
I then set up a system that utilised these new software capabilities to simulate crowds of pedestrians. The technique which I call ‘Ped-Catch’ creates agent-based pedestrians that are capable of: ‘seeking’ goal destinations such as libraries or railway stations; being ‘repelled’ by destinations/objects, e.g. move as far as they can from a particular building; avoid bumping into each other; and navigate around ‘walls’ or boundaries (roads are conceived of as walls) (see Figure 86, Figure 87, Figure 88). To calculate transport interchange catchments, I run the agent process in reverse, with agents beginning at the transport node (railway station) programmed to move as far away from the node as possible in ten minutes, negotiating streets and intersections as they go. This then demonstrates how far the agents can get from the node in 10 minutes illustrating a pedestrian catchment areas, and also (when run backwards) shows that all the people within the catchment area can get to the station within 10 minutes.

Figure 86: Ped-Catch boundaries are modelled as ‘walls’, LHS major roads with gaps for pedestrian crossings, RHS railway cutting boundary.

Figure 87: LHS minor block pedestrian boundaries, RHS boundaries to pedestrian movement used for simulation.
Case Study A: Mega-Mile – Railway Walk

The ‘Mega-Mile’ is an area between two Melbourne suburbs - Mitcham and Nunawading where the Melbourne 2030 – smart growth policy is being implemented. MGS Architects were producing a Structure Plan for the area, setting up guidelines for buildings and highlighting urban intervention opportunities. One such opportunity (identified by practice partner Rob McGauran) involves the use of land to the north of the Nunawading railway station for a pedestrian connection. To assess the validity of this suggestion, I applied my Ped-Catch technique to the existing conditions for the Nunawading station, which highlighted that the pedestrian catchment area rating was poor, particularly to the north of the station caused by a lack of direct access from the station to the main road (see Figure 91 LHS). There is currently a vacant block and a piece of publicly owned land to the north of the station, so a proposal of acquiring this land for a pedestrian link was put forward. I ran a Ped-Catch simulation on this proposed scenario, which increased the pedestrian catchment area greatly. (Figure 91 RHS). My analysis was then presented to the planning department and to the council in the form of a multi page ‘animated’ PDF file. With the support of the council, planners and local user groups, the proposed connection is set to go ahead early 2009 (Figure 92).
Figure 89: Frames from Ped-Catch pedestrian animation for 10 minutes walking distance - existing street layout for the Nunawading railway station precinct. (An animation of this analysis is on the accompanying CD).

Figure 90: Frames from Ped-Catch pedestrian animation for 10 minutes walking distance - proposed street layout for the Nunawading railway station precinct. (An animation of this analysis is on the accompanying CD).
Validation and Verification

Simulating real human behaviour is an extremely complex exercise. There are an infinite number of factors that effect a person’s movements from the width of a footpath, time of day, to what a person has on their mind. For urban planning – measuring pedestrian catchments, the level of accuracy of pedestrian simulation does not need to go beyond what is required for an urban designer to be able to say with some confidence that ‘it is possible for people to be able walk from their home to the railway station in less than ten minutes’.

The methods chosen to test the accuracy of the technique were limited in a number of ways. Following advice of the RMIT University Human Research Ethics Sub-Committee, one of the most effective methods used by Professor Bill Hillier (University College London/ Space Syntax) was not permissible:

\[ \text{The stalking for pedestrian data collection… Hillier (1982) used this ‘stalking’ method. He followed pedestrians from an intersection to their destinations, where he handed them a questionnaire for additional, personal information (Daamen 2004 p.64).} \]

Another limitation was a lack of rescores for large scale pedestrian analysis (a limited amount of people to use in empirical testing) along with limited access to satellite aerial photography/video footage. Two simpler methods were adopted for verification. Firstly, the technique was tested
against the manual creation of pedestrian catchment area, and secondly tested against groups of real pedestrians. In the first verification exercise I used a cadastral map of the area of Prahran, Melbourne in AutoCAD™ manually tracing all of the possible routes away from a chosen node. I then used an Auto-lisp routine called “enlengthen.lsp”, which extends or shortens poly lines to match a chosen distance (800m). I then measured the area of a polygon that traced each of the 800m points at the ends of the paths. I used this area compared to a circle with radius 800m drawn from the same centre point to calculate the pedestrian catchment area (PCA).

![Figure 93: CAD drawing showing possible routes from chosen node in Red. These routes are poly-lines with total length of 800m.](image)

<table>
<thead>
<tr>
<th>800m radius catchment area</th>
<th>2010619m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual vector measured pedestrian catchment area</td>
<td>1286208m²</td>
</tr>
<tr>
<td>Ped-Catch simulated pedestrian 10 min catchment area</td>
<td>1203294m²</td>
</tr>
</tbody>
</table>

Table 5: Results of manual pedestrian catchment analysis.
The second verification technique involved testing *Ped-Catch* against the movement of ‘real people’ - architecture students from RMIT University. The empirical research technique is similar to that used by Daamen & Hoogendoorn (2003). The technique involved giving 30 students a piece of paper with a map of the suburb and one of the 30 pedestrian routes marked on the map. The students then walked along the given path using mobile phones to measure movement and time, marking times every 200m on the map, and marking time spent waiting at traffic lights.

The results showed that the average distance travelled in ten minutes was slightly less than 800m. The average distance was 90% accurate compared to the manual pedestrian catchment area and when speeds were adjusted to factor in time spent at traffic lights the accuracy was closer to 95%.

<table>
<thead>
<tr>
<th>Measured speed and distance covered.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AV. DIST IN 10 MIN</td>
<td>721m</td>
</tr>
<tr>
<td>AV. SPEED</td>
<td>1.20m/s</td>
</tr>
<tr>
<td><strong>Corrected for traffic light stops</strong></td>
<td></td>
</tr>
<tr>
<td>AV. DIST 10 MIN</td>
<td>746m</td>
</tr>
<tr>
<td>AV. SPEED</td>
<td>1.24m/s</td>
</tr>
</tbody>
</table>

Table 6: Summary of results from pedestrian analysis using real people. (For more detailed results see Appendix 10.6 p.300).
Results – Speed, Accuracy, Level of Abstraction

In application of Ped-Catch, the speed failed to match existing 2D method of analysis. To draw the 800m radius in plan takes approximately seven seconds compared with Ped-Catch method, which takes approximately seven hours although this includes modelling of the site.

According to verification studies, the Circular Catchment method of analysis is less than 50% accurate and there is no mechanism for comparison studies – ‘what if’ scenarios which look at different street configurations, something Ped-Catch allows for. Based on this research the accuracy of Ped-Catch is substantially higher (more than 80%) than that of the Circle Catchment.
method. The results would imply very high accuracy for both the manual pedestrian catchment area measurement as well as the Ped-Catch method, though I feel that many more tests with many more pedestrians would be required for this study to be conclusive. There are many factors which may have contributed to distorting the test (Williams 2008), such as all pedestrians being of similar age (all undergraduate university students) and similar fitness levels. The diversity of the general community was not covered. The tests were run in the middle of a weekday, so the footpaths were not congested. Had the test been conducted at peak morning (8.45 am), the results may have been affected.

This method also visually illustrates the catchments more clearly than the circle technique. Ped-Catch analysis presented to community focus groups as animations have proved to be a powerful advocacy tool, with the proposed changes to street layout in the Mega-mile case study gaining support from stakeholders and community representatives in the suburb.

Ped-Catch allows designers to make educated decisions on where density should be increased with regard to access – suggesting higher density within five minutes walking distance, tapering down to lower density at ten minutes walking distance.

6.3 Daylight Amenity Assessment

The next group of techniques I will examine relate to daylight amenity assessment. As discussed in earlier chapters, addressing community fears of loss of amenity is a very large factor in the objective for increased density within targeted activity centre areas. Of the many types of amenity, access to daylight is highly valued, with ‘over shadowing’ being a prime concern for resident groups (Thwaites 2001 p.2). In Melbourne 2030, Direction 1 – ‘A more compact city’ requires people to live more densely, which in turn put pressure on issues of daylight amenity. Direction 6 – ‘A fairer city’ also implies fairness in access to amenity, where development on one site should not unfairly infringe on the amenity of a neighbour. Direction 7 – ‘A greener city’ relies on urban consolidation for reasons discussed earlier, but a greener city also implies the opportunity for buildings to use passive heat and lighting techniques which rely on solar access.

6.3.1 ‘P-Radiance’ – Quick Solar Access Assessment

The Urban Agenda

Increased density should not be at the expense of access to daylight and fresh air, a sentiment reflected in the 2030 objectives of ‘a better place to be’. In response to these issues, investigation into urban form simulation as well as solar access has been conducted.
Existing Method and their Shortcomings

Though it is relatively straightforward to produce shadow studies of a building using 2D plans and sections using solar tables tracing azimuth and altitude, complex building forms or large areas involving many buildings can be time consuming, and if on undulating topography, can be almost impossible. Fortunately over the last ten years or so, 3D modelling packages have gained the ability to raytrace shadows, with a light rotated to match azimuth and altitude in the solar table (see Figure 97). In some programs, Solar Systems have been included so the user can choose the location and the time of day and the system moves the light to the correct angle to cast accurate shadows. This feature alone is a very powerful ally for urban designers and better still, in some programs the system is parametric and capable of being animated.

The Technique

To create a more powerful solar analysis technique I used some simple scripting to setup multiple sun positions with linked parameters for location and day of year which could render multiple shadow positions simultaneously. I then combined this technique with a built in post processing exposure control render setting, to analyse the amount of daylight hitting each surface over the course of a full day and over different days of the year. This technique, which I call ‘P-Radiance’, gives almost real-time feedback on different urban design proposals (Figure 98). Questions such as ‘what is the difference between two levels and four levels in an area with regard to footpath over-shadowing?’ can be answered with almost instant feedback.
Case Study

The usefulness of the *P-Radiance* technique has been tested on a master plan proposal for the ‘Office of Housing’ in Prahran, Melbourne. The tool was used to evaluate 18 different options of slab block / tower configurations for daylight impact within the site as well as neighbouring sites. This will be discussed further in the next chapter.

![Case study for Prahran Office of Housing – Urban Design Framework for City of Stonnington using P-Radiance comparing different tower positions and sizes. (An animation of this analysis is on the accompanying CD).](image)

Results – Speed, Accuracy, Level of Abstraction

When using *P-Radiance*, the speed with which comparative solar studies can be made is greatly improved. What would normally have taken a day can be done in a minute using this technique.
The level of accuracy is also greater than existing solar table methods. Whilst a solar study might previously have taken into account two or three different time/sun positions for the year, _P-Radiance_ can easily take into account 20-60 solar positions. Whilst not as accurate as a full radiance/daylight hours calculation analysis performed by specialist lighting engineers\(^1\), speed is maintained and accuracy is improved to a level in which a comparative in-house form studies are possible. This technique enhances the urban designer’s ability to assess cause and effect, where a design can be proposed and the effects can be seen quickly allowing for comparison and more informed decision making.

### 6.3.2 ‘Para-Shadows’ - Parametric Real-Time Shadow

#### The Urban Agenda

In urban design frameworks or structure plans, reference to over shadowing of existing buildings and open space is common. Protection of solar amenity has been a concern for planners for many years. Since the adoption of the lift after the 1850s, the height of buildings has increased (Korom 2008 pp.28-29) leading to greater concern for solar amenity. This concern for light (along with concern for fire egress), led to the adoption of height limits in many cities in the world (Korom 2008 p.246), where city planners decided upon heights that they believed would limit the over shadowing of new buildings onto existing buildings and the streets (Daniell 2005). In Manhattan New York, solar angles were adopted, whereby buildings could go as high as they wanted but had to taper inwards as they went up according to a set formula. Though this was subsequently abandoned in favour of a plot ratio system, a similar approach has continued to be used in cities in Japan (Daniell 2005). Victoria’s planning guide lines ‘ResCode’ also uses a formula driven setback system which refers to solar access. There are also requirements to do with over shadowing neighbour’s private open space.

\[\text{Figure 99: ResCode - Residential setbacks.} \]

Boundary for building height at any point - more than 3·6m but not more than 6·9m must be: 1m plus an additional distance calculated at the rate of .3m for every metre of height over 3.6m.'

\[\text{\textsuperscript{1} Full radiance lighting studies can be performed by lighting engineers who can assess each minute of each day for the entire year, however these studies are computationally demanding and can take days to run the analysis.}\]

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According to medical academic Professor Michael Holick from the Boston University Medical Centre:

*Up to 25 per cent of Australians could be Vitamin D deficient. The cause is something that's been known for nearly a century, a lack of sunshine. There now seems to be a connection between breast, colon and prostate cancer and a lack of Vitamin D* (Kelly 2003).

With increasing pressure on business to take account of energy use and their carbon foot print, the issue of overshadowing may soon also become a legal one, the financial impact of effects of overshadowing on neighbouring building’s energy consumption, where businesses try to recoup the additional costs incurred for heating and lighting buildings due to the overshadowing.

**Existing Method**

As I have pointed out above, it is relatively straightforward to produce shadow studies of a building using 2D plans and sections, but large or complex forms can be almost impossible. When this kind of analysis has been required in the past, it has been done intuitively (see Figure 100). Using 3D modelling software with *Solar Systems*, accurate shadows can now be cast for large or complex geometry. The downside of this solar tracing capability is that in most programs, the shadow casting is only shown after the 3D model is rendered – involving the computationally intensive process of tracing lighting onto materials. Though this is very useful, the process still requires a designer to make a design change to the 3d model, and then render the view to see the overshadowing effect. If a desired position of overshadowing is required, it involves a lengthy trial and error process – make a design change, re-render, make another change, re-render and so on. It would be ideal if this process could skip this in-between step of re-rendering. A designer could then see the immediate effects of design changes on the shadows cast by a building as the changes were being made – ‘real-time’ feedback.

There are some 3d modelling programs that do include this real-time shadow or a similar function but these programs tend to not be as flexible for early design stages of projects (see software review Appendix 10.2.1 p.283). An example of where real-time shadows might be useful could be when designing a building adjacent to a sports facility. In the Melbourne Docklands the Urban Design Framework stipulates that the Docklands stadium sports field should not be overshadowed by any adjacent building (as was the case in Figure 97).
The Technique

In order to address the issues discussed above, I developed a technique I call Para-Shadow. The technique utilises the inbuilt solar system in 3D Studio Max™, along with parametric capabilities, associative geometry, and animation special effect tools. To generate the Para-Shadow, a solar system is used to create a parametric sun light source with the location set (setting azimuth and altitude) and time (time of day and day of year). An animation special effect called space warp conform is then created and its position and direction parameters are harvested from the current position of the sun. This means that as the sun’s time parameters are adjusted, the angle of both the sun and the space warp change together (see Figure 101). The space warp is then applied to a referenced clone1 of the building geometry. The space warp then pushes (conforms) the copy of the building geometry onto a chosen surface (the ground). This means that when the sun’s position is moved by adjusting the time parameter ‘spinner’, the shadow adjusts instantaneously. When the building geometry is altered (eg if the building is expressed as a simple extruded shape and the extrude distance is changed), the shadow updates in real-time. Because the shadow shares the same vector geometry information, the shadow can also be selected and altered, with the effects of the changed shadow being instantaneously reflected in the shadow casting object. This technique reverses the way we usually think about building shadows. Typically, we think of shadows as a

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1 A ‘referenced clone’ is a copy of geometry that continuously references the original object’s geometry and parameters, where if the original object is altered, the ‘referenced clone’ is altered, however, the referenced clone can be modified (eg. twisted), without modifying the original object. For further explanation of this concept, see www.cadtutor.net/tutorials/3ds-max/transforming-objects.php.
result of geometry\textsuperscript{1}, but by using the \textit{Para-Shadow} technique, we can think of the building geometry as the result of the shadow it casts.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig101.png}
\caption{Screen grab showing \textit{Para-Shadow} real-time movement of sun time and resulting shadow.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig102.png}
\caption{Screen grab showing real-time adjustment of object height and resulting shadow.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig103.png}
\caption{Screen grab showing the reverse logic of adjusting the shadow as though it was an object to alter the shadow casting object.}
\end{figure}

**Case study: St Vincent’s Hospital Master Plan**

Part of the St Vincent’s Hospital master plan undertaken in 2005 by MGS Architects and Urban Designers involved a feasibility study of an area adjacent an existing public open space. The St Vincent’s Hospital client requested that potential yield for the site be tested with the stipulation that the existing plaza could not be overshadowed during 9.30 am and 3.30 pm between March and September. I tested the \textit{Para-Shadow} technique on the project. Though the outcomes were useful in gauging rough sizes of buildings that would likely fit on the site, the technique was not capable of dealing with such a wide range of times without many days worth of trial and error shadow testing, illustrating that the technique was better suited to two or three different times where a space is not to be overshadowed (see Figure 104).

\textsuperscript{1} For an explanation of typical building shadow analysis, see www.shadowdraw.com.au/manualversion.html.
Figure 104: The technique was used on the massing of buildings adjacent the public plaza adjusting height parameter of the shadow to affect the building mass. (An animation of this analysis is on the accompanying CD).

**Results – Speed, Accuracy, Level of Abstraction**

Though useful in the discussions this technique was unsuccessful in the specific case study as more than one specific time needed to be considered. The technique did however show potential to be used on other projects where large ranges of times where not needed.

Further evidence to the potential of this technique has since been provided with a real-time render process has recently been added to both AutoCAD™ 2007 and to 3D Studio Max 2008™. These use the computers video card to process real-time shadow previews in shaded viewports. This means that the shadows, though previewing in real-time, are not vector based, and the reverse parametric control of the shadow to influence the shadow casting object is not possible. This validates the usefulness of the initial study confirming that there is a need in the industry for such a tool.

**6.3.3 ‘Subtracto-Sun’ – Solid Negative Shadow Subtraction**

**The Urban Agenda**

Where a clearly defined outcome is given – for example ‘This plaza must not be in shadow between these hours’ – a kind of reverse solar modelling is required. For the St Vincent’s Hospital in Melbourne discussed above, part of the master plan brief dictated that a particular plaza should remain unaffected by shadows during 9.30 am and 3.30 pm between March and September.

**Existing Method and Their Shortcomings**

Other than an extremely time-consuming process of trial and error, there was no existing method to perform this task within the available software; unless the times are limited to just one or two and simple sectional setbacks are devised (see Figure 105 and Figure 106).
The Technique

In response to this problem I developed a technique called *Subtracto-Sun*, a scripted tool which utilises parametric solar systems, real-time parametric Boolean operations, and wired (linked) parameters (Figure 108). The script creates a permissible building envelope by subtracting a solid negative ‘shadow’ object derived from angles of the sun during the given period. This results in a development envelope within which any building can be built without casting a shadow onto the plaza within the designated times.
Case Study 1: St Vincent’s Hospital Master Plan

The case study used to test the technique was St Vincent’s Hospital plaza. The client requested that the plaza be not overshadowed during 9.30 am and 3.30 pm between March and September. I applied the technique to the plaza, subtracting from adjacent potential building envelopes (see Figure 108). Unfortunately when areas studies were conducted for the permissible envelopes, the result exposed that the areas of building gained by constructing within the envelope were not substantial enough to justify the new construction. The Subtracto-Sun demonstrated that it was not possible to build new buildings feasibly and retain the solar amenity to the public open space. The technique was verified with the use of with raytraced solar shadows based on Melbourne Solar tables (see Figure 68). This technique was successful in the assessment of potential building yield within the client’s requirements.

Figure 108: St Vincent’s Hospital master plan using Subtracto-Sun to project plaza shape as a subtractive solid of different times of day and removed from surrounding potential built form. (An animation of this analysis is on the accompanying CD).

Figure 109: Permissible building volume created with Subtracto-Sun tested with raytraced solar shadows based on Melbourne Solar tables. (An animation of this analysis is on the accompanying CD).

Case Study 2: South Melbourne Structure Plan – C52 Amendment study

The following case study involved solar studies that I produced using Subtracto-Sun used by Robert McGauran (MGS) for ‘expert witness’ testimony given at VCAT (Victorian Civil and Administrative Tribunal) for the amendment of South Melbourne Planning Scheme. The
argument put forward involved demonstrating that current Structure Plan objectives were not met within the current planning scheme guidelines, thus making the document contradictory and flawed.

The *South Melbourne Structure Plan* document\(^1\), point 3.11 Activity streets and sunlight access states:

- Retail and/or restaurant venues, with outdoor dining profiting from the solar access on the southern footpaths.
- Community feedback strongly supported planning controls to avoid overshadowing of the public realm in areas of street activity.
- Year-round sunlight to the southern footpaths of the principal east-west activity streets should be retained during the middle of the day.
- Year-round sunlight to the principal north-south activity streets should also be retained: the western side receiving morning sun and the eastern side receiving afternoon sun.
- Sunlight should access the entire width of these footpaths at these times, up to the property frontage, so that maximum use can be made of this space.

These objectives are legislated with sectional diagrams which show solar penetration for various areas of South Melbourne (see Figure 110). The permissible building envelope created by following the structure plan guidelines results in the volume shown in Figure 113 and Figure 114 which is radically different to the form suggested in (see Figure 110). This point was further demonstrated with perspective images showing a potential office building which could fit onto the site (Figure 115). The technique was successful in having the site height restrictions amended (see C52 Amendment)\(^2\).

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\(^2\) C52 Amendment to planning scheme is available for download at www.portphillip.vic.gov.au/attachments/o28191.pdf.
Figure 111: Permissible building envelopes for study area of South Melbourne according to solar penetration sections.

Figure 112: Theoretical permissible building envelopes using Subtracto-Sun technique when using literal translation of structure plan objectives (using the winter solstice).

Figure 113: Theoretical permissible building envelopes using Subtracto-Sun technique when using Spring Equinox.

Figure 114: Theoretical permissible building envelope shown in urban context.
Case Study 3: South Melbourne Structure Plan – Theoretical Extension of Idea – Hugh Ferriss Meets South Melbourne

The use of this technique on practice case studies suggested to me the potential for a purely academic extension of the investigation into a theoretical study of the whole of the area in question, what if Subtracto-Sun is used on large scale areas? A one-day study was undertaken to test this question using the listed objectives discussed earlier. Taking the existing site boundaries, extruding them to a height of 100 metres (Figure 117), I applied the Subtracto-Sun technique to all east, west and north footpaths for the designated area (Figure 118). This resulted in interesting tapering forms (Figure 119 and Figure 120), reminiscent of pyramidal forms of Teotihuacán of pre Hispanic Mexico or the rendering of New York City by Hugh Ferriss in the 1920s (Figure 121).

Figure 115: Views using envelopes with ‘Quick Tower’ technique to illustrate radical difference between planning objectives and planning sections.

Figure 116: Existing Structure plan planning envelopes.

Figure 117: LHS – Extrusion of site boundaries for solid mass, RHS extrusion of east, west and north footpaths.
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Figure 118: Application of Subtracto-Sun technique set to the Melbourne winter solstice between 9am and 5pm.

Figure 119: Resulting permissible building envelopes.

Figure 120: Perspective views of permissible building envelopes.

Figure 121: Teotihuacán Pyramid of the Sun, Mexico (LHS), Rendering of New York City by Hugh Ferriss (RHS).
Results – Speed, Accuracy, Level of Abstraction

The level of accuracy for the Subtracto-Sun can be as high as the amount of detail in the model. This technique was both developed and used within the time allocated for the initial specific St Vincent’s Hospital case study. Subtracto-Sun has since been used on many other projects where similar desires have been expressed, such as providing a height limit on the opposite side of a café strip footpath requiring direct sunlight at lunch times throughout the year. It has been used for a development site directly adjacent to an existing high school library to ensure no overshadowing of the reading room during school hours (discussed in Section 6.4.3 and Appendix 10.7 p.313). The technique has also been used on other projects within the MGS office (See Appendix 10.13.1 p. 324) including residential jobs where it was used to work within residential solar penetration guidelines (see Figure 122). When presenting the technique at The University of Cincinnati’s Sustainable Urban Design Forum in (held in Cincinnati in the U.S. on the 10th August 2007, see Appendix 10.16.2 p.340) it was suggested that the technique could be used for solar access to footpaths and driveways for the purposes of melting snow (an application that had not occurred to a Melbourne practitioner).

Figure 122: Example of residential project conducted within MGS by Kun Tran (MGS staff member) utilising Subtracto-Sun technique. (An animation of this analysis is on the accompanying CD).

6.4 Visual Impact - Urban form: Visualisation, Generation, Composition

In the following section I will discuss the results of studies into visual impact analysis techniques developed to assess urban form visualisation, generation and composition. This section will respond to the issue of cultural sustainability that was discussed in earlier chapters. The section
will also respond to concerns voiced in *Melbourne 2030* with specific reference to Direction 1 – A more compact city, and Direction 5 – a great place to be, with both directions 1 & 5 requiring visual implications to be taken into account.

### 6.4.1 Rapid Urban Modelling and the ‘First Person Shooter’

#### The Urban Agenda

When density is increased, there is a perceived need to protect heritage, community identity and consider the visual impact of development¹. There is generally a desire to keep buildings low, to ‘hide’ upper floors of buildings or ‘reduce visual bulk’. This can be a somewhat subjective discussion, as what is bulky to one may be elegant to another. For this subjective decision to be made, it is necessary to represent both existing and proposed urbanism in a format that can facilitate a healthy discussion.

#### Existing Method and Their Shortcomings

In the creation of urban design frameworks, as mentioned earlier, three dimensional representations are used sparingly, and are either crude 3D digital models (often using SketchUp™), or specious pencil and water coloured hand drawings. These 3D views of the frameworks are evasive and do not give any indication of the quality of the framework, nor the quality of the resulting urban spaces. The SketchUp models are simple extrusions of building outlines, with no typological information (see Figure 123). The freehand images are equally vague with little to no semblance of reality (see Figure 124). These representations reflect the limited time and budgets allocated to producing visualisations of this kind.

![Figure 123: Planning scheme amendment adopted for Forest Hill precinct (City of Stonnington), FHSP 19 Dec 2005, SketchUp model produced by Beca AMEC Limited planning consultants.](image)

¹ Almost all municipalities within Victoria, Australia make reference to the visual impact agendas in their planning schemes. For just one example, see [www.dse.vic.gov.au/planningschemes/aavpp/43_01.pdf](http://www.dse.vic.gov.au/planningschemes/aavpp/43_01.pdf).
For architects submitting to council planning departments, it is generally stipulated that plans, sections and elevations be submitted to as part of the planning application process. These 2D drawings are then compared with the 2D legislation drawings for compliance (see Figure 130). Perspective images are sometimes submitted, but are rarely a requirement. This means that urban designs are not necessarily tested three dimensionally leading to discrepancies between the aspirations of local councils and their constituents and the design frameworks they are attempting to implement.

**The Techniques**

To improve the process of generation and representation of three dimensional urban frameworks, I sought a more rapid method of form generation. Once again I developed scripted techniques to enhance the speed of creating building envelopes. To represent existing low density detached housing, a quick-house script was created which I have called ‘The Housifyor’. The script takes house outlines taken from cadastral plan information of councils (or traced from aerial photography if this information is not available), and uses a generic pitched roof and eave profile to create a form that is indicative of common Australian suburban houses. This script was then compiled and given a user interface by architecture student (and my brother), Cameron White, allowing the user to adjust simple parameters such as height of house (to represent 1, 2 or 3 level houses), as well as roof ridge height and eave depth.
I also wrote a script to produce an indicative curtain wall office building using a series of scripted commands that take a building outline (poly line), and make various parametrically linked copies of the outline, extruding, bevelling and arraying a set number of floors, then applying complex transparency mapping and materials to create the ‘Quick Tower’. This tower is parametric with changes to the original building shape affecting all of the walls, the floors, the ceiling bulkheads, lighting grids, as well as glazing mullions.

For simulating medium density I developed a technique by utilising Tom Hudson’s ‘Greeble’ plug-in. A surface representing street blocks is used with the Greeble with parameters set in such a way to create ‘Quick Medium Density’, which creates masses representing random heights between two specified parameters, lowest mass and highest mass (see Figure 128). This technique can be used to simulate the effects of building height limit restrictions on large areas of a city giving a level of fine grain formal articulation to aid the assessment of visual impact.

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1 For more information on Tom Hudson’s ‘Greeble’ plug-in modifier see www.klanky.com.
With the adoption of 3D Studio Max™ as the program used for modelling, the recently built-in walk-through command can be used to test eye height perspective views in real-time ‘first person shooter’ mode. This software capability has been added to the program to aid gaming modellers to develop their games scenes (for example for Sony PlayStation® games) testing the scenes as they model them, without having to take geometry into another virtual reality or games engine. Because the modelling techniques described above use associative and parametric geometry, their shapes and envelopes can be adjusted parametrically, with changes registering in perspective views in real-time.

Case Study

The City of Port Phillip council’s planning code legislatates a desire ‘not to see’ upper levels of buildings. This desire not to be seen is legislated by way of a 2D sectional diagram alongside a description (Figure 130). When modelled in 3D and ‘walked through’, it quickly becomes apparent that, though the upper level is in fact not visible in sectional viewing position, the upper levels may be clearly seen from many other viewpoints. This exposes a flaw in the legislation and
highlights the need to test planning policies three and four dimensionally, by actually moving around the virtual 3D model of the proposed urban form.

Figure 130: 2D section of legislated height limits aiming to obscure upper level of building. (South Melbourne Central – Urban Design Framework for city of Port Phillip, by David Lock Associates (Nov 2005) PDF exhibition version).

Figure 131: 3D model of permissible form exposing the inadequacies of the legislated 2D section, as the upper level is clearly visible when viewed from numerous perspectives at eye level.

Results – Speed, Accuracy, Level of Abstraction

These techniques improve statutory planners’ ability to generate maximum building envelopes that represent the planners’ aspirations more closely. Real-time building envelope manipulation provides the opportunity to ensure with greater confidence that envelopes function as they are intended. Though the quick urban form generation techniques are not necessarily 100% accurate when simulating existing urban conditions, they are typologically accurate and give a much greater indication of spatial qualities and visual impacts of urban proposals than other methods. They convey a level of detail that helps with the readability of forms, and can be created in just a few seconds. These techniques have been taken up within the practice of MGS on a number of projects, since the study began (See Appendix 10.12 p.323) and have been effective in ‘selling designs to clients’ (See interview with Rob McGauran Appendix 10.13.2 p.325). There is also a possibility to revisit forgotten ideas from the Renaissance such as perspectival composition of urban form and the Picturesque which I will discuss in the next section.

6.4.2 ‘Parametric-Picturesque’ Modelling

The Urban Agenda

As I discussed in Section 1.6 (p.8), The Brundtland definition of Sustainable Development (WCED 1983 p.24) is often accompanied by a Venn-diagram showing economic, environmental and
social sustainability though, in reality, one of these bubbles ends up being a great deal larger than the others and the smallest bubble tends to be social. Assuming that cultural fits within a subset of social, it is my opinion that this factor should be at least as big as the other two if not larger, for development that is perceived as culturally barren leads to demolition and redevelopment, a process that has great financial cost as well as environmental cost. There are endless examples of American architect Louis Sullivan’s ‘form ever follows function’ phrase being misread (1896), not understanding that part of the ‘function’ of a design is an aesthetic and cultural function. For a building or urban design to function, aesthetics must considered, and not just in a nostalgic application of period decoration and inclusion of Italian style plazas as suggested by the New-Urbanists, but in a holistic composition. Designs should be rich with contemporary ideas and aesthetics, reflecting society’s aspirations and technological advancements three dimensionally.

Figure 132: LHS - Commonly used diagram illustrating sustainability (Johann Dreo 2007), RHS distorted version of diagram illustrating what happens in practice.

Problem: How shall we impart to this sterile pile, this crude, harsh, brutal agglomeration, this stark, glaring exclamation of eternal strife, the graciousness of those higher forms of sensibility and culture that rest on the lower and fiercer passions? How shall we proclaim from the dizzy height of this strange, weird, modern housetop the peaceful evangel of sentiment, of beauty, the cult of a higher life? (Sullivan 1896).

Existing Method and Their Shortcomings

It is likely that there are many reasons that perspective composition in urban design is uncommon today. In addition to perspective composition not being currently fashionable, vehicular traffic movement is seen as primary importance; numbers of car parks provided are seen as more important, net lettable areas (real-estate yield) are seen as more important.

Perspective planning composition was also quite difficult and time consuming to draw by hand. It required drawing perspectives, but then in addition, reversing the drawing process, where one would normally use the plans projected to the horizon back to the picture plane, the perspective image was composed and projected back to the plan; a process that requires a high level of skill and time.

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1 This is evident in his the introduction problems statement of the essay. Sullivan’s buildings were formally restrained but were decorated with ornamental detailing, with a purely aesthetic function.
With the increased availability of 3D CAD programs, it has become much faster to produce 3D perspective views of buildings, but only in the last ten years or so have computers had enough power to handle modelling cities. Modelling cities is still seen as a major undertaking (Hudson-Smith 2007 p.28) requiring many staff modelling on many computers and a great deal of time. The normal procedure involves a designer coming up with the plans and the modelling team producing the digital model to take perspective views to ‘sell’ the design. Once the model is built, it is often very slow to change and so the perspective view usually ends up as purely a representation of the plan with additional height data.

The Technique

The Parametric-Picturesque modelling technique simply involves the utilisation of existing perspective and parametric capabilities of the commonly used animation package 3D Studio Max™. Like most 3D modelling programs it allows multiple viewports so the user can look at the top, side, and perspective ‘camera view’, but unlike many programs the user is able to alter parameters of the model and see the perspective view update instantaneously – real-time. For example the height of a tower can be changed by pulling the height parameter ‘spinner’ up and down seeing the tower height update instantly in the viewport or in the Michelangelo’s Campidoglio example, the angle of the trapezoidal plaza can be manipulated for visual effect in the perspective viewport. The program also has associative geometry capabilities where parameters can be shared. For example, all tower heights may be set as the same, such that when one height is changed, all the tower heights are changed. Mathematical formulas and functions can also be applied to the parameter relationships, for example the first tower height could be set as the height of the second tower height squared.

Case Study

In December 2005 the Melbourne City Council commissioned MGS to produce a study of the Melbourne South Bank to look at development opportunities in the area. The council did not possess a 3D digital model, so an ‘existing conditions’ model needed to be produced using a cadastral base and surveyed spot levels. The study was also limited to a one week time frame, so the digital model was made, a design with feasibility areas were produced, design feasibility areas were refined, and presentation images produced all within this restrictive timeframe. The time constraints dictated that the one digital model needed to be able to fulfil all these roles – feasibility, presentation, co-ordination. Key perspective views were set up within the model, and the buildings within the views were ‘sculpted’ like ‘virtual clay’ by adjusting object parameters for

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1 Due to the real-time on-screen feedback of changes of a model’s parameters, the digital model has a kind of tactile quality where polygons can be ‘pushed’ about the digital Cartesian space like one might sculpt wet clay – or like ‘virtual clay’.
those particular views – much like the traditional picturesque composition (Price 1810 pp.70, 172 – 177, 326) where the picture plane from a specific viewing point is used to compose the perspective image, using this image to ‘reverse engineer’ the plans. The added advantage of producing the scheme in this way was that the floor areas of the buildings were also measured as parameters linked to a table, such that the building massing could be sculpted whilst maintaining site yield.

Figure 133: Plan view from digital model showing proposed new buildings and area and residential units and commercial yields.

Figure 134: Aerial view of 3D digital model of South-bank Melbourne.

Figure 135: Key composed view employing the Parametric-Picturesque design technique.

Figure 136: Perspectival emphasis.
Results – Speed, Accuracy, Level of Abstraction

The Parametric-Picturesque technique allows the designer to ‘sculpt’ space with a level of tactility and fluidity that has previously not been possible. A discussion on defining beauty in the context of the picturesque is beyond the scope of this thesis given visual appreciation of composition is extremely subjective, varying enormously from person to person. I can however state with some certainty that this parametric technique would provide any designer, regardless of their particular view on urban beauty, a powerful aid to realising their particular urban aesthetic.

The speed in which one can move around the model can be rapid and the perspective view is as accurate as that of a photo taken with a digital camera. The level of detail in the model is definitely a factor in both the speed of model making and also of model viewing, where the higher the level of detail, the more powerful the computer required for viewing the model.

6.4.3 ‘Solid Subtractive Silhouette’ - Historic Silhouette Preservation

The Urban Agenda

Melbourne 2030 Policy 5.4 lists among its objectives a requirement to ‘Protect heritage places and values’ (DOI 2003 p.98). This protection is to be done by assessment and retention of historic buildings, but also seeks the protection of urban scaled historic ‘gestures’. There is a long history of city silhouettes, or skylines being important to a cities’ identity. Until the 20th century, there has been an understanding that key civic buildings would announce themselves upon the skyline, be it as the gothic church spire or the town library dome. In recent times, this priority has fallen away with commercial towers eroding the skyline. In Melbourne, relatively unsuccessful attempts have been made to restrict building heights within the CBD to 40 metres. There are however two key legislative regulations that have made an impact on the Melbourne skyline with respect to historic vistas/silhouettes – The Shrine of Remembrance – (war memorial), and St Paul’s Cathedral. The Shrine of Remembrance was built between July 1928 and November 1934 in memory of the men and women of Victoria who served and died in the Great War of 1914-18. The Shrine has been protected since the passing of the Shrine of Remembrance Act in 1978, and various master plans for the area over the years, all protecting the historic silhouette looking down St Kilda road to the South (see Figure 137).

1 For more information, see www.shrine.org.au
Figure 137: Photo of the Shrine in the 1930s (LHS), and photo taken in 2006 (RHS). Note the absence of buildings in the background due to the preserved silhouette.

Figure 138: Plan from the St Kilda Road Master Plan document.

The other important protection of historic vistas in Melbourne has been characterised by the highly publicised St Paul’s Cathedral/ Federation Square ‘Shard’ controversy\(^1\). In 2000 the Victorian State Government commissioned a report from Evan Walker on the effects of the proposed new Federation Square development, concluded with a recommendation that ‘the heritage vista of St Paul’s Cathedral southern façade and complete silhouette should be preserved and protected in perpetuity’ (Office of the Premier & Treasurer 2000). This led to a redesign of the ‘Shard’ building so it did not interrupt the view or the silhouette of the Church.

Figure 139: LHS: Federation Square original scheme with full sized ‘shard’, RHS: view from the ‘Walker position’ showing shard reduction for view.

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\(^{1}\) For a thorough account of Shard controversy, see ‘Survey Response in How can we understand the decision to remove the Shard at Federation Square’, in *Architect Victoria*, July/August 2000.
Existing Method and Their Shortcomings

Both of the examples sited above have been difficult to communicate and enforce and consequently have been surrounded in controversy, particularly the example of Federation Square. It is not enough for the Melbourne City Council to describe in text that a view should be preserved, or show an area in plan that is ‘under a heritage vista overlay’: volumetric envelopes must be described using plans and sections. To create these envelopes is a time consuming and costly exercise.

The Technique

The technique that I have developed uses the same built in 3D perspective camera creation for animation and gaming discussed in the previous technique. Camera position (XY) as well as height (Z) can be altered along with the direction and lens aperture of the virtual camera. A 3D digital model of the historic building in question is made and the camera can be matched to a designated viewing point. ‘PFlow’ (a built in particle system used to simulate explosions) is used to generate particle rays that move through the eye (camera) position, and then through each of the corners (vertices) of the historic building. The particle rays then intersect with an extrusion of the neighbouring property boundaries marking the intersection with a point. These marks can then be used to sculpt the permissible envelope, within which, anything can be built without impacting on the historic silhouette. I call this process the ‘Solid Subtractive Silhouette’ technique.

Case Study – Melbourne High School

As part of the Chapel Vision structure plan for the Melbourne suburbs of South Yarra and Prahran, an analysis of potential future development adjacent the historic school was undertaken. The heritage report produced by Bryce Raworth Pty Ltd Conservation recommended that the view of the school from the corner of Yarra Street and Alexander Avenue should be retained unimpeded by development – ‘the castle hill view’. Due to its form and castled parapet, the building’s silhouette was considered important enough to be maintained. Any development to the east of the school must therefore be restricted in height. To work out the permissible heights, I employed the Solid Subtractive Silhouette technique. The resulting envelope maximised the potential yield of adjacent sites whilst ensuring the heritage silhouette is protected.

Figure 140: LHS - image of historic school building, Middle – photo from designated historic view point (photo MW 2006), RHS digital model perspective matched to photo.
Results – Speed, Accuracy, Level of Abstraction

The proposed envelope was incorporated into the planning report (by Jocelyn Chiew of MGS) and has been presented and approved by the Stonnington City Council and has also successfully undergone a public consultation process. The building envelope described using this technique has now become part of the structure plan for the City of Stonnington and has amended the planning scheme with amendment C58 for the area¹, and *Schedule 8 To The Design And Development Overlay DDO8 Forrest Hill Precinct*² (see Appendix 10.7 p.313 for extract from report). The technique has proven to be as accurate as the surveyed digital model and can be tested by checking with independent 3D cameras. The speed with which the particle rays can be applied take just a few minutes, however there is some manual tracing of the shape marked intersections in order to remove the tops of the extruded forms. Future development of the tool would require the automation of this part of the procedure. This technique proves to be useful not only when dealing with sensitive historic design responses, but also offers a great deal of potential for non historical urban gestures, new public buildings, and silhouettes having a direct relationship with the surrounding urban form.

6.4.4 Visual Connectivity – ‘Visibility Graph Analysis’ (VGA)

The Urban Agenda

In his book *The Image of the City* (Lynch 1960 pp.3, 4, 125), Kevin Lynch coined the term ‘way-finding’, which referred to the readability of space and the ability to find one’s way by understanding surroundings in consistent and predictable ways, forming mental maps with five elements types: paths; edges boundaries; districts; nodal focal points and intersections landmarks. The reading of these elements requires visual connection, for example, a landmark building is not effective for way-finding unless it can be seen from numerous positions within a street network. Lynch suggests that once ‘the mishap of disorientation occur[s], [a] the sense of anxiety and even terror accompanies it’ (Lynch 1960 p.4). This feeling of orientation and perception of safety is reflected in the objectives of *Melbourne 2030*. Policy 2.2 (pp.63, 64) which lists ‘designing well-planned, easy-to-maintain and safe streets and neighbourhoods that reduce opportunities for...’
crime, improve perceptions of safety and increase levels of community participation’ and policy 5.3 lists among its objectives to ‘improve community safety and encourage neighbourhood design that makes people feel safe’ (DOI 2002 p.96). The feeling of safety can be achieved by ‘foster[ing] natural surveillance’ (policy 5.1 p.94), as well as visual connectivity and natural surveillance through movement of people.

**Existing Method and Their Shortcomings**

Apart from intuitive readings of plans for visual connectivity, a more scientific measurement has been developed based on the work of Hillier (Hillier 1999), by University College London (UCL), Space Syntax member, Alasdair Turner in his Depthmap software (Turner & Penn 1999). The Depthmap software is capable of calculating ‘isovist’ maps which show an area of direct lines of sight in all directions (see Figure 145). An extension of this analysis is a method called ‘*Visibility Graph Analysis* (VGA), which uses a grid laid over an area with each point analysed for Isovist values. These Isovist values are then translated into a colour in order to describe areas with good or poor visual connectivity (see Figure 145). On a small scale analysis (of an art gallery) central gallery areas are shown to have good VGA (shown in red), whereas corridors and more isolated rooms have poor VGA (green and blue). This also correlates to human movement with the majority of movement occurring in the more visually integrated areas (Conroy 2001).

Literature from the UCL includes various studies comparing VGA to crime patterns finding that alongside other factors such as land-use and socio economic, visibility and natural surveillance of space are important aspects of deterring criminal activity (Baran et al. 2007 119-03). According to Hillier, there is a direct relationship between connectivity (space syntax depth and visual connectively) and not only feeling of safety but actual crime. ‘Burgled dwellings are significantly more segregated on average than unburgled dwellings’ (Hillier 1999 p.124).

![Figure 144 Isovist from a single position measuring how far one can see in every direction.](image)

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Constraints

The Depthmap software is available for download for academic use only from the Space Syntax website www.spacesyntax.org/downloads.aspx. This academic version is very useful within research, but is not available for professional use as Space Syntax prefers to offer themselves as the specialists who can perform V/G/A analysis as sub-consultants. According to Council focus group members (see Appendix 10.14 p.332), the Spatial Syntax consultation, though seemingly useful in addressing visual connectivity concerns, is prohibitively expensive, and thus this kind of analysis is not commonly performed in Australia.

The Technique

Investigations into recreating and alternative isovist measurements were initially made using particle rays using the Particle Flow (PFflow) system within 3D Studio Max™ (Figure 146). My technique for modelling the isovist allows the user to determine levels of accuracy (the number of rays shot from eye position) and depending on the complexity of the scenario, can be moved around the model with instantaneous real-time feedback. Unlike the UCL Depthmap software, the isovist can also be calculated three dimensionally (Figure 147). When used three dimensionally, the isovist measurement resembles another form of spatial analysis called sky view factor (SVF)¹. Sky view factors have a strong relationship with air temperature (Svensson 2004)², due to the ‘urban heat island effect’ (Morris n.d.)³. Though measuring SVF is a valid investigation, it is not the subject of my inquiry.

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¹ A higher sky view factor provides the feeling of ‘openness’ in outdoor space, a value that is emerged as an important factor for people using open spaces (EU RUROS 2004) Designing Open Spaces in the Urban Environment: A Bioclimatic Approach, (C.R.E.S.).
The next step in the process for \( VGA \) is to take values from individual isovist nodes spreading a grid of nodes across an area, taking values of all isovist calculations and giving each point a value. Within 3D Studio Max\textsuperscript{TM} using PFlow, this procedure could theoretically be scripted to automate the process giving \( VGA \) results within the common architectural software. The time of this investigation was limited by practice constraints, and when a freeware program was found that could produce \( VGA \) easily using .3DS files exported from 3D Studio Max\textsuperscript{TM}, the technique development was abandoned. Ajanachara is an unrestricted piece of freeware software created by Gerald Franz at the Max Planck Institute for Biological Cybernetics in Tübingen, Germany (Franz 2004).
Case Studies

This technique was initially tested for accuracy against well known and tested UCL Depthmap with convincing results. The application of the technique will be discussed further in the following chapter (Chapter 7).

Results – Speed, Accuracy, Level of Abstraction

The speed of application of the Ajanachara program is quite fast once program settings and variables are set for large scale analysis (the program was intended for analysis of building interior visual connectivity), taking around 20 minutes to produce a full V/G/A study of one urban scenario against another. If the analysis was built into (plug-in) the 3D Studio program, it could yield much faster results, possibly real-time results, where a building location could be dragged with the computer’s mouse seeing instantaneous results in a similar way to the Parametric-Picturesque technique discussed in section 6.4.2 (pp.164-168). This technique investigation also suggests further possibilities for developing techniques for measuring sky view factors and urban heat island effects.

6.5 Density Distribution and Feasibility Modelling

In this section I will discuss techniques for modelling population density and the financial feasibility of developments. Of the principles of the overarching aim for sustainability outlined in Section 4.2.7 (p.68), one of the three sustainability pillars is financial sustainability – the built environment needs to be profitable to a certain extent or it is unsustainable. If it costs a developer around the same amount to develop a site to the potential returns from selling or renting the development, then the developer is unlikely to build anything. Melbourne 2030 Direction 1 – A more compact city, as discussed in Section 4.2, requires increasing density in strategic areas. It requires more compact forms of housing, multiple dwelling developments in the form of infill or low or high rise apartments. This kind of construction is more expensive than single detached housing development, and consequentially carries more financial risk for developers. This risk is amplified due to the relatively unclear and unpredictable planning procedure where much of the planning rhetoric in council structure plans is vague and open to interpretation and consequentially open to a planning official’s interpretation (Millar 2007). If a developer asks ‘can I build apartments on this site?’ an architect would usually reply ‘you might be able to, but you never know how the town planning procedure might go, you might need to go to VCAT\(^1\). The uncertainty of the approval process for multi-dwelling developments in inner and middle suburbs is a disincentive when compared with ease and certainty of single detached dwelling development in fringe suburbs, where the risk is almost non-existent.

\(^1\) VCAT (Victorian Civil and Administrative Tribunal).
Melbourne 2030 *Direction 9 – Better planning decisions* aims to address this uncertainty for developers with ‘careful management’ making planning process more predictable by simplifying the development process and reducing the risk for developers developing the right kind of buildings in the correct locations (DOI 2002 p.43). *Direction 4 – A more prosperous city*, also implies residential as well as commercial and retail development must be financially feasible.

For local structure plans to meet these directives, improved methods of density distribution, and ways of testing viability of the type and amounts of increased density are needed. This section proposes new techniques for measuring areas and volumes for feasibility studies at urban scale level, and methods for density distribution modelling.

### 6.5.1 Density Distribution Surface – Density Distribution Modelling

**The Urban Agenda**

As outlined above, the location of increased density, housing affordability and location are critically important factors in achieving Melbourne 2030 objectives. The transport oriented development (TOD) model for density distribution has been stated in Melbourne 2030, but the implementation techniques are not well defined and are inconsistent with what is now possible using digital technology. I will now give an overview of key theories for the distribution of density in order to show the advantages and disadvantages of various density models and background my own density distribution modelling technique.

**Existing Method and Their Shortcomings**

*Circular catchment model:*

One commonly used method for designating areas for increased density, is the circular catchment model discussed in Section 6.2.2 (p.133). This method is currently used in many of Melbourne municipality structure plans in response to Melbourne 2030 objectives. This technique is positioned with that of TOD which has been demonstrated as an effective design technique for sustainable urbanism, but due to the same reasons discussed in section 6.2.2, the system is flawed.

**Shortcomings:**

The circular catchment method for density distribution suggests either tiered development within the circular catchments of 400 and 800m, or arbitrary areas within the theoretical catchments chosen for increased density.
Johann Von Thünen model:

In 1826 German land owner and economist Johann Von Thünen described his land-use theory in the book *The Isolated State* (1826) which developed the first serious treatment of spatial economics, connecting it with the theory of rent (Rodrigue 2008). Von Thünen’s Regional Land-use Model compares the relationships between production cost, the market price and the transport cost of an agricultural commodity dictating the most feasible locations for different land-uses. The further away from the central node (market) the less profitable certain land-uses become and consequently the less land value (see Figure 149) with the effect of different land-uses occurring in concentric circles away from the centre. Milk production, for example, was both costly to transport and needed to be close enough to the centre for the milk not to have turned by the time it had been transported to the centre, yet also returned a high rate for the produce. Thus in the Von Thünen model dairy production would be close to the centre of the circles (Figure 153).

![Figure 149: Von Thünen's land rent curves and the resulting land-use pattern (Briassoulis 2000).](image)

Shortcomings:

The Von Thünen model made many assumptions such as that the city is located centrally within an ‘isolated state’ surrounded by forest; the site has no rivers or roads and no changes in topography; soil quality and climate are consistent; farmers transport their own goods to market by oxcart directly to the central city. There are no roads, nor are there any forms of governmental zoning restrictions. The model also is dated in that it predates trucks as well as refrigeration.

Digital Von Thünen model:

A digital version of the Von Thünen model has been created by the team at CASA (Centre for Advanced Spatial Analysis) in the UK. This stand alone program allows the input of maps or aerial photographs to test likely distributions of land-uses according to the Von Thünen
principles. The program produces a distribution map as well as a 3D density surface (see Figure 150).

**Shortcomings:**

Though this application seems to have great potential, there are many built-in limitations. For example, the scale of the input image or map is limited to a low-res image (less than 1000 pixels wide), and there is no method to export the calculated results data. The software application seems to be a useful teaching aid, but not suitable for practical use.

![Von Thünen GIS software used on Mega Mile site](1)

Figure 150: Von Thünen GIS software used on Mega Mile site1, for more detail, see Appendix 10.5.1 p.288)

**Walter Christaller, Central Place Theory**

In the early 1930’s a German geographer named Walter Christaller proposed a theory called *Central Place Theory*. The theory suggests that settlement is made up of various services that are of varying degrees or orders: low order services (grocery stores) and high order services (specialist services such as universities). These services exert a sphere of influence in an area effecting the location of other services. The theory states that the larger the settlements, the fewer their number; the larger a settlement, the farther away a similar size settlement is; the larger the settlement, the higher the order of its services (Desyllas 1999 p.26).

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1 For more information on this freeware program see [www.casa.ucl.ac.uk/software/vonthunen.asp](http://www.casa.ucl.ac.uk/software/vonthunen.asp).
Shortcomings:
Once again many great assumptions are made: the site is an isotropic (all flat), homogeneous, unbounded limitless surface; There are no zoning ordinances in play; transport is equally distributed in all directions; resources and population are evenly distributed.

William Alonso – The Alonso Model
In 1960 the American economist, William Alonso, completed his dissertation *Location and land-use* in which Alonso pioneered the adaptation of Von Thünen’s land-use model into a modern urban context. He replaced the central market area with a CBD (central business district) and agricultural produce with various alternative uses such as retail, commercial (office) and residential (Zhang 2002 pp.4-8).
A ‘bid-rent curve’ graph can be produced showing land rents for different distances from the CBD. Like Von Thünen, the Alonso model assumes that transport costs rise with distance from the market, and rents generally fall further away from the centre. This segregates the different land-uses as they have different bid-rent curves. For example, retail land-use, where accessibility is of great importance, retailers will be willing to pay more to be closer to the centre, whereas industrial land-use is less likely to be able to afford the rent that close to the centre.¹

Figure 153: LHS Von Thünen’s concentric circles of land-use. RHS, Alonso’s modern version showing retail commercial and residential land-uses.

Shortcomings:
Once again the theory takes no account of topography variations, lines of communication, zoning constraints, road networks and so on.

Christopher Alexander Pattern 29 – Density Rings
In Christopher Alexander’s 1977 book, A Pattern Language, among the 250 plus patterns for describing good design practice, pattern number 29 - Density Rings describes a method for generating population intensity distribution based on concentric density rings with highest densities at a civic node, reducing the densities with distance from the node. (Alexander et al 1977 pat.29) In Alexander’s theory, a ‘balance of density and distance’ can be achieved without the rental hierarchy segregation of the Von Thünen or Alonso models. By decreasing the density as distance from the centre increases there is a compensation for distance; the more distance one has to travel to get to the centre, the more ‘room’ they are entitled to, thus creating a kind of rental equilibrium.

The land would not need to cost different prices at different distances, because the total available number of houses in each ring would exactly correspond to the number of people who wanted to live at those distances. With demand equal to supply in every ring, the ground rents, or the price of land, could be the same in every ring, and everyone, rich and poor, could be certain of having the balance they require (Alexander et al 1977).

Though not explicitly expressed in structure plans, a version of Alexander’s density rings is common. Walkability catchments, as discussed in 6.2.2, are used to set out density targets for areas with adjacency to public transport nodes. In this case, density is translated directly to height limits (see Figure 155).

**Shortcomings:**

There are similar weaknesses as for this method to those of Von Thünen, Christaller and Alonso models such as an assumed flatness to the topography as well as ignoring street layout. Interestingly, Alexander’s Pattern 31 Promenade does take into account road layout when he works out 10 minute walking catchments for nodes along the promenading street.
Concentric Volcanic population density distribution

Most cities, including modern industrial as well as ancient settlements, have a residential concentric population distribution that in section resembles the shape of a volcano. Settlements generally have a central non-residential district either a CBD or monumental district or both, surrounded by high density residential, with the density tapering off the further away from the centre, with low density suburbs on the outer ring (Chase-Dunn 2005). This basic structure is the case in traditional cities from back as far as Mesopotamia (around 5000 years ago) to cities built up until the time of the automobile (see Figure 157 and Figure 158).

![Concentric Volcano population density distribution model, Sumerian Ur in southern Mesopotamia (modern day Iraq). Image source (Chase-Dunn 2005) section overlay by M White.](image1)

![The 'volcano' model of natural population density. (Chase-Dunn 2005).](image2)

![Residential Densities in Melbourne Australia 1986 and 1996 (Baker et al. 2000) reflecting an 'over scaled' version of the volcano model.](image3)

In ancient cities, population density was commonly located within walking distance city centre in a similar fashion to the TOD proposals discussed in earlier chapters until the use of the automobile exaggerated the size of the volcano (see Figure 159). In a study of the relationship between distance from activity nodes and likelihood of non petrol based transport (walking and cycling), Figure 160 shows a similar graph shape without the ‘hole’ of the volcano, which resembles a kind of distribution bell curve (Figure 161).
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

**Shortcomings:**

This kind of density model is similar to Alexander’s pattern 29 – Density Rings, but with a smooth transition between high to low densities. When used for Melbourne 2030 style activity centre TODs the model of distribution reflects urban agendas for a more walkable, connected city. Though this model makes the most sense as far as distribution for walkable communities in that it locates people where they are more likely to walk to transit (statistically), it is the most complex in section, and is generally used to describe existing conditions rather than to propose urban density regulations. However the model also suffers from the same assumptions of the previous modelling methods in that it assumes flat topography, and no street network, or at least a radial street network. There are also difficulties in applying the model to multi-nodal urban scenarios, for example, where there is a key node such as a railway station, with a shopping centre nearby.

Figure 161: comparison of traditional walkable city density, with non fossil fuel based transport graph.
The technique - part 1: Density Distribution Surface (DDS)

Using principles from the different methods discussed above, with the use of various animation software capabilities as well as some freeware third party plug-ins, I developed a technique I call the Density Distribution Surface (DDS) modelling technique. The first part of the technique involves deformation of one surface (A), with another surface (B) using a displacement space warp. This involves creating the density population distribution surface (A) using a profile (in this case using the non-fuel based transport curve from Figure 160), revolved around a central point making a 3D ‘bell curve’ surface. A flat surface (B) is created which is then deformed using the displace space warp referencing surface A once or more (see Figure 162). These deformations can then be moved to different locations under the ‘density surface skin’. The space warp is set to amplify the effects where two activities coincide (Figure 163). This deformation uses a simple interference theory where a peak meets peak doubling the amplitude of the wave (Figure 164). This technique allows the designer to vary the density distribution curve (surface A) to use any distribution equation they choose. For example, the bell curve could just as easily be the Von Thünen distribution curve, the Alonso distribution curve, or the Alexander stepped density rings. The flexibility of this density surface means that multiple key nodes can be considered together – access to a railway station can be considered with access to a market or school. The level of density can relate to the accessibility or desirability, for example, higher density is considered more desirable in locations that are close to both railway stations and parks.

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1 3D Studio Max™ has various spatial deformation capabilities called ‘space warps’.
The technique - part 2 – Density Distribution Surface (DDS) Compliance Simulation

The second part of this technique involves using the medium density simulation technique mentioned earlier in this chapter to visualise the effects of this *Density Distribution Surface* (DDS). This technique assumes that a direct relationship between density and building height is adopted. Once a DDS has been created, the random medium density simulation technique is used to fill the blocks with random urban form. Another kind of space warp is then used to conform the random urban form to the DDS (Figure 166). This technique allows not only all of the advantages of the previously discussed density distribution techniques, but can also be used to demonstrate the resulting urban form.

Figure 165: Random medium density simulation model with Density Distribution Surface over the top.

Figure 166: Random medium density simulation model 'squashed' down by Density Distribution Surface.

Figure 167: Resulting simulated urban density model. (An animation of this technique is on the accompanying CD).
The technique - part 3 – DDS Informed by Ped-Catch Walkability Vatchments.

Two of the weaknesses of established density distribution methods were the lack of influence of natural topography, and more importantly the lack of acknowledgment of street layout. In response to these problems, the use of the Ped-Catch technique along with Particle Displace modifier (by Peter Watje) can be used to distort the ‘3D bell curve’ according to where pedestrian movements are possible within the street layout. By deforming the Density Distribution Surface with the movement of the pedestrian agents, a more complex surface occurs. Figure 168 shows a simple movement of pedestrian agents from moving from a node (railway station) through a street network displacing the DDS according to the distance they have travelled. The deformation amount can be set by adjusting parameters within the Particle Displace modifier to replicate the various rent curves or density distributions required.

I tested this technique on two street layout scenarios, firstly a radial street grid, and secondly a more conventional rectilinear street grid (based on Melbourne CBD grid dimensions). In the first test, the radial grid model is constructed using Ped-Catch to calculate the pedestrian catchment area. Given that the grid is radial, and the Ped-Catch technique uses agents moving at 1.3 metres per second, the ten minute catchment area created is equal to a circle with a radius of 800m (Figure 169). The pedestrian agents are then used to distort the DDS, with simulated urban form conformed to within the surface (Figure 170). The resulting urban form reflects the ‘pure’ 3D bell curve shape one might expect if using the assumption that the ground is flat and the road layout is non existent (or radial).

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1 Available from www.max3dstuff.com/.
The next experiment used a rectilinear street grid following the same procedure. Ped-Catch is used, a DDS is created based on pedestrian agent movements, and then a simulated urban form is created. The catchment area created from the pedestrian agents does not create a circular area and is more diamond in shape. This is due to the additional distances travelled whilst navigating through the street layout. The consequent DDS (Figure 172) and simulated urban form (Figure 174) are radically different to that of the radial grid experiment.
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Figure 171: Screen grabs of Ped-Catch calculating 5 and 10 minute catchments for a rectilinear street grid. For more detail, see Appendix 10.5.5 p.293.

Figure 172: Three dimensional Density Distribution Surface set as building height limit.

Figure 173: Simulated urban form with height limited to Density Distribution Surface.

Figure 174: Detailed view of simulated urban form with height limited to Density Distribution Surface, see Appendix 10.5.6 p.295 (An animation of this technique is on the accompanying CD).
Case Studies

This particular technique was not used on an isolated case study: for application on case study see Chapter 7.4 p.228.

Results – Speed, Accuracy, Level of Abstraction

These simplified model tests show that the techniques provide a great degree of flexibility in representing density distribution. Unlike the other methods discussed earlier, by integrating with Ped-Catch, this method can factor in the street layout, thus making a vast improvement on the aforementioned techniques. In these tests the DDS is translated directly into height limits, there are however many other ways that the density could be translated (for example. plot ratios, or floor area ratios). These techniques could be used to create the DDS and then the surface contoured to create a 2D plan of different plot ratio areas. The speed of modelling and parametric nature of the digital model mean that the model is flexible in that the street layout could be altered and the resulting DDS and simulated urban form result can be seen, or different ‘rent curves’ could be input with almost real-time feedback\(^1\).

Conclusion

There is the potential for further development of this technique by using the Ped-Catch and the Gradiator technique together to effect the pedestrian catchments with respect to topography. Different street layouts and density scenarios can be tested with resulting urban forms gauged for other design factors such as amenity or potential areas - lettable areas or numbers of new residential apartments. There is also the possibility of using various speeds for the Ped-Catch agents representing different age groups and effects of topography building up demographics layers of DDS.

6.5.2 Yield Analysis Techniques – Area Measurement and Data Harvesting

The Urban Agenda

The location of density within transport serviced areas is also affected by the capacity of the land and the limitations of urban design frameworks. For a site to be worthy of developer investment, the site yield and potential profit from building sales or rentals needs to be economically viable. Unless a site meets the objective of being economically sustainable, there is little likelihood that the desired density will be achieved. From the position of a council looking to address issues of

\(^1\) The speed of feedback is reliant on the processor speed of the hardware and the accuracy used in the Ped-Catch parameters. With the tests illustrated above, model updates took just seconds to re-process.
housing supply and affordability raised in *Melbourne 2030*, site yields need to be assessed with respect to proposed planning ordinances. For an urban design framework being informed by urban designers in a financially sustainable manner, as well as with respect for housing supply goals, urban scaled feasibility analysis is required.

**Existing Method and Their Shortcomings**

The current process for assessing site yields and feasibility generally involves the use of architects creating designs (plans), which are sent to quantity surveyors to measure and apply costs. This is a multi-step process which can take a great deal of time particularly when design changes being made, where revised drawings are printed out, couriered to quantity surveyors, the quantity surveyor manually measuring areas, and applies cost per square metre rates\(^1\) then tables the overall building costs. This manual measurement not only slows down the design process, but also leads to inaccuracies due to the increased potential for human error. In the MGS office, CAD software was used to measure areas which were then forwarded to the quantity surveyors. A study of projects at MGS revealed that areas were taken using the *Measure* command in AutoCAD™ where a polyline area is measured for square metres, this number was entered into a text ‘room description label’ (See Appendix 10.2.3 p.285). This increased the accuracy of measurement, but when building or room shapes changed, the area needed to be recalculated. Though the office possesses a copy of the 3D BIM (building information modelling) software Revit™ also by Autodesk, which has ‘live’ links between floor plate areas and room or building description text boxes, the steep learning curve and additional cost had limited the uptake of the software. As mentioned earlier, the minimal capacity for user customisation has also excluded this software from my investigation.

**Constraints**

Again, the speed of analysis was paramount. New techniques for measuring areas needed to be quickly implemented and within existing drafting software.

**The Technique Part 1 – Live 2D Area**

This technique involves utilising new features within common drafting software. In the release of AutoCAD 2005™, Autodesk opened the program up to the use of ‘field’ objects. These fields access information from the program and drawing file databases, linking drawing attributes to text boxes. This technique allows for the direct linking of a CAD poly line (building outline) to be linked to a text description which is updated when the shape of the building outline changes. For

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\(^1\) This was the case for work with Newton Kerr Quantity Surveyors for the St Luke’s project (discussed in section 7.3).
example a building outline can be altered with almost real-time feedback in the area description on the drawing (Figure 175 and Figure 176). This area data can then be linked to an area table. Another advancement of AutoCAD 2005™ onwards has been the potential for data export from CAD tables. This exportability has meant that an area table in AutoCAD™ can be easily exported to a file in Microsoft Excel™, where more powerful expressions can be applied to the area numbers. For example: square metre rates for construction can be multiplied by the AutoCAD™ building areas to work out preliminary cost of construction of buildings, or areas can be divided by average apartment sizes to assess an urban layout scenario for potential residential unit yields.

Figure 175: Area plan of St Luke’s Church using linked data area ‘fields’ showing canopy area at 88.3 square metres.

Figure 176: Plan of St Luke’s Church using linked data area ‘fields’ updated to reflect building outline change, showing canopy area at 83.3 square metres.
The Technique Part 2 – ‘Areator’ 3D Massing Feasibility

Another variation on this theme of area measurement involves volumetric measurement using three dimensional massing for schematic and urban design proposals. The following example uses a volumetric measurement technique utilising the inbuilt 3D Studio Max™ measure command. The volume of an object is measured and stored as a linked parameter. This parameter can then be used for various calculations for use in feasibility assessment. Using an interface plug-in developed with Cameron White¹, the volume parameter can be divided by the number of floors using common preset floor to floor heights (Commercial office 4 metres, residential 3 metres), or specify their own floor to floor height. This floor to floor number is then divided into the building mass volume to calculate gross building floor area (GFA) (see Figure 177 and Figure 178). Another parameter for building efficiency (the amount of the building not taken up by lift cores, services and structure) can be used to estimate a building’s net lettable area (NLA), where an ‘efficient percentage’ number is multiplied by the GFA. The GFA and NLA are then instantly updated with any alteration of the volume shape (see Appendix 10.5.7 p.298), or height (see Figure 179).

Figure 177: Using the Areator to measure gross floor area (GFA) and net lettable areas (NLA) of blue volume.

¹ Cameron is an RMIT University architecture student (and my brother).
The Technique Part 3 – Australian Standards Carpark Blocks

Another simple technique used for feasibility assessment is parametric carpark drawing block¹ in AutoCAD™. In many local council planning schemes, much of a site’s potential yield is dictated by the amount of carparking a site can contain. For example, according to the City of Brimbank planning scheme’s carparking table 52.06-5², an office building requires 3.5 Car spaces to each 100 sq m of net floor area. These carparks are then designed either using dimensions set out in Clause 52.06-5 or a variation generally in accordance with Australian Standard AS2890.1 – 1993 for off-street car parking. Using the Dynamic Blocks system for different variations on the AS2890.1 carpark dimensions and isle widths were created where the carpark block object,

¹ ‘Blocks’ are used for repeating elements within an AutoCAD drawing. Each instance of that reference shares the same data information, which can be altered once with changes affecting all other copies of the block.
enabling the user to click on the block and choose from a list of standard carparks, having the block size and shape as well as a text description of permissible isle widths (Figure 180 and Figure 181). The number of blocks can also be tabled and listed using the \textit{EATTEXT} command, which can be linked to both a carpark title on a drawing (Figure 182), or a linked to an MS Excel™ spread sheet.

Figure 180: On grade parametric 2D BIM carpark.

Figure 181: On grade parametric 2D BIM carpark showing space dimensions and Australian Standard aisle widths.

Figure 182: Carpark blocks automatically counted and displayed in carpark title text.
Case Studies
No specific case studies have been conducted using just the feasibility study techniques. Both techniques 1 and 3 (Live 2D Area and AS Carpark Blocks) have been tested on the St Luke’s Church Master Plan defragmented case study in Chapter 7.3, and technique 2 (‘Areator’ 3D massing feasibility) has been tested on defragmented case studies 7.2 Prahran South Yarra and 7.4 A Real Walking City.

Results – Speed, Accuracy, Level of Abstraction
1 - Live 2D Area: This technique does take longer to use in the initial stage of design than manual, non-linked area calculation method. The technique becomes a great deal faster when a design change results in multiple areas requiring updating. When this occurs, the manual method would require recalculating the initial work of area measurement, as well as manually updating this data in any spreadsheets where this information is used.

2 – ‘Areator’ 3D massing feasibility: The limitations of this technique are that it is not always 100% accurate where more complex forms are used in the calculation. For example if the volume measurement was used on the Sydney Opera House (by Jørn Utzon), might result in a fairly distorted GFA calculation. The calculation also does not consider mezzanine areas, though this could be taken into account by the designer’s choice of efficiency parameter percentage. The technique is, however, extremely rapid and able to give immediate feedback on design maneuvers. Having the technique embedded within the 3D modelling and visualisation program means that there is a potential for visual composition and GFA and NLA to be considered simultaneously.

3 - AS Carpark Blocks: This technique is slower than the drawing of typical carpark blocks, but like the Live 2D Area technique, it becomes dramatically faster when multiple changes are made to a design scheme (not an uncommon occurrence in the design process).

6.6 Summary
In this chapter I have identified specific contemporary urban aspirations elaborating on urban agendas discussed in chapter 4.2. Existing techniques have been interrogated insight of how effectively they address concerns, the speed of application and practicality of the techniques within a practice environment. I have outlined how I have developed techniques utilising new functions of common software and user customisation to add to a design repertoire. I have illustrated my techniques, testing on both simple diagrammatic models, as well as testing them on various case studies. The results of these tests have been discussed in terms of speed and accuracy. Some of the techniques surpassed the speed of current methods: the high speed
urbanism modelling techniques (Section 6.4.1 pp.164 were not only faster, but increased the ‘typological accuracy’ of urban models. Other techniques took longer to use in the initial stage with greater ‘set up’ time than a manual, non-linked parametric methods, but became a great deal faster when multiple design iterations took place. For example, live linked areas (section 6.5.2 p. 191) took considerably longer to initially set up, but then gave immediate area and financial feasibility feedback with respect to design changes. Other areas of analysis that were previously not possible at all in the practice, and consequently would normally not be done, became possible using the Gradiator and Subtracto-Sun.

I have verified the level of accuracy of the different techniques which proved to be variable, depending on the user input, and the time allocated to the studies. In some cases the techniques are used to give a rough guide only, for example the volumetric area measurement technique is useful for schematic massing stages of design, but does not have the accuracy to give quantity costs to the nearest dollar, where as the 2D area measurement can be accurate to the nearest millimetre. The solar amenity P-Radiance technique is useful for comparative studies, but where exact daylight measurement is required, the input from high end lighting engineers would be needed. The Subtracto-Sun can be as accurate as the designer requires. For more accuracy, the designer simply needs to put more information into the model. This is also the case with the Ped-Catch agent-based modelling technique, where agents can have as many levels of ‘intelligence’ as the designer has time to input and the hardware can handle computationally. With the limited amount of agent intelligence used in the models shown in Section 6.2.2 (p.136), the technique proved to closely match the very long winded manual pedestrian catchment method of analysis.

The processes for these investigations have been fruitful not only in finding techniques suitable for addressing specific urban agendas, but also in suggesting unforseen uses for techniques such as the Gradiator technique surface gradients with respect to turf planting and drainage; and additional lines of inquiry to address less obvious amenity concerns such as Sky View Factors and Urban Heat Islands. The CFD technique investigated for use in pedestrian connectivity showed potential in use in simulating wind. The Subtracto-Sun also could have practical applications in snow affected areas.

The implications of these findings will be discussed in greater detail in the Discussion and Conclusions chapter, Chapter 8, but I will note here that the results thus far suggest possibilities of ‘mixing and matching’ the techniques. It seems that there is prospective in mixing the financial aspects of feasibility with revisiting forgotten ideas from the Renaissance such as perspectival composition of urban form ‘sculpting’ feasible space. There are a number of other possible
pairings: visual connectivity could be considered alongside pedestrian connectivity; linking pedestrian connectivity with rent curves and density distribution; gradient analysis with pedestrian catchments; density with solar penetration.
Informing an Integrated and Sustainable Urbanism through Rapid, Defragmented Analysis and Design.

Volume 2
Chapter 6 – Chapter 8

A thesis submitted in fulfilment of RMIT University requirements for the degree of Doctor of Philosophy

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For a full interactive version of this thesis with additional animations, see:


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Chapter 7. Defragmental Case Studies - Simultaneous Application of Techniques

7.1 Introduction

In the previous chapter I identified specific urban agendas related to sustainable urbanism and local planning policy; I developed individual design techniques directed towards addressing those aims; and tested the techniques on both simple variable models and simple urban design practice case studies.

The function of this chapter is to test the concept of the rapid, defragmented analysis and design approach by taking some of the techniques developed in the previous chapter, and applying them concurrently on more complex design case studies.

In this chapter I discuss three urban design case studies: firstly a housing project in the Melbourne suburb of Prahran carried out within the MGS practice; secondly a mixed use development in a western suburb of Melbourne consisting of a Church, childcare, office and residential with my practice of Harrison and White; and finally a design ideas competition entry conducted in collaboration with architecture student Cameron White.

In each case study I discuss the specific design brief, the key site issues and the analysis and design responses. I then go on to examine how the techniques interacted and look at the resulting urban forms.

7.2 Prahran South Yarra - Horace Petty Housing Estate

Project Brief:
The following pages describe a case study project as part of the Chapel Vision Structure Plan for the area of Prahran and South Yarra for the Stonnington City Council. The Structure Plan has been a long-standing project within the MGS office having commenced prior to 2005. The structure plan had already been developed, identifying areas of ‘potential substantial change’, where building stock was either dilapidated and not serving the community, or where there was potential to improve amenity and services. Though many areas were identified in the Structure Plan, the study I discuss here is just one of the areas designated for substantial change. The area I have chosen to use for this first defragmented case study is the Horace Petty Housing Estate on Malvern Road in Prahran (near Chapel Street, the popular shopping strip). The site is extremely...
well connected to public transport, with the choice of two tram lines, one running along the southern boundary of the site (Malvern Road #72 tram), and the others that run along Chapel Street (#78 and #79 trams). The site is also within 600m of the Hawksburn Railway Station (see Figure 183).

The project was initiated partly in response to the Structure Plan and partly as a pitch orchestrated by Rob McGauran (Director of MGS) to Stonnington Council, VicUrban1 and the Office of Housing (OOH) in an attempt to convince these parties to join forces to improve a problem area in Prahran.

This project brief involved a fast-tracked feasibility analysis for alterations and additions to the Housing Estate. The proposed reconfiguration involved the demolition of the ‘walk-up’ buildings2 (Figure 184) deemed unsuitable by the OOH due to a changed demographic for people requiring social housing – predominantly single mothers with prams or those who need wheelchair access and therefore access to lifts. The new buildings were proposed for a mixed demographic, in a model close to that seen throughout Europe involving one third social housing, one third affordable housing and one third private housing. The financial model proposed was that of a PPP (Private Public Partnership). The new buildings would need to maximise the site yield without being detrimental to existing amenity, and if possible, improve amenity.

Figure 183: Horace Petty Housing Estate site showing existing buildings and parks to both north and south of site.

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1 Victorian Government’s sustainable land development agency.
2 ‘Walk-up’ buildings are multilevel residential buildings which do not have lift access.
Analysis and Design:
The analysis and design were intertwined with various techniques applied concurrently in this case study, testing the rapid, defragmented approach. The Structure Plan identified potential locations for new buildings and suggested a pedestrian link through the site to make better connections between the Prahran Pool and Princess Gardens (both to the south of the site) and Dye Works Park (a pocket park) to the north of the site. A scheme had been drawn for the site by MGS staff member Ganga Ratnayake which created an orthogonal pedestrian link (See Figure 185). I used this scheme as a starting point, which I ‘massaged’ using my defragmented approach leading to a number of alterations and refinements.

Wheelchair Accessibility of the Suburb:
The analysis and design began with a test of accessibility. Before concluding that the ‘walk-up’ housing should be demolished because they are not wheelchair friendly, I assessed whether the surrounding environment was wheelchair friendly by applying my Gradiator analysis technique. The outcome of this analysis highlighted some areas that are not wheelchair accessible, but predominantly the area was suitable (Figure 187) with almost flat gradient access to the railway station and shops.
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**Connectivity:**

Visual connectivity was assessed alongside pedestrian connectivity. I conducted a rapid study of a number of key positions within and adjacent to the site and tested isovist values (two are examples shown in Figure 188 and Figure 190). This showed that the visual connectivity was poor between the two parks to the north and south of the OOH site, and suggested that a more direct visual connection was desirable. The poor connectivity began to inform a less orthogonally shaped urban intervention (see Figure 186). This design approach of a more direct line of sight was confirmed to have improved visual connectivity with the use of the ‘Ajanachara’ full *Visibility Graph Analysis (VGA)* technique (Figure 192 and Figure 193).
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Figure 190 Isovist from centre of Horace Petty Estate showing existing building layout.

Figure 191 Isovist from centre of Horace Petty Estate showing proposed building layout.

Figure 192 Existing VGA showing poor visual connection between the two park areas.

Figure 193 Proposed VGA showing greatly improved onsite and off site visual connectivity in public areas, as well as more visually private non-public spaces.

Whilst the visual connectivity analysis and design was taking place, I was also considering pedestrian connectivity for the potential to improve public access to parks through the site at the same time. The purpose of this was twofold, firstly to demonstrate that their proposed connection through the site improved the catchment area of both parks, secondly to demonstrate that there was the potential for improving passive visual surveillance and safety by increasing visual connectivity through the site. I employed the Ped-Catch pedestrian modelling technique to test the proposal. The 3D model was made with two scenarios (using different information layers within the file), firstly the existing conditions (Figure 194) and secondly the proposed pedestrian connections (Figure 195). This test resulted in a clear increase in pedestrian catchment for the Princess Gardens Park and the Dyeworks Park.
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Figure 194: *Ped-Catch* model for existing site, showing the way the fenced site acts as a barrier to movement.

Figure 195: *Ped-Catch* model for proposed site configuration showing link between parks and more direct link through to Chapel Street to the west.

Figure 196: *Ped-Catch* analysis conducted on existing site conditions from the Princess Gardens.

Figure 197: *Ped-Catch* analysis conducted on proposed site conditions from the Princess Gardens, resulting in a 18% increase in pedestrian catchment area for the park. See Appendix 10.5.2 for more detail.
Formal Composition and Contextual Integration:
In the interest of urban integration\textsuperscript{1} the new buildings were designed to be sensitive to the prominent and significant ‘Y’ shaped towers, which were to be retained due to their working lifts. The geometry of the new buildings referenced the ‘kinked’ 120 degree angle of the existing towers. This gesture was tested in the real-time perspective model using the \textit{Parametric-Picturesque} technique discussed in the previous chapter. The forms were adjusted to ensure that there was a visual dialogue between existing and proposed, as well as testing the visual connections between elements (described in Figure 189 isovist. Heights of the new serviced buildings were also tested for ‘visual bulk’ (in Figure 198, Figure 199 and Figure 200) whilst concurrently undergoing testing for feasibility and amenity impact (discussed later in this section). To give the buildings a physical ‘grain’ without going into detailed design, the rapid simulation technique used for representing medium density in Section 6.4.1 (on an urban scale) was used here as a kind of decorative façade treatment. This gave the forms both visual depth and differentiated the new buildings from the existing modernist slab block buildings.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure198.png}
\caption{View from Princess Park looking north through the proposal for the OOH site.}
\end{figure}

\begin{footnotesize}
\textsuperscript{1} This concept of sensitivity is normally enforced where pre-modern buildings are near a development, but is rarely a concern in the vicinity of ‘unpopular’ modernist buildings.
\end{footnotesize}
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Figure 199: View from the Dye Works Park looking south into the OOH site showing housing tower in the distance (beyond the Princess Park to the south).

Figure 200: A series of architectural vignettes of the design scheme showing the quality of space and indicative building fabric.

I modelled the greater urban context as part of the inquiry by taking 2D information collected from the cadastral map, and BIM (building information modelling) style CAD layering (CAD drawing produced by Jocelyn Chiew of MGS). Building types and height information was captured in the CAD layers, which were quickly and easily converted to 3D using the various scripted form simulation techniques discussed in the previous chapter (such as the quick-house). This allowed the design of a small group of buildings to be considered in a far wider urban...
context, seeing them as elements contributing to the fabric of an entire suburb (see Figure 201 and Figure 202).

Figure 201: Aerial view of proposal for the OOH site (in red) in a greater urban context, showing the urban massing along the length of Chapel Street, the visual bulk of the Jam Factory (centre) and the large scale recent development of the Forest Hill precinct (right).

Figure 202: Aerial perspective of the OOH site showing the clear visual and pedestrian link through the site, linking the parks to the north and south of the site. This view also illustrates the contextually 'sensitive' building massing with respect to the existing 'Y' shaped towers.

**Daylight and Money:**

Along with the visual analysis of connectivity and composition, I analysed the massing model with respect to both daylight penetration and feasibility. The desire for access to daylight was not restricted to specific times or areas of the site so the *P-Radiance* technique was chosen over the *Subtracto-Sun* technique in this instance.

This technique was used to test many design iterations for solar access (Figure 203 to Figure 208 show 6 of the 18 daylight P-radiance tests that were conducted). These images show the
‘sculpting’ of the buildings, with particular care taken for the configuration of one higher ‘bolt-on’ tower element, testing its shape, height and location.

Figure 203: P-Radiance analysis for OOH existing conditions.

Figure 204: P-Radiance analysis for OOH proposal with generally 5 levels.

Figure 205: P-Radiance analysis for OOH proposal with generally 5 levels and ‘bolt on’ tower facing Commercial road.

Figure 206: P-Radiance analysis for OOH proposal with generally 5 levels and ‘bolt on’ tower facing Commercial Road with revised shape for better daylight penetration.

Figure 207: P-Radiance analysis for OOH proposal with generally 5 levels and ‘bolt on’ tower facing Commercial Road with revised shape again for better daylight penetration.

Figure 208: P-Radiance analysis for OOH proposal with generally 5 levels and ‘bolt on’ tower moved to new location, resulting in good solar access whilst increasing site yield.
Whilst this solar amenity assessment was being conducted, I performed feasibility analysis concurrently, using building area information from the digital model linked to a simple Excel spreadsheet. The spreadsheet included linked data cells, which were used to apply mathematical functions in order to estimate the site yield. Areas were multiplied by ‘efficiency’ factors\(^1\) and then divided by areas and numbers of units depending on desired unit size and distribution (Figure 209 and Figure 210). The final design included seven new buildings providing a total of 48196 m\(^2\) of new residential, up to 627 units.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure209.png}
\caption{Feasibility study for OOH proposal showing linked cells from digital spatial model with unit size, building size, and unit breakdown.}
\end{figure}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure210.png}
\caption{Feasibility study for OOH proposal showing design change increasing the number of floors for building type 02 resulting in improved unit yield: increasing the number of three bedroom units from 61 to 77, two bedroom units from 122 to 152 and one bedroom units from 216 to 270, increasing the total number of units by 99.}
\end{figure}

**Results:**

This project offered the opportunity to test more than one of the techniques concurrently showing some of the possible synergies created by adopting the rapid, defragmented approach.

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\(^1\) Building efficiency percentages can be used during feasibility analysis to estimate Net Lettable Areas (NLA) after the non-lettable areas, such as lift cores, corridors are subtracted from the Gross Floor Area.
for an urban scaled architectural project. The proposed buildings have been considered in the context of the whole site as well as the entire surrounding urban area. By using the defragmented techniques simultaneously the design could be ‘sculpted’ to meet financial objectives for desired unit numbers and building sizes, whilst meeting more subjective intentions for the design, such as composition and contextual sensitivity. Solar amenity was considered whilst proposing multi-storey tower buildings, pedestrian movement and passive surveillance were considered along with visual connectivity. This project was presented to members of Stonnington Council, Office of Housing and Vic Urban and is currently under consideration.

7.3 St Luke’s Church Development: Sydenham

Project Brief:
The St Luke’s Church Development case study was a project for the St Luke’s Anglican Parish of Sydenham for the development of a site of nearly 7000 square metres in close proximity to the Sydenham Watergardens Activity Centre and Transit City (Figure 211 & Figure 212). The project brief was for a new church for 300 people, a childcare facility for 120 children, a small office building and an element of medium density residential (Figure 213). The development also needed to meet council planning requirements for carparking numbers. In order to fund the construction of the new Church, the project brief required maximising site yield. The brief also required the creation of a Church building with a distinct urban presence.

This case study uses a variety of defragmented techniques illustrating the techniques flexibility for application on smaller scale projects, and in some cases, the techniques are used to solve different problems to those which they were originally intended.

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1 The St Luke’s Church Development project was produced within my own practice of Harrison and White. This case study is offered as further support of the rapid, defragmented approach when used in a small architecture practice in Melbourne.
Financial Analysis:

I began the project by setting up the briefed areas using a 2D parametric CAD model with area data linked to an Excel spread sheet (Figure 214 and Figure 215) using the same procedure outlined in Section 6.5.2 (p.191) of the previous chapter. A quantity surveyor (QS) was engaged (Newton Kerr Pty. Ltd.) to cost designs by taking the areas and apply square metre building cost rates. Different design options were put to the client group for discussion, and then the QS would give a construction estimate. The construction estimate was then plugged back into a...
feasibility spreadsheet that compared the estimate with existing Parish funding, and projected income from leasing the childcare building and selling the residential. With a several day turn around for costing feedback from the QS, I decided to take area cost rates from information already supplied by the QS and put that into a spreadsheet of our own, along with the areas linked from the CAD model (Figure 216). This meant that instantaneous cost feedback was available for over 30 different design iterations in the master plan stage.

Figure 214: CAD plan with building outlines linked to area labels and table.

Figure 215: Area schedule with areas linked to CAD file (shown in pink), with forecasted rental incomes and required carparking numbers.
Visual Connectivity:

The arrangement of buildings was also informed by the Parish client group’s desire for a visually ‘open’ building layout but with some sense of protection from the wind and noise from the west.\(^1\)

I used \textit{VGA} analysis technique (discussed in Section 6.4.4 p.174) on the many different building layouts to gauge visual connectivity and level of passive surveillance, whilst retaining a feeling of enclosure eg. Figure 217 and Figure 218 (see detail Figure 219).\(^2\) The process allowed quick testing of different options for visual connectivity and the benefits or problems of each design option in a visual way.

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\(^1\) The layout of the final design made reference to Gothic period cloisters and to Walter Burley Griffin’s Newman College at Melbourne University.

\(^2\) It should be noted that the site to the South is designated for major development which is why a high fence to the boundary hinders potential visual connection to Watergardens.
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Figure 217: Visual Graph Analysis (VGA) for ‘internal court yard’ scheme.

Figure 218: Visual Graph Analysis (VGA) for ‘open cloister’ scheme.

Figure 219: Zoomed in Church site plan showing a reasonably good VGA rating whilst maintaining a feeling of enclosure.

Carparking:

The master-plan required an assessment of carparking capacity of the site with respect to the Activity Centre Guidelines document (DSE 2005) and the Brimbank Council’s planning scheme requirements. In the section titled ‘Element 8 – Car Parking’, the Activity Centre Guidelines encourages ‘shared parking’ (DSE 2005 p.44), particularly in mixed use designs. Shared parking was one of the key ideas put forward in the design to maximise the potential site use, taking advantage of the different programs proposed; the Church having its peak use on Sunday mornings, child care having its peak carpark needs in mornings on weekdays, and the community support centre (office) having its peak at normal week days. Despite the supportive rhetoric of Melbourne 2030, the Transit City / Brimbank Framework documents, this proposal was met with resistance from the Brimbank Council, who were concerned that nearby residents would complain if carparking ever ‘spilled out’ onto the street in front of their houses. At the insistence
of the Council, a traffic engineering consultant was engaged (Grogan Richards) who were used to argue that carparks could be shared allowing a reduced number of carparks from that listed in the planning scheme.

As discussed in 6.5.2 I created flexible car ‘blocks’ within AutoCAD™ which allowed the rapid testing of various carpark layouts, with different Australian Standard carparking dimensions. The number of carparks was linked to Excel spreadsheets where comparisons could be made of what was ‘needed’ against what could be provided. An initial carpark layout was produced that was issued to the traffic engineers. A week later hand sketches (scanned) were emailed back with suggestions of alternate layouts. The production of the layouts not only took too long to be useful, the layouts needed to be redrawn in CAD, and had not been co-ordinated with the landscape architect’s environmentally responsive drainage strategy (the traffic engineers preferred to use maximum sized carparks than include landscaped strips and trees). To expedite the carpark design iteration process and to ensure the inclusion of the bio-retention swale drainage strategy, the carpark layout was developed ‘in-house’, with the traffic engineer’s role relegated to ‘signing off’ on the final carpark design.

Site Works:
Using the carpark landscape for water cleansing and detention required some preliminary gradient analysis to ensure that the proposed building levels worked with the carpark and the drainage. There was also a requirement for wheelchair accessibility for the site, and a special building overlay (SBO) that required buildings to the north-east half of the site to sit 300mm above natural ground level (due to concerns for flooding). I used a ‘fine-grain’ application of the Gradiator technique to test various proposed site level arrangements. Firstly I created a 3D model of the site using surveyed levels, building footprint shapes and drainage points (including the

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1 Variations on the Planning Scheme carparking numbers are allowed at the discretion of the local council according to Clause 52.06-5 of the Brimbank Planning Scheme, www.dse.vic.gov.au/planningschemes/aavpp/52_06.pdf
2 A theoretical test of the amount of carparking was drawn using the council’s planning scheme carpark numbers for the briefed areas without shared parking, which when layed out, completely covered the whole site, leaving no room for buildings.
3 A ‘bio-retention swale’ involves the carpark water grading towards a central landscaped strip. The landscape strip consists of native grasses that tolerate high and low levels of water, and are used to clean the car park’s storm water run-off before it is drained into the sea, in a kind of natural water filtration system, that also detains water applying less strain on the suburb’s drainage infrastructure during storm events.
4 Water ‘detention’ differs from water ‘retention’ in that the water detention holds water for a short period of time to be filtered and partially discharged into the storm water system, as opposed to water retention which stores rain water for long term future use.
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design. I created a minimised surface using various meshing and surface relaxing commands in 3D Studio Max™. The building outlines and drain shapes were then moved up and down in the Z axis (Figure 220 & Figure 221), whilst applying the Gradiator to see the impact of different levels (Figure 222). This made it possible to ensure a minimum of 1 degree was maintained on the site for drainage, whilst maintaining wheelchair access to all buildings, and working with Australian Standard off-street parking guidelines.

Figure 220: LHS building and drain shapes, RHS topographic surface applied.

Figure 221: Relaxed surface manipulated to test different levels for buildings and drainage.

Figure 222: Gradiator technique applied to ensure minimum of 1 degree for drainage, whilst maintaining wheelchair access to buildings.

1 The minimised surface created by the ‘relax’ plug-in creates a surface similar to that of a piece of fabric stretched between wire shapes.
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Parametric-Picturesque Church Roof: Forty Days, Forty Nights and Forty Beams:

The Parametric-Picturesque technique discussed in Section 6.4.2 (p.166), was used in this project particularly on the Church roof. Taking the significant number of 40 (days of lent)\(^1\) and incorporated it into the roof design by taking a curved pleated roof element arrayed radially creating 40 surface ‘pleats’ supported by 40 steel beams (see Figure 224 & Figure 225). This large scale architectural gesture inspired by Oscar Niemeyer’s Cathedral of Brasilia, was then trimmed down to a suburban size using a parametric Boolean intersection collision model (Figure 226 & Figure 227). The centre point of the circular array was modelled to be flexible, able to be moved in X and Y directions, so that the geometry was suitable to use the Parametric-Picturesque technique.

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\(^1\) Biblical narratives are rich with references to the period of ‘forty days and forty nights’: the period of Noah’s flood; the period Jesus spent fasting in the wilderness; the period from Jesus’ resurrection until his ascension into heaven, and 40 days preceding Easter celebrated in the Anglican Church as the season of Lent.
Moving the centre point of the array dramatically changed the building form and congregation space with immediate visual feedback. Though the Parishioners had preconceived ideas about symmetry, they were presented with a number of design solutions (17 Apr 07), using key perspective viewpoints to assess the composition of the church in both an internal and external urban scaled context. The multiple options were rendered in order to make direct comparisons, which illustrated that, though my preferred scheme was not symmetrical, it gestured towards the south-west corner of the site, raising up to wards the higher density of the Watergardens activity centre (see Figure 228, Figure 229 & Figure 230). The parish were convinced that asymmetrical option was preferable, ‘signing off’ on the building massing (see Appendix 10.10 p.321). The massing model continued to be used in refining the design in more detail for the Town Planning drawing submission, as well as for testing colours, materials and opening shapes and sizes (Figure 231 & Figure 232).
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Figure 228: Parametric-Picturesque design technique used for the design of the Church roof. View from Kings Road (prominent viewing position). LHS centrally located 'crown' element, HRS asymmetrically located 'crown' element.

Figure 229: Parametric-Picturesque design technique used to test effects of design gestures internally on the Church ceiling. LHS centrally located 'crown' element, HRS asymmetrically located 'crown' element.

Figure 230: The other prominent external view of the Church from the corner of Bellbird Avenue and Kings Road. LHS centrally located 'crown' element, HRS asymmetrically located 'crown' element.
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Figure 231: Rendered view of Church building showing feature roof coloured purple to symbolise the season of Lent.

Figure 232: Aerial rendering of Church building showing feature roof pleats.

Water Shedding – Gradiator for Roof Angles:
The pleating of roof surfaces (Figure 232) presented challenges for water proofing, and the varying gradients of roof surface did not suggest a conventional roofing system, with typical materials (due to the changing gradients and three dimensionally warping planes). Different roof materials have different minimum pitches, so to test out potential roofing systems I used the Gradiator technique. Instead of using the Gradiator on topography to assess wheelchair access, the technique was applied on the 3D model of the Church roof to test the geometry for suitability of different proprietary roofing systems. The Gradiator settings were adjusted to suit the different kind of analysis by ‘tweaking’ the parameters of the ‘gradient curve’ (Figure 233) so that the colour change between different angles (blue and red) was more clear on the roof geometry, and could be set to change colour at the minimum pitches of the different materials.
Recycled plastic ‘slate’, ceramic roof tiles, zinc, shingles and a variety of metal roofs were all tested on the Church roof geometry (Figure 233 to Figure 236). A recycled aluminium roofing material was found that could go as low as 1 degree roof pitch and was not as expensive as zinc or copper, called Kalzip™. It was also found that the material could be supplied in the colour purple, the ecclesiastical colour for the Season of Lent. As this material was shown by the Gradiator test to be suitable for application to the pleated roof geometry and had the added appeal of the ecclesiastical colouring, Kalzip™ was specified for the roof. This analysis of the roof slope using the Gradiator demonstrated the flexibility of the technique, where the settings for measuring wheelchair accessibility were quickly changed to measure roof gradients.

Feedback:

The project was presented at a ‘community information session’ on 26th July 2007, attended by around 15 local residents who were not supportive of the project. The most prominent objection being against the medium density housing which they believed would result in a ‘decrease of their own property values’, and result in houses ‘occupied by renters and not home owners’ (see point 4.1 in Appendix 10.12 p.323). Though this response was disturbing, an even more disturbing response came from the local Save Our Suburbs representative who claimed to ‘speak for the suburb’ as she had been a vocal objector to the medium density housing on Wentworth drive.
(opposite the site), stating that she did not ‘trust’ the council to make the right decision in the best interest of the suburb (see Appendix 10.8 p.317). The individual from SOS objected to the colour of the roof as it was ‘foreign’ and not within the character of the street (see Appendix 10.8 p.317). As I discussed in Section 4.3.3 (p.79), this tactic of using ‘neighbourhood character’ is documented on the Residents Guide To Objecting section of the SOS website (SOS 2005). The SOS representative, familiar with the objection process, threatened to delay the project unless her demands were met for changing the roof colour to ‘sage’ ‘without the necessity to go down the “formal objection” path which is a costly and time consuming process’ (see Appendix 10.8 p.317). The colour was not changed, and she did lodge a formal objection, which did prolong the planning process, though fortunately the objection was dismissed (see Appendix 10.11 p.322).

Results:
This section has discussed a mixed use development which has utilised many of the defragmented design techniques. Though this project deals with the scale of individual buildings, it demonstrates the flexibility of the defragmented techniques, showing how they can be used on smaller scale investigations, or ‘tweaked’ to be used to solve quite different problems to what they were originally intended. Like the project in the previous section, the St Luke’s project demonstrates the synergistic possibilities when the realm of the architect/ urban designer is expanded, where they ‘take up the slack’ by supplementing much of what is done by other consultants with new digital techniques. For liability reasons, these consultants were still necessary to ‘sign off’ on the design suggesting a different relationship with consultants is needed for sustainable development.

This project was successful in acquiring a planning permit, with all four medium density units, and the purple roof. The project is now undergoing the next stage of Diocese review within the Anglican Church.

1 I pointed out to the SOS representative that on the same street, the bright yellow and red facia of the Shell Service Station and opposite side of the street the bright red KFC with proudly lit red bucket, and bright yellow and red Hungry Jacks (Burger King) building.
7.4 A Real Walking City

Project Brief:
The following is a theoretical re-examination of the Mega-Mile case study (discussed in Section 6.2.2 p.139). Like in the theoretical extension of the Subtracto-Sun technique in Section 6.3.3 where I tested the technique on a hypothetical brief for solar penetration for a large urban area. The purpose of this section is to examine the use of multiple techniques concurrently applied on a hypothetical brief to demonstrate theoretical possibilities of the rapid, defragmented approach. This project is the result of collaboration between myself and RMIT University architecture student Cameron White. We set out a theoretical brief which involved reinvestigating the urban design for the site used in the MGS case study (Section 6.2.2) testing the rapid, defragmented approach by simultaneously utilising:

- Gradiator
- Quick Medium Density
- Ped-Catch
- Linked Area Analysis
- Density Distribution Surface.

We then produced a design scheme which was entered in various architectural ‘ideas’ competitions. In The Real Walking City project, we set out partially to produce a critique of typical urban design proposals in Melbourne and partly to create an inversion of the ‘Walking City’ project by British architect Ron Herron1 (Cook 1964 pp.48, 49, 142).

The Site:
The location for this theoretical investigation is an area approximately twenty kilometres east of the Melbourne central business district. The site covers the area surrounding the Nunawading and Mitcham railway stations (see Figure 237). The area is the subject of a Structure Plan produced by MGS, who had been working on the design framework for the area since 2004, setting out areas for potential change (Figure 237) as well as building uses, height and setback requirements (Figure 238). The publicly available structure plan2 by MGS was used as a point of departure for this project.

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1 Herron’s project proposed enormous walking machine cities that were nomadic, consuming resources from an area and then moving on to consume the resources from another area. The project was published in the avant-garde architecture journal Archigram in 1964. Ironically, ‘The Real Walking City’ sets out to consume minimal resources and to ‘stay put’ in a sustainable manner.

2 The Mega-Mile Structure plan is available to download at the City of Whitehorse website: www.whitehorse.vic.gov.au.
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Figure 237: ‘Potential for Change’ Site plan produced by MGS for the city of Whitehorse 2005 (before my involvement with MGS).

Figure 238: 3D massing model of the Nunawading precinct produced by Ben Reynolds (then MGS staff member) for the city of Whitehorse in 2006 (using some my modelling techniques).
Visual Connectivity:
The proposed pedestrian connection discussed in Section 6.2.2 was tested for potential improvement of visual connectivity by using *Visibility Graph Analysis (VGA)* comparing the existing conditions and proposed. This showed that if a reasonably wide (12m) pedestrian connection was introduced; it would improve the visible prominence of the Station and provide a walkway with good passive surveillance potential.

![Visibility Graph Analysis](image1)

**Figure 239: Visibility Graph Analysis for existing Mitcham and Nunawading area**

![Visibility Graph Analysis](image2)

**Figure 240: Visibility Graph Analysis for pedestrian link connection proposal.**

Topography:
To test the suitability of site development the suburb was modelled using 3D contour lines from the RMIT University MITS Maps (AutoCAD™ maps of Melbourne and surrounding suburbs).
This three dimensional terrain model (Figure 241) was then analysed using the *Gradiator* technique (Figure 242), with an overlay of the public transport routes for the area. This test showed that areas close to the main railway stations were predominantly less than 1:40 gradients which, according to Australian Standard 1428.1, is suitable for unassisted wheelchair access and is essentially considered flat. Some of the bus routes however are not in flat areas and it would be ill advised to locate elderly / social housing in these areas (see Figure 242).

![Figure 241: 3D topographical model of Mitcham and Nunawading area.](image1)

![Figure 242: Gradiator technique applied to 3D topographical model showing gradient of topography with public transport route overlay.](image2)
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Figure 243: Gradiator technique legend showing gradients for site.

The *Gradiator* surface was then used in conjunction with *Ped-Catch* to affect the speed of pedestrians. To do this the *Gradiator* surface was rendered as a black and white image (black being steep, white being flat) (see Figure 244) and using Naismith’s Rule\(^1\) (Fritz and Carver 1998) the speed of the pedestrian agent was adjusted. This adjustment was made according to the black and white gradient map (see Figure 244) using the *Pflow-Speed By Surface* (where the surface map is used to slow the agent depending on how steep the topography). Though an interesting exercise, due to the relative flatness of the site, this had very little effect on the pedestrian catchment, giving results that were very similar to that described in Section 6.2.2.

![Figure 244: Black and white version of the Gradiator surface used with ‘Naismith’s rule’ and ‘speed by surface’ to slow pedestrian agents according to terrain.](image)

\(^1\) Naismith was a Scottish mountaineer in the late 1800’s who worked out a system for making time allowances for ‘height gains’ on walks. Naismith’s Rule: Allow 1 hour for every 5 km forward, plus \(\frac{1}{2}\) hour for every 300 metres of ascent.
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Figure 245: Ped-Catch technique applied to the Nunawading Railway station with ‘Speed By Surface’ used with black and white Gradiator map to slow pedestrian movements down according to Naismith’s rule.

Pedestrian Catchments and Density Distribution Surfaces:

The potential of making a more direct relationship between pedestrian connectivity, public transport and density distribution as suggested in Section 6.2.2, was also investigated in this project. By linking catchment data created by Ped-Catch with the Gradiator technique, with the ‘traditional walkable city’ density curve based on non fossil fuel based transport (discussed in Section 6.5.1), a Density Distribution Surface (DDS) was created for the different catchment areas. A DDS created for the Nunawading Railway station for both options allowing a comparison of potential volumetric site yield (see Figure 247 & Figure 248; Figure 251 & Figure 252) resulting in approximately 20% increase. The DDS for the Nunawading Railway station was then added to the DDS of the Park areas, and the DDS of the Mitcham railway station catchment area, to create an overall DDS for the suburbs of the ‘Mega-Mile’ (Figure 249 and Figure 253).

Figure 246: Pedestrian catchments for Mitcham Railway station (LHS) and for the Walker Park (RHS).
Figure 247: Pedestrian catchment areas for 5 and 10 minutes walk from Nunawading Railway station using Ped-Catch technique applied to the existing conditions.

Figure 248: Pedestrian catchment areas for 5 and 10 minutes walk from Nunawading Railway station using Ped-Catch technique applied with proposed pedestrian linkage.
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Figure 249: Pedestrian catchment areas for both railway stations and public open space.

Figure 250: Density Distribution Surface for the Park (LHS) and Mitcham Station (RHS) Catchment areas.

Figure 251: Density Distribution Surface for the Nunawading Station Catchment area, existing.
Project Packaging.

The DDS was then used on the simulated urban form, Conforming the urbanism to the DDS in the manner described in Section 6.5.1. Perspectival composition was also checked with various ‘first person shooter’ views, as well as aerial perspective views. The resulting urbanism was rendered with a randomly tiling blue pattern to enhance the depth of the images. The project was ‘packaged’ as four A3 posters (Figure 254 to Figure 257), with perspective images; supporting data and simulations; a photo of a simulated physical model; as well as various propagandas dot points and title. The project was then submitted to numerous ‘ideas competitions’ gauging the validity of the proposal.
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Figure 254: Poster panel 01.

Figure 255: Poster panel 02.
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Figure 256: Poster panel 03.

Cycling & walking takes priority over the car

‘...people living in sprawling places were likely to weigh more, walk less, and have a greater prevalence of hypertension than people living in counties with more compact development patterns’
Barbara A. McCann Reid loving. Measuring the Health Effects of SPRAWL. A National Analysis of Physical Activity, Obesity and Chronic Disease

Figure 257: Poster panel 04.
Results:
This theoretical project demonstrates the great potential of making the relationship between walkability and density more explicit and giving form to this idea. The perspective views of the project show that the idea can also be implicit in the experience of the suburb, with a clearly undulating skyline embodying the idea of sustainable pedestrian and transit oriented development (POD and TOD). The resulting urban form appears somewhat similar to the very recent work of Zaha Hadid (Figure 258) though less formally expressive and informed by very different ideas, perhaps having more in common with the work done for the *Co-Evolution Danish/Chinese Collaboration on Sustainable Urban Development* (DAC 2006 pp.82, 112) which has a stronger relationship with pedestrians (Figure 259).

If this project was to undergo further examination, I suggest that the higher densities adjacent to the public open spaces could be tested for daylight access. These areas may be prime candidates for the *Subtracto-Sun* technique.

The success of this project could be gauged by the responses it has had in national design competitions. It has been recognised and published in more than one architectural journal and with very positive responses from the competition juries. The project won a Commendation for the AA Unbuilt competition run by *Architecture Australia*, competing against projects by many prominent design firms such as Bates Smart; LAB Architecture Studio; Edmond & Corrigan; Minifie Nixon Architects; S. Staughton; Woods Bagot; DesignInc Melbourne; Donovan Hill; Simon Anderson and Woodhead.
Urban planning strategies to encourage increased residential density around transport nodes or open spaces often use simplistic 400-metre and 800-metre-radius circles to encourage more intense development within five- and ten-minute walking distances. Resulting density models take the form of tiered wedding cakes. Like our tiered taxation system, the mathematics is simple but overall fairness is questionable. Tiered models correlate crudely to smoothly graduated phenomena and inevitably produce distortion, inequity and disputation at the thresholds. The project proposes densities (and hence heights) based on more sophisticated modelling that simulates real walking times, allowing for street layouts, thoroughfares, intersections and topography. The demonstration project, centred on the precincts around Mitcham and Nunawading stations in Melbourne, results in a persuasively responsive urban massing model. The process rewards routes and arcades leading towards the nodes, generating a texture of narrow directional block forms close to the activity centres while allowing lower, deeper block formations in the diagonal (NW, NE, SE, SW) sectors. Most intriguingly, the articulated form-model generates a public space texture reminiscent of those old-world cities evolved from centuries of pedestrian movement. The richness of form derived from one simple correlation of accessibility and building density is persuasive and suggestive of further application. This truly computer-aided design technique is commended to all with a commitment to planning, rather than simply legislating, our cities.

2007 AA Prize for Unbuilt Work Jury: Shelley Penn¹, Peter Skinner², Anthony Burke³, Justine Clark⁴. See Appendix 10.15.1 p.337 for more information.

The proposal also won the Canberra Biennial national design competition, with the following citation:

The scheme proposes a direct link between walkability, urban form and population density using ‘ped sheds’ or ‘walk-ability catchment areas’ to inform where increased density should occur, in an attempt to achieve more healthy cities. This project proposes techniques for analysing connectivity and is applied to a growing ‘virtual’ Melbourne (but equally applicable throughout Australia). White used relatively cheap 3D animation software for crowd simulation, similar to technology used in Peter Jackson’s film of Tolkien’s Lord of the Rings. The technique enables designers to send out an ‘agent crowd’ walking from a central node (eg. railway station) interacting with street layouts, intersections and topography to attain a more accurate shape for the walkable catchment area — how far people can actually walk in five and 10 minutes. The technique can be used for assessing existing walkability and to design decision support whilst testing proposed urban designs. Almost real-time comparative studies can be undertaken: such as, does street layout option ‘A’ have a larger pedestrian catchment area than option ‘B’? The technique can also inform decisions on where increases in residential density should occur. In a world where the most unhealthy people live in car dependent cities, this urban design scheme

¹ Shelley Penn is the associate Victorian Government Architect for the Office of the Victorian Government.
² Peter Skinner is an associate professor at the University Of Queensland.
³ Anthony Burke is a senior lecturer and director of Masters of Digital Architecture at the University of Technology, Sydney.
⁴ Justine Clark is the editor of Architecture Australia, Architectural Journal.
suggests that if the issue of public health and obesity is to be addressed we must reduce the priority for cars in our cities, and increase the priority of the pedestrians. Walking cities are healthy cities.¹

See Appendix 10.15.2 p.339 for more information.

7.5 Summary

In this chapter I have described three distinctly different design projects. Each has been shown to demonstrate different synergies possible by using the rapid, defragmented analysis and design approach.

In the first case study I demonstrated the synergies that can occur when automated area measurement; pedestrian connectivity; daylight penetration; visual connectivity and visual composition of urban fabric; are all considered concurrently.

In the second case study I demonstrated the coherency possible in early stages of design between financial feasibility; civil drainage and storm water treatment; water shedding and collection; carparking and landscape; and urban scaled formal composition. I discussed some of the opposition to a sustainability driven project, but also the success in gaining planning approval in a conservative suburban council.

In the third case study I demonstrated that the design approach with a variety of techniques can be applied to produce award winning urban designs. The project proved to be a provocative illustration of the new design approach, generating a great deal of interest within the Australian architectural community.

The three case studies have shown that a rapid, defragmented approach can inform the design process, offering greater insight into specific aspects of urbanism, whilst maintaining a holistic integration of analysis and design.

¹ It should be noted that where published, in some cases the project has been incorrectly attributed, and should be attributed to Cameron White with Marcus White (embedded PhD researcher). This error has been corrected for all future publication of the work.
Informing an Integrated and Sustainable Urbanism through Rapid, Defragmented Analysis and Design.

Volume 2
Chapter 6 – Chapter 8

A thesis submitted in fulfilment of RMIT University requirements for the degree of Doctor of Philosophy

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For a full interactive version of this thesis with additional animations, see:


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Chapter 8. Discussion and Conclusions

8.1 Introduction

In the previous chapter, the results of three urban design case studies were tabled which illustrated the rapid, defragmented analysis and design approach.

The aim of this chapter is to summarise key findings of the whole thesis; discuss how the research has formed a contribution to the knowledge in the sustainable development research field; and draw conclusions with respect to the thesis aim and hypothesis. As stated in Section 1.2 (p.2), the aim of my thesis is:

…to identify and address disparities between current urban design practice and contemporary society’s prevailing urban agenda for integrated and sustainable cities.

The hypothesis tested by my thesis, as stated in Section 2.2 (p.17), is:

… that a gulf between contemporary society’s prominent urban agendas and urban design can be minimised by developing a ‘defragmented’ design approach that uses rapid, parametric, four-dimensional, digital analysis and design techniques, utilising customised industry software – A rapid, defragmented analysis and design approach can be used to inform an integrated and sustainable urbanism.

This chapter is be made up of five sections. Firstly I summarise the thesis findings, and then discuss the level of success of the proposed design techniques. I then go on to discuss the application of the techniques on the numerous case studies, and evaluate the level to which these case studies suggest applicability on different sites and different design scenarios. Thirdly I discuss the implications of the research findings on contemporary urban design practice and a broader theoretical context. I identify then the limitations of the research and make suggestions where I believe further research should be conducted. Finally I draw my conclusions in response to my thesis aim and hypothesis as restated above.

8.2 Findings and Discussion

Historical Context – Three Facets of Urbanism

In Section 3.2 The Ordered-Network City: Pack Donkey versus the 2D Grid (pp.31-33), I discussed early street networks of both planned gridded cities and unplanned organic street networks of what Le Corbusier called the ‘pack donkey’s way’. The application of the grid, sometimes completely oblivious to terrain, climate and orientation would eventually mutate with a mix of ideas of the gridded street hierarchy of the Modernists and the labyrinth of the medieval, in cul-de-sac
enclaves within super blocks, the model adopted for most post WWII suburbs in Australia and North America. This system of street hierarchy of networks has since been questioned, particularly by the New Urbanists who favour a finer grained rectilinear grid with Baroque style terminating vistas. Though the grid does provide clear advantages for pedestrians over the hierarchical cul-de-sac model, other networks are shown to be even better as far as pedestrian connectivity to key infrastructure nodes, as was illustrated in the investigation using Ped-Catch in Section 6.2.2 (pp.133) where the radial grid was shown to have a greater pedestrian catchment area, an thus a greater potential site yield for walkable developments. This suggests that further investigation into other kinds of street networks could be conducted using Ped-Catch such as hexagonal grids, Voronoi or triangular tessellating street networks, as I will discuss later. As I discussed in Section 7.4 (p.228) the potential effects of synergistic design of street layouts with gradient analysis using Gradiator, and solar access could lead to something closer to that of the ‘pack donkey’ who ‘...zigzags in order to avoid larger stones, or ease the climb, or gain a little shade; ...the line of least resistance’. It would seem that the pack donkey is more attuned to the requirements of contemporary society and Melbourne 2030 than the many contemporary urban designers.

The composition of cities is discussed in Section 3.3 The Composed City: A New Perspective on the City (pp.33-40) which recognized the close relationship the designs had with the available technology and design techniques of that time. This was epitomised with the use of perspective in large scale compositions, in particular the Campidoglio by Michelangelo (1546), where synergies of visual composition, civic and political aspirations, and new possibilities with drawing technology were found. Though I suggest that it is not overtly apparent in contemporary urban agendas, the concept of sustainable development implies longevity, which requires cultural sustainability. Therefore artful composition of cities is important. In Section 6.4.2 (p.166), I elaborate on the possibilities of parametric urban modelling with the Parametric Picturesque, a technique that allows real-time re-examination of perspectival composition of urban form, a technique that makes it possible to investigate contemporary interpretations of Sitte’s ‘artful’ cities, going beyond simplistic New Urbanist terminating vistas. New ideas, ‘Embracing chaos’, reflecting the unpredictable contemporary society such of those of Koolhaas, can sit alongside ideas of civic beauty.

In Section 3.4 The Healthy City: Urban Amenity (pp.40-47), I discussed the strong historical relationship between health and urban design approaches in a historical context. I cited examples of urban interventions where two dimensionally planned boulevards were cut through medieval
cities in an attempt to obtain clean air. I discussed new urban design approaches to sewerage and water separation with reference to Haussmann and Cerdà, where urban form and composition were intrinsically linked to what we refer to as civil engineering. The contemporary concerns for public health and the relationship with urbanism was also discussed in Section 4.2.5 with reference to the obesity epidemic particularly in Australia and America. The links between urban street networks was discussed with attempts to improve walkability demonstrated in contemporary urban design discussion in New Urbanism, Smart Growth, and Melbourne 2030 where street connectivity features heavily amongst their key objectives. I went on to discuss how, though the intention of these objectives were sound, these design movements do not currently possess the techniques to implement the objective other than intuitive two dimensional planning methods that have been used since the 1940s. This finding directed a significant section of the research where in Section 6.2 Pedestrian Networks: Connectivity, Walkability and Accessibility, more effective techniques were explored and developed, with the resulting techniques Gradiator and Ped-Catch. These techniques proved not only to be effective on simple case studies, but also effective when used in unison with each other as well as several other techniques as demonstrated in Section 7.2 Prahran South Yarra- Horace Petty Housing Estate and Section 7.4 A Real Walking City.

In Section 3.5 (pp.47-55), I explained how early concerns about suburban sprawl and the perceived wastefulness of ever expanding low density cities were confirmed after the world oil scare of 1973. I then described some urban responses that attempted to reduce oil dependence particularly in Copenhagen, Denmark and Portland Oregon in the United States, cities where growth management strategies of targeted intensified densities were implemented. Resistance factors to density were discussed particularly with the ‘fall of Modernism’ and the stigma and prejudice that has become attached to much high density living.

These factors of resistance to urban consolidation were explained as being counter to the overarching contemporary urban agendas in society identified in Section 4.2: fear for peak oil – loss of cheap fuel; climate change – loss of environmental stability; long commutes – loss of time; Social segregation – loss of diversity; the obesity epidemic – loss of health; and a fear of amenity loss.

**Contemporary Context – Three Facets of Urbanism**

Section 4.2.7 *The Over Arching Social Aim: Sustainability* (pp.68-69), conveyed how the overwhelming majority of the academic literature in response to these fears support urban
consolidation and development aimed at long term sustainability. This literature condemned uncoordinated growth (sprawl) and planning that encourages car dependency. I discussed the complexity of sustainable development with the multiple ‘pillars’ of social, environmental, economic and cultural sustainability, and the need for a holistic balanced urban design approach.

Five contemporary urban design positions were discussed using the analogy of Kübler-Ross’s five stages of grief. This device proved to be effective as a narrative device setting out a framework for the discussion, facilitating comparisons between the numerous paradigms as well as the investigation of design techniques. The analogy also assisted in comparing global paradigms to the approach taken in local context of Melbourne.

The first two urban paradigms, ‘denial’ and ‘anger’, dealt with a dark side of human responses to fear of loss. Though clouded in what might be considered greed and intolerance, some valid questions were raised; particularly preservation of daylight amenity and density distribution. These two urban responses also exposed the difficulty in implementing sustainable urban strategies where strong political lobby group forces conflict with the perceived greater good.

I then discuss the third stage, ‘bargaining’ (New Urbanism), with its nostalgic take on urban design, attempts to turn back the clock with strict traditionalist aesthetic controls. I demonstrated that this approach is problematic for a number of reasons, not least of which is that it is a simplistic, superficial aesthetic reading of historic urban forms missing the opportunity for contemporary readings of the original design paradigms. We might learn from historic cities, but not necessarily try to repeat them. Examples of where historic ideas have been revisited in this thesis are historic density distribution (the distorted 3D Bell curve) in Section 6.5.1 (p.177), and St Luke’s project in Section 7.3 (p. 213), where I move beyond boulevards and terminating vistas, by exploring asymmetrical urban scaled composition with the Parametric Picturesque technique. I do, however, highlight some of the more positive aspects of New Urbanism such as pedestrian connectivity and emphasis on public transport to be very relevant to the sustainable urbanism discussion.

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1 ‘Careful you must be when sensing the future, Anakin. The fear of loss is a path to the dark side.’ Master Yoda to Anakin Skywalker in Star Wars Episode III: Revenge of the Sith (2005). The fear of loss is also discussed in today’s Gospel text from Matthew 10, ‘Do not be afraid of those who kill the body but cannot kill the soul.’
In Section 4.3.5 (pp.87-92), the forth stage, ‘depression’ position of Post Urban, ‘Starchitects’ and Avant-garde architects are partially dismissed for their lack of engagement with urbanism, but looked to for their clever uptake and development of design technologies in both the analysis and synthesis of designs. I draw on these developments greatly throughout the thesis, particularly the use of 3D and 4D parametric modelling and software customisation.

In Section 4.3.6 (pp.92-103), the category of ‘acceptance’ investigates forward looking work of Rem Koolhaas’ OMA, as well as the London based Space Syntax Group, and Smart Growth from different parts of the world. These design positions informed the direction of the investigation where a forced crossover of these three urban design paradigms was found. The development of the defragmented approach and the techniques built upon the scientific interrogation of the Space Syntax group, and embraced the unorthodox ‘ideas based design’ of OMA et al. whilst working within what is in essence a Smart Growth framework Melbourne 2030, focusing closely on transport oriented development.

In this chapter I also identified the lack of utilisation of available technology and design techniques in all but the Space Syntax group, the ‘Starchitects’ and the Post-Post Urbanists (optimistic Koolhaas). Of those three groups, the Space Syntax group restricts itself predominantly to 2D, whilst the ‘starchitects’ are object-oriented without a great deal of urban consideration and Post-Post Urbanists are ideas based without concern for the sustainability agenda. From this analysis I adopted a design research position that sat somewhere between Space Syntax, Post-Post Urban, and Smart Growth.

In the chapter (Chapter 4), I identified gaps in current practice with regard to urban design paradigms and the aspirations of the community and the government. This informed the direction of the hypothesis and design approach development.

In Section 1.6 Terminology, I gave definitions to terms particular to the thesis, key being the term ‘defragmented’ (p.13), which would form the basis for the hypothesis. The hypothesis was that a rapid, defragmented analysis and design approach can be used to inform an integrated and sustainable urbanism.

The proposed defragmented analysis and design approach using rapid, parametric, four dimensional, digital analysis and design techniques, using customised industry software was tested within an urban design practice in Melbourne. This placement was part of the Embedded Research
Program at SIAL RMIT (See Appendix 10.1 p.281) which involved testing the hypothesis predominantly within the confines of urban design practice. This research scenario helped to constrain the research method, suggesting a mixture of simplified experimental and applied research on practice case studies, predominantly using what was ‘to hand’ in terms of software and hardware, and possible research methods to conduct as an active participant in the urban design process.

In Section 2.5 (pp.22-28), I set out the research framework with a semi linear process. The realities of practice showed that, though this framework was useful as a guide, the steps did not always occur in that order, and were more fluid in the actual process. The method also proved to be fruitful in terms of balancing the weaknesses and strengths of simple variable modelling experiments supplemented with multiple case studies. The large range of projects that the design techniques could be tested on provided not only individual case studies, but multiple case studies allowing findings to be more conclusive and poignant. For example the Gradiator technique was used on more than one simple topographical analysis case study, but was also employed on a variety of other case studies where the technique’s ability to fulfil its original aim was demonstrated, as well as demonstrating the flexibility of the technique for a multitude of other unforseen uses. This demonstrates the success of this particular method, which I suggest, yields results that would not be nearly as applicable in practice had they been developed solely by software engineers or non practicing academics. The positive outcomes, particularly for the MGS practice would also suggest the practice based research method to be a very fruitful direction for all practices, though it should be reiterated that without the significant government subsidy through the ARC Linkage Grant, recent history in Melbourne shows any medium sized design practice would be very unlikely to sustain research of this kind.

The Design Approach and the Techniques

Chapter 6 covers the techniques that have been developed and evaluated to test the hypothesis. I discuss the identification of specific design issues, and explain the process of responding to these issues with the development of specific techniques. These techniques were grouped into four categories: pedestrian connectivity; solar amenity; visual impact; and feasibility modelling. I then discussed the application of the techniques on various case studies evaluating their degree of accuracy and usefulness in each instance. The implications of the findings are significant within practice, as well as the broader theoretical debate about urbanism.
Pedestrian Connectivity:

The *Gradiator* technique investigations have several implications. Firstly, the technique provides urban designers with a rapid and affordable method for large scale topographical assessment. This knowledge can be used to inform decisions such as transport infrastructure upgrade locations, locating social housing, respite / housing for the elderly, responding to social needs for equality and social sustainability. The technique also has potential implications in new subdivisions and housing affordability, where savings on cut and fill due to better informed building siting could benefit low income potential home owners, or at the very least, make building housing more profitable for developers, thus potentially increasing the supply of housing. This has implications in both economic and social sustainability. The fact that less earthworks are necessary most likely will have environmental implications, with less topsoil disturbed thus lessening impact through erosion.

The *Ped-Catch* technique also has implications for urban designers. The technique means that urban designers can be more informed about what areas are accessible to various activity nodes such as transport and public open spaces. The technique allows the designer to test different urban intervention propositions, not only through making comparisons of different design scenarios, but also through the ability to use the technique as an advocacy tool, to ‘sell’ the design to stakeholders and councils, as demonstrated in Section 6.2.2 with the Mega-Mile case study (p.139). The technique also suggested itself to being used in conjunction with other techniques such as the *Gradiator*, and the *Density Distribution Surface*, which were explored in Section 7.4 *A Real Walking City*. As discussed in Section 4.2 by increasing walkability in our urban layouts it is possible for this technique to increase the likelihood of people walking instead of driving, which can reduce carbon emissions, reduce obesity, increase public passive surveillance (eyes on the street) and decrease road congestion, assisting in developing a significantly improved urban environment.

Solar amenity assessment:

My various solar modelling design techniques have demonstrated the effectiveness of envelope based planning with respect to preserving solar amenity. Each of the techniques discussed in Section 6.3 *Daylight Amenity Assessment* (pp.145-159), were shown to have practical applications on specific case studies. I discussed an example of a local planning document (South Melbourne Central Urban Design Framework), where the listed written objective did not match the three dimensional planning envelopes, and showed what the envelopes would really need to be to meet...
the written objectives. The implications of the techniques extend to future use on other
comparative urban design scenarios, as well as finer grain architectural studies, when designing to
the current residential building regulations.¹

The techniques described in Chapter 6, have significant implications in the advocacy of higher
density in that they can alleviate key resident fears of a loss of solar amenity that are believed to
go hand in hand with increased density. The techniques also has implications on the design of
permissible building envelopes that, in turn, can have an effect on heating and lighting of either
future or existing buildings as was illustrated with the Chapel Street North case study (see Section
6.4.3 p.170 and Appendix 10.7 p.313), where natural lighting of the school library has been
preserved by utilising the Subtracto-Sun technique. This technique may find additional uses in the
future; if / when renewable energy alternatives become important such as solar power in the
form of localised solar panels. In the case of solar power panels, a direct measurable impact of
overshadowing from one building to another will be possible, and unless techniques like the
Subtracto-Sun are adopted, there may be reasonable claims for compensation by property
owners, which could become the subject of major legal battles between residents and councils.

Visual Impact - Urban form: Visualisation, Generation, Composition

In Section 6.4 (pp.159-176), I discussed the various rapid urban modelling techniques that I
developed utilising a range of technologies from special effects tools to simple user programming
in the form of scripting. I have shown that the techniques can be used to quickly describe large
scale urban scenarios of both existing and proposed urban grains. In my investigation of the
Parametric-Picturesque I explained how, by using real-time parametric features of animation
software with accurate simulated virtual cameras, a designer can ‘sculpt’ space with a level of
tactility and fluidity, which may well have excited Michelangelo. Though I would not suggest that
the design presented in this thesis is quite up to the standard of Michelangelo’s Campidoglio, the
research suggests that this level of enhanced composition is not outside of the realm of possibility
in today’s practice

¹ Building Regulations 2006 S.R. No. 68/2006 Section 418 Overshadowing of recreational private open space,
states: A building must not reduce the sunlight to a recreational private open space of an existing
dwelling on an adjoining allotment to the extent that less than the required minimum area of the
recreational private open space has less than 5 hours of sunlight between 9 a.m. and 3 p.m. on 22
September.
The *Solid Subtractive Silhouette* technique proved to be effective in approaching contentious historic vista and silhouette preservation. This technique was shown to be convincing enough to alter the planning scheme for the City of Stonington (see Appendix 10.7 p.313). The technique also suggests potential use in non historical urban gestures. For example, perhaps the vista and silhouette of Frank O Gehry’s Guggenheim in Bilbao, Spain from Calle de Iparraguirre is significant enough to warrant protection using the Solid Subtractive Silhouette.

The investigation of the *Visibility Graph Analysis* technique was, in some respects, unsuccessful in that it did not result in a new technique that was directly linked to other modelling information, it did however result in identifying and adapting a very clever piece of freeware which, though not directly linking to models, could generate the analysis through a straight file transfer process relatively quickly. The investigations also alluded to further possibilities with simulating wind and urban heat islands.

**Density Distribution and Feasibility Modelling**

In Section 6.5 (pp.176-190), I detailed the development of a series of feasibility focused techniques relating to key financial yield forces. Carparking, though not consistent with the urban agenda for environmental sustainability, is never the less a reality of urban design. This section showed that the impact of carparking on developments can at least be minimised by expanding the role of the architect with the use of advanced drawing methods. Once again the implications of this investigation relate to how legislation is communicated. If the carparking standards were communicated as ‘intelligent blocks’ in the various CAD formats, or at very least using a format that all drawing packages use such as DXF\(^1\), perhaps more synergistic designs could occur.

The area and volume feasibility modelling techniques discussed in Section 6.5.2 (pp.191-194), built upon new information linking capabilities of common industry software. These techniques, though perhaps not as visually seductive as some of the other techniques I have discussed, are extremely important in the implementation process for urban design. High levels of flexibility imply that many more design iterations are possible with immediate financial and aesthetic feedback so that more refined proposals that also meet the drivers for economic sustainability can be designed.

\(^1\) DXF, or direct exchange file can be imported into all known drawing or modeling software.
Density Distribution Surface – Density Distribution Modelling

In Section 6.5.1 (pp.177-190), I reviewed key population density distribution modelling theories in some detail. I then proposed a new hybrid technique which drew on combinations of models including historic walkable cities and the Alonso rent-theory 2D sections, mixed with a 3D deformation according to simulated Ped-Catch pedestrian catchments. This concept was shown to have less immediate implications within the specific urban design practice (MGS), but proved to have great theoretical implications demonstrated in the Real Walking City defragmented case study. The technique takes the concept of Transit Oriented Development (TOD) to a new level of refinement, which has been recognised in both academic and professional competitions and journals.

Defragmental Case Studies - Simultaneous Application of Techniques

In the three defragmented case studies in Chapter 7, I have shown a range of possibilities for the techniques when used simultaneously on projects demonstrating the design approach and testing my hypothesis that a rapid, defragmented analysis and design approach can be used to inform an integrated and sustainable urbanism. The three case studies were purposefully quite different from each other which demonstrated the flexibility of the approach. Some of the same techniques were used on entire suburbs in the Real Walking City project, down to the smaller scaled master plan of the St Luke’s Church Development.

In the first project Section 7.2 Prahran South Yarra- Horace Petty Housing Estate (pp.199-209), in the inter Eastern Melbourne suburb of Prahran I demonstrated how the rapid, defragmented analysis and design process was used to inform the master plan and feasibility study for proposed new social, affordable and private housing located with close proximity of public transport. The proposal was informed by using a variety of the techniques developed in Chapter 6 such as Ped-Catch; Gradiator; P-Radiance; Visibility Graph Analysis; Linked Area Analysis; Parametric-Picturesque; and urban form simulation techniques (Quick House, Quick Tower and Quick Medium Density). I showed how, by considering the urban area well beyond the confines of the site boundary, the design can be integrated into the suburb, actually contributing in a positive way to urban amenity through development. Not only does the scheme maintain daylight amenity for neighbouring properties, it increases neighbouring properties accessibility to public open space, as well as potentially increasing the safety and reducing crime by improving visibility. By modelling the surrounding area, the urban composition can be sensitive to the existing suburb by complementing the ‘urban grain’ of the suburb with the massing and surface treatment of the proposed buildings.
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The scheme therefore contributes to the suburb socially by way of providing additional affordable and social housing; economically by providing new private housing, as well as new feasibility tested construction; environmentally by way of increasing density within walking distance of public transport; and culturally by way of architecturally composed urban forms. The initial design of the development with these contributions was shown to be capable of being tested very quickly, without input from other specialist consultants.

The results of this case study suggest wider implications for the many other problematic social housing sites throughout Melbourne, and indeed in other cities throughout Australia and around the world, where modernist social housing has occurred and is in decay (Andersen 2003 p.70).

In the *St Luke's Church Development: Sydenham* project discussed in *Section 7.3* (pp.210-222), I demonstrated the *rapid, defragmented analysis and design* approach on a smaller, but more detailed scale. Once again, this case study utilised numerous techniques from Chapter 6. These techniques informed the design in a number of ways: the integration of 2D BIM area analysis linked to MS Excel™ financial modelling proved to be a fast and effective way to understand better the cause and effect of design manoeuvres on feasibility; the use of the *Gradiator* technique proved to be useful to inform location of building structural floor levels, as well as material finishes on a complex roof form; visual depth and passive observation were balanced with traditional cloister planning and notions of enclosure; council’s desires for carparking numbers and dimensions were balanced with environmental strategies for water detention and ecclesiastical meaning; external urban form composition and internal spatial composition were balanced using the *Parametric-Picturesque* design technique.

Once again, the St Luke’s Church Development project responds to social, economic, environmental and culturally sustainable objectives. In the case study, some specialist consultants were available in earlier stages of design, particularly a quantity surveyor and traffic engineer but, as was described in *Section 7.3* (p.214), the fragmented nature of this process and the slow and manual methods employed by these particular disciplines¹ meant that the rapid, defragmented techniques made up for a lack of useful input from these specialists.

¹ There are traffic engineers and quantity surveyors who use CAD, as was the case with the traffic engineers on this job, they refuse to draw using CAD unless they are paid extra fees to ‘CAD up the sketches’.
Though the master planning of an Anglican Church community hub is a very particular case study, and one that is not very common, if the project is considered as mixed use, the implications of this project in the broader context of urban design practice and theory are great. Almost all developments in and around activity centres are mixed use, and all need to balance needs or carparking, financial feasibility, with cultural, social and environmental objectives.

The final case study, *A Real Walking City* (Section 7.4 pp.223-222) demonstrated the significant theoretical possibilities of the rapid, defragmented analysis and design on a theoretical large scale urban design project in an academic context. The project described the potential for a direct link between pedestrian catchments, topography and urban morphology made possible because of the defragmented approach. This project goes beyond the Transit Oriented Development theory for density to be informed by transport locations and proximity, with the proposed density distribution being informed directly by integrating with the street network of the place. The proposal shows how the potential capacity for an area to sustainably house a growing population can be increased through strategically located and designed urban interventions. This project is not only relevant and potentially applicable in all well serviced transport nodes in Melbourne, but could be adopted anywhere in the world.

### 8.3 Contribution to Research Field

#### 8.3.1 Implications within Urban Design Practice in Melbourne

As I have discussed throughout the two previous chapters, a number of techniques developed for the rapid, defragmented approach have impacted on the much of the work produced by the urban design practice MGS, and have influenced legislative urban design frameworks in Melbourne. Volumetric planning envelopes developed for solar penetration have been adopted on a number of projects, as has the volumetric envelope developed for the historic silhouette of Melbourne High School, with the City of Stonington making the planning scheme with Amendment C58 for the area, and Schedule 8 To The Design And Development Overlay DDO8 Forrest Hill Precinct\(^1\). This has not only demonstrated the contribution to the practice, and to the planning regulations of the City of Stonington, but also the possibilities of three dimensional form based planning. The *Ped-Catch* technique has been successful in convincing City of

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\(^1\) These documents are available to the public for download at: www.stonnington.vic.gov.au/www/html/696-c55--c58---forrest-hill-planning-controls-.asp
Whitehorse to adopt new pedestrian link which would have been unlikely without the use of Ped-Catch. (McGauran 2008; see Appendix 10.13.2 p.325).

My research has changed the way MGS practices, with a large number of projects continuing to use the approach. According to director Rob McGauran, my research has initiated a new level of inquiry within the offices staff (see Appendix 10.13.2 p.325).

I think the competencies within the office in managing the software even, has dramatically improved… I think it is speed and quality of response, the [techniques] have brought into sharper focus the underlying principles of say of Melbourne 2030 about liveability and its impact on three dimensional decision making, so in itself it has brought about the better alignment between the way we think about places and the [design] response. The technical proficiency has been improved by using those [techniques] so the quality of the presentation has also improved, and they have broadened their other presentation techniques as a result of that additional skill. So, yes it has sped up design responses and yes it has improved the quality of responses (McGauran 2008, Appendix 10.13.2 p.325).

8.3.2 Sustainable Development Research:

Over the time in which my research has been conducted (March 2005 to September 2008), the research topic has continued to increase in relevance as awareness of sustainability grows within the broader population. The large political swing late in 2007 towards the Australian Labor Party (ABC News 2007) who campaigned with a strong stance on environmental issues in the recent Federal election, indicates the sentiment of the public at large, and suggests that research directed at urban sustainability, developing approaches and techniques to inform better the urban design process will only grow in relevance in the coming years.

As I pointed out in Section 1.4 of Chapter 1 (p.4), the field of research is necessarily broad, and suggests a holistic, transdisciplinary approach which has been reflected in this thesis. I have explained some of the factors in real practice that impede the ideal, but somewhat naïve scenario, where all consultants work together collaboratively from the beginning of all projects. The rapid, defragmented approach compensates for the lack of involvement of all specialist consultants from the outset by developing digital techniques that in some ways replicate the specialist’s input ‘in-house’. Though I have not set out to replace specialist consultants with software, the research findings do suggest that certain elements of some consultants work can be integrated more effectively if undertaken by architects and urban designers rather than by specialist consultants (as I suggest in Section 7.3 p.222). The research also suggests that other specialists, who are still relevant, could also benefit by adopting the rapid, defragmented approach. The flexibility of the approach would easily transfer across to other disciplines, for example landscape architects or
planners who may be using different base software such as GIS, but the approach of targeted research and user customisation of software could still apply. This is similar to how the different techniques could translate across different projects, and because of the flexibility of the techniques, could be reconfigured to perform completely different types of analysis.

Well I think what it is doing is, for a start, giving a visual expression to written objectives within the broader debate about the future of Melbourne as a city that align between the research and Melbourne 2030 commentary is a very important one to explore, as much as anything, to get a debate going about well, what is the importance of that particular objective in a physical sense or otherwise and in having physical responses are we hitting all the buttons that we need to, so I think has had not only a significant role for us [MGS] but I think potentially for that broader debate (McGauran 2008 Appendix 10.13.2 p.325).

8.4 Limitations of Study

In addition to the limitations and exclusions of the study outlined in Section: 1.4 (p.4), in the process of testing the hypothesis, further limitations on the study were identified. The following section will outline these limitations.

8.4.1 Compressed Research Time, Too Short To Judge Built Work Success

This research was conducted over a period of three and a half years. Although the research being conducted within an architectural practice provided real life case studies, the timeframe of these large scale urban projects is such that any conclusion based on built outcomes cannot be included. The research outcomes can, however, be gauged by the level of inclusion in the practice’s planning consultancy work, and the level of adoption of this consultancy work with councils and planning legislation (See Appendix 10.13.1 p.324).

8.4.2 Limited Number of Focus Groups/ Local Based Focus Groups

As I have discussed in the introductory chapter, it was not the intention of the research to focus on ‘democratisation of design’, with ‘community participatory design’ for the reasons stated earlier such as conflicts of interest and lack of a fair representation of participants (Community charettes rarely include representatives of those people not already in the community). The community should be informed of proposals in a manner in which they can understand. Since the new design techniques shown to council planners and developers were met with a clear understanding, it could be suggested that the techniques were effective at communicating and illustrating the reasoning behind the design decisions. Therefore one could further suggest that this clarity of communication would also be the case with the general public. Though the
outcome of the application of a number of the techniques was presented to local residents for the St Luke’s Church case study, this was not a purpose designed focus group, and the limited number of participants means that a great deal of further research would be required for the findings on this matter to be conclusive.

8.4.3 Local Case Studies, Are They Indicative of Generic International Condition?

As was discussed in Section 2.3 and Chapter 5, this research has been conducted in Melbourne, Australia, and has utilised a number of real projects for its case studies within Greater Melbourne, a city of four million. This geographical limitation cuts down the variables allowing more confident predictions of the effectiveness of the techniques on other projects in similar suburbs within Melbourne; however the effectiveness outside of Melbourne has not been tested. This is not to say that the problems are only found in Melbourne, as was made apparent by the great interest in the techniques at international conferences and forums. Many of the same specific urban agendas addressed by the Rapid Defragmented design techniques are prevalent throughout cities with increasing population – Sydney, Australia; many North American cities; many European cities; and in far more extreme cases, cities in Asian countries such as India and China. The suggested application of Subtracto-Sun on snow that came out of the ‘Forum on the application of sustainable theory to urban development practice’ – University of Cincinnati (OH) (see appendix 10.16.2 p.340) does suggest suitability with minor reconfiguration for localised needs in other countries.

8.4.4 Limited Verification of Ped-Catch

The Ped-Catch technique was tested in two main ways. The validation technique that was chosen as the most effective comparison was to compare to the manual Manhattan vector measurement method. The other technique which was dismissed was to compare the Ped-Catch results to movements of groups of subjects using printed maps and mobile phones to track their positions at different times. As was discussed in Section 6.2.2 (p.141), for this verification technique to be conclusive I believe it would have to involve far greater numbers of pedestrians and include a greater cross section of ages and fitness levels. This research program did not have funding for such large scale empirical analysis. One other method that may have been effective – the ‘stalking method’ used by Hillier, would be difficult with the Ethics Approval system at RMIT University

1 After presenting at the Texas A&M ‘Sustainable Urbanism’ conference in College Station Texas US, I was invited and funded to participate in the ‘Forum on the application of sustainable theory to urban development practice’ at the University of Cincinnati, OH (Appendix 10.16.2 p.340).
where I conducted this research. Other effective pedestrian tracking may be from fine grain, highly detailed census data (to individual residences), mobile phone GPS tracking or from military keyhole satellite video, all of which were unavailable to me.

Agent based pedestrian analysis has great potential to be further developed in detail and accuracy, it is limited predominantly by hardware (though this is continually becoming less of a problem) and by the time taken to enter the agent’s intelligence.

**8.5 Recommendations for Further Research**

My research findings suggest a number of avenues for potential further research. The challenges of sustainable development research will continue to grow, and new specific urban agendas will emerge to greater prominence. The rapid, defragmented approach allows for continuing evolution, adding new techniques as aims arise and as software, hardware and user customisation allows, or improving the techniques discussed in this thesis.

With some more time spent on developing scripting the **Gradiator** technique could be improved to give real-time feedback for gradients where landscapes are manipulated (instead of having to perform a render to see results). The feasibility techniques could be improved by adding various measurements and formulas to deal with the complexities of mixed use. Perhaps, a technique could be developed that takes 3D site yields and compares them with projected population growths for an area, to see if they can be made to match without sacrificing urban quality.

The **Ped-Catch** could be refined to measure speeds of various demographics (young and fit versus elderly or wheelchair bound). Perhaps the technique could be reconfigured to assess cycling catchments. The links between pedestrian catchments, street layouts and density could go further to assess the connectivity and potential 3D urban yield by experimenting with various non typical street layouts such as hexagonal grids, Voronoi or triangular tessellating street networks.

An issue that is seen to have less impact on sustainability, but is often thought to be equally important is urban noise. The particle systems investigated in this thesis could with some research be used to simulate the qualities of sound, where major sound sources, such as railway lines, emit sound particles that disperse and reflect through the digital model.
Further investigation could also be conducted into areas that were suggested in the development of the *Visibility Graph Analysis* technique, such as testing sky view factors and urban heat island effects.

As illustrated in the St Luke’s project, one of the major hindrances to sustainable development is local interest group opposition and the common process of community consultation, suggesting that more research into the effectiveness of various techniques in terms of advocacy power could be tested with large numbers of focus groups and targeted presentations. The presentation of the techniques could then be honed to maximise their persuasiveness.

### 8.6 Conclusions

Through a review of both broad urban design theory and more detailed, specific urban modelling theories, my thesis has identified a number of civic aims of contemporary society that relate directly to aspects of sustainable urbanism. The aims identified are not definitive, but do cover a good proportion of key urban issues. Through the analysis of current practice methods with respect to these key urban agendas I have identified areas where design and analysis techniques in practice are inadequate. I have reported on my steps to improve this current situation with a design approach which includes the development of new digital techniques, which I have proven go well beyond existing methods in addressing the urban agendas, improving the level of interrogation and synthesis of urban design solutions.

My thesis has demonstrated the effectiveness of balancing academic and applied case study research. I have shown how the method of targeting the very specific focus of local state planning legislation in the form of *Melbourne 2030 Planning for Sustainable Growth*, and predominantly using apparatus that was ‘to hand’, can have far reaching implications in the broader international sustainable urbanism discourse. The research acknowledges Rem Koolhaas’ discussion of the irrelevance of the study of urbanism – that ‘urbanism is dead’ (Koolhaas 1997) but proposes a tangible design approach and techniques to bring relevance back to the study of urban design. Koolhaas was wrong; to paraphrase Frank Zappa, Urbanism is not dead, it just smells funny.1

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1 Frank Zappa’s famous line in song Be - bop tango, (Track 8, 3:43) on the Yellow Shark album: ‘Jazz is not dead, it just smells funny’, (Zappa 1993), which was the last Zappa album to be released before his death.
The outcomes of this research demonstrate the *flexibility* of the design approach. The approach can be adopted successfully in urban design practice, or applied in academic investigations. The high level of both speed and flexibility of the techniques means that many more design iterations are possible with immediate environmental, financial as well as aesthetic quality feedback, which is not only useful to designers but, as I have shown, is highly persuasive for advocacy, selling the design outcomes to clients and stakeholders. The flexibility of the approach is more important than the individual techniques being developed into a set of definitive tools. I suggest that the flexibility is crucial for continuously increasing the repertoire of techniques to meet new design challenges as they occur, where as if they were finalised ‘tools’ with user friendly graphic interfaces, they would stagnate, losing their flexibility and adaptability. This flexibility has been demonstrated on the multitude of project case studies, which has allowed the findings to be more conclusive and incisive, suggesting that the approach is effective on the many different scenarios encountered in Melbourne urban design practice, but would be effective in other cities throughout the world, particularly areas of the world that are growing rapidly such as China and India.

In this thesis I have tested the hypothesis that a rapid, defragmented analysis and design approach can be used to inform an integrated and sustainable urbanism. From the results and discussion I can conclude that, yes, this approach can indeed inform integrated and sustainable urbanism; and I suggest that the approach is the direction urban designers and other disciplines ought to adopt in some form if the major challenges of the 21st Century such as climate change, peak oil, obesity, social segregation are to be met. Urban designers, architects and planners could reinvigorate the symbiotic relationship between the three facets of urbanism discussed in Chapter 3 and Chapter 4 – increasing the overlap between prevailing urban agendas of society, urban design paradigms and urban design techniques.

From my review of contemporary paradigms using five stages of grief as a metaphor, I conclude that urban designers should not continue in stages of ‘denial’ or ‘anger’, which hinder implementation of sustainable urban strategies and advocate territorial middle upper class agendas over the needs of the greater community, resulting in environmentally and socially unsustainable sprawl and car dependency. They ought not continue with the ‘depressed’ position of superficial surface or object oriented designs, without concern for broader urban agendas. They need not continue in the vain hope of returning to the past with the nostalgic, pseudo historicism of the New Urbanists. They ought to adopt a forward looking approach that ‘accepts’ the contemporary prevailing urban agendas of society and the realities of urbanism.
Conversely the new science (including Spatial Syntax) approaches ought to broaden to include subjective cultural aims; avant-garde urban designers ought to broaden their scope to include scientific inquiry and social responsibility; and Smart Growth ought to evolve to address finer grain issues of urban form. Urban designers ought to embrace the chaotic, reflecting the unpredictability of contemporary society whilst aiming for contemporary interpretations of ideas of civic beauty. The positions of Sitte and Koolhaas can coexist; urbanism can be composed artfully as well as be open to chaotic and loose definitions of mixed used development, not restricted to single use zoning and strict aesthetic regulations. New positions and methods need to be adopted to address imbalances of heritage preservation over social sustainability needs to address housing shortages.

The modernist masters were right to have considered the 4th dimension of movement; unfortunately they were wrong in their choice of mode of movement. (If only they had put rail, cycling and walking above the car in their hierarchy of streets…) If we look again Le Corbusier’s statement made in 1929 in the light of this thesis:

\[\text{The pack-donkey meanders along, mediates a little in his scatter-brained and distracted fashion, he zigzags in order to avoid larger stones, or ease the climb, or gain a little shade; he takes the line of least resistance (Le Corbusier 1929 p. 6).}\]

It seems to me that the pack donkey is far more in tune with contemporary urban agendas than many planners; the donkey is not thinking with a simplistic two dimensional grid, the donkey is thinking four dimensionally (White 2007b p.26). The donkey is thinking about solar penetration and the movement and position of the sun, gradient analysis in easing the climb and about way finding, visual connectivity as it navigates around larger stones and energy use as it takes the line of least resistance. We ought to now adopt a ‘4D digital pack-donkey’ design method.

Urban analysis and design ought to be adapted to be akin to the work of Ildefons Cerdà who understood the city holistically, with the three pillars of social, economic, and environmental sustainability represented in his extension ‘Eixample’ to Barcelona. Cerdà designed the streets, the rail networks, the pedestrian networks, the communications, the building envelopes, as well as the drainage and sewerage. This approach from over 100 years ago, now might be referred to as ‘transdisciplinary’, and as I have explained earlier, in order to achieve this holistic approach, urban designers ought to broaden their realm of understanding of areas that are currently considered.
‘someone else’s problem’ and once again become ‘expert generalists’ who can compensate for a lack of affordable input from fragmented and isolated specialist consultants, with clever use of technology and a rapid, defragmented analysis and design approach.

A human being should be able to change a diaper, plan an invasion, butcher a hog, conn a ship, design a building, write a sonnet, balance accounts, build a wall, set a bone, comfort the dying, take orders, give orders, cooperate, act alone, solve equations, analyse a new problem, pitch manure, program a computer, cook a tasty meal, fight efficiently, die gallantly. Specialization is for insects. (Heinlein, 1972)

1 At term used by Robert McGauran (director of MGS) in interview (see Appendix 10.13.2).
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Informing an Integrated and Sustainable Urbanism through Rapid, Defragmented Analysis and Design.

Volume 3
Bibliography – Appendixes

A thesis submitted in fulfilment of RMIT University requirements for the degree of Doctor of Philosophy

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Sep-2008
For a full interactive version of this thesis with additional animations, see:

Chapter 10. Appendixes

The images, tables and minutes in this chapter are also available in high resolution on the accompanying CD.

10.1 Embedded Research within Architectural Practice

Explanation (referred to on p. III, 17, 242)

The following information has been obtained from: www.sial.rmit.edu.au/Projects/

Embedded Research within Architectural Practice

SIAL has been awarded an ARC Linkage grant Technology Transfer through Embedded Research within Architectural Practice: the creation of an Australian practice-based architectural research and development network.

This research project is for a three year period commencing 1 March 2005.

Prof. Mark Burry is the Chief Investigator. Andrew Maher is the Research Associate.

Three Aims of the Research

» The first aim of this project is to investigate four different routes to design practice innovation in four different and unique practice contexts through project-based research.
» The second aim is to create a better understanding of the factors that lead to change and innovation in architectural design practice.
» The third aim is to initiate a forum composed of key members of each of the participating practices for dialogue leading to new areas of research and development that will help maintain the competitive position of Australian architectural design and its role in the construction industry in the world market.

Background

Architecture and structural design practices undertake research usually on a per project basis, but are unlikely to sustain dedicated research and development to capture what is known formally as ‘tacit’ or inexplicit disciplinary knowledge. International research has found that systems for knowledge capture from project to project have been generally nonexistent or where they did exist, were inadequate. The effect is that despite large amounts of new knowledge generated through collaborative project work, most is not retained within individual firms.
Practices contribute directly to schools of architecture through tutoring, and help mentor young architects but it is generally difficult for universities to reciprocate by contributing significantly to the research and development within practice except with regard to building science issues. Research in architecture is often seen as unrelated to the practice of architecture. While many practices welcome the opportunities for their staff to undertake concurrent postgraduate study, and assist wherever possible, this has to be undertaken in an ad hoc part-time manner, and almost certainly will not go beyond the level of Masters.

**Industry Partners**

The grant has four leading Australian architectural and engineering practices as industry partners. Together with SIAL, through the direct and continuous involvement of PhD scholars, these practices will explore how their processes can be mapped onto new digitally-supported and supportive ways of working.

The Industry Partners are: Arup Melbourne, Black Koslof Knott, McGauran Giannini Soon, and Terroir.

**PhD candidates**

The PhD candidates are:

Sarah Benton, Rory Hyde, Paul Nicholas and Marcus White.

The candidates are enrolled within the School of Architecture and Design which operates at the leading edge of design education nationally and internationally with over one hundred and fifty candidates enrolled in Master and PhD by research. The highlight of the research year are the Graduate Research Conferences held every May and October where postgraduate students present their work to a panel of invited national and international critics, and informally discuss aspects of their research with colleagues and visitors.

Chief Investigator Mark Burry is the candidate’s principal supervisor.

**Practice Research Topics Supported within SIAL**

SIAL staff and existing practice collaborators have internationally recognised research expertise in a range of areas, summarised, although not exhaustively, under the seven headings below. Each of these areas relates to creative applications for digital technologies covering the full range of practice activity.

For more information see [sitem.herts.ac.uk/artdes_research/papers/wpades/vol4/amafull.html](http://sitem.herts.ac.uk/artdes_research/papers/wpades/vol4/amafull.html)
### 10.2.1 Contemporary Architectural Software Analysis (Referred to on P.149) 

Table 7: Software review for use in urban design practice.

This table gives a simple review of software used in architectural and urban design practices. A series of features are looked at such as parametric capabilities, user customisation, fourth dimension etc. These are looked at against software cost. Though this study is subjective, it does confirm that the software used in the MGS office (Auto CAD and 3D Studio Max) are well suited to the defragmented approach, and are competitive on cost.

<table>
<thead>
<tr>
<th>Reference/Provider</th>
<th>Program</th>
<th>Vendor</th>
<th>Principles</th>
<th>Accessibility</th>
<th>Quality Assurance</th>
<th>User Customisation</th>
<th>Fourth Dimension</th>
<th>Parametric</th>
<th>3D model</th>
<th>Resource Management</th>
<th>Communications</th>
<th>RAM</th>
<th>System</th>
<th>Price (AU$)</th>
<th>Recommended?</th>
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<td>0</td>
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<td>0</td>
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<td>$495.00</td>
<td>Not recommended</td>
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<td>No</td>
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</tr>
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</table>

**Table Note:**
- **Table 7:** Software review for use in Architectural Planning/Urban Design (Sep 2007)
Table 8: Preliminary time program for St Luke’s project. This program (produced in MS Project) shows a reasonably typical time frame for a medium scaled project. Note the way in which specialist consultants are engaged predominantly after the feasibility / master planning stage and sketch design stage. This is contrary to the theoretical ideal (where all consultants are engaged form the outset). This structure is, in my opinion, likely to continue due to the large percentage of projects that never make it past the sketch design stage. It would be exposing a client to a great deal of unnecessary financial risk to advise them to pay for all consultants to be engaged from the start of a project, thus exposing the urban designer or architect to future liability claims.
10.2.3 Example of Current Fragmented Working Methods for Structure Planning (Referred To On P.122).

A variety of digital techniques and software are used, through there is a relatively ‘manual’ flavour of the usage. Note that information is embedded from one program to another, which means that information transfer is unidirectional.

When designs are developed or changed, due to the unidirectional and manual embedded manner of this system, a great deal of work must be re-done, work that is low grade, repetitive and time consuming. Note the transfer between programs coloured red, where one change to a design (eg. change the shape of a building plan), requires manual redrawing, or manual re-entry of data.

Figure 260: Planning / Design report (current practice). Analysis diagram of MGS ‘current practice’ (before being my involvement) for producing planning and design reports.

Figure 261: Planning / Design report (current practice for design revisions). Analysis diagram of MGS ‘current practice’ (before being my involvement) for revising planning and design reports.
10.2.4 Proposed ‘Hot Linked’ Defragmented Working Methods for Structure Planning

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Figure 262: Planning / Design report (proposed). Diagram showing the rapid, defragmented design structure, where the potential of automation and file linking is fulfilled. This diagram shows where information is ‘linked’ between programs in a similar way to how a website works (file names and locations are kept the same, and links direct the flow of information).

Figure 263: Planning / Design report (proposed for revisions). Diagram showing the massive advantage this system has over the manual embedded system, when designs are developed or revised. Note that because information is linked, changes to a design are automatically updated, or with very minimal ‘manual’ work required. (Simply saving over the top of linked pdf files).
As described in Section 2.5 the process involves roughly following a series of steps which involve identifying problems, reviewing current methods of analysis, developing and testing new tools in a variety of ways, and then testing on assorted case studies.
10.4 Transport Choice Table (referred to on p.184).

Table 9: (Schollberg et al 2006) School Trips: Effects of Urban From and Distance on Travel Mode retabulated (White) to show metres.
This table demonstrates the clear relationship between distance from the node (school in this case) and the mode of transport. Those who live closer are much more likely to use non fossil fuel based transport. See Section 6.5.1 for graph and Section 7.3 for a design application for this kind of data.

10.5 Modelling Experiments

10.5.1 Von Thünen Freeware Experiment Model (Referred to on p.179).

Table 10: Sequence of screen grabs of the application of the Von Thünen urban distribution model. Using Von Thünen / GIS 1.3 software from the ‘Open University’, applied to the Mega Mile project, urban density distribution is suggested. This technique is referred to in Section 6.5.1.
10.5.2 Prahran Princess Gardens Ped-Catch Analysis (Referred to on p.204).

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Figure 265: Ped-Catch analysis conducted on existing site conditions from the Princess Gardens.

Figure 266: Ped-Catch analysis conducted on proposed site conditions from the Princess Gardens, resulting 18% increase in pedestrian catchment area for the park.
10.5.3 Radial Grid – Ped-Catch Catchment Analysis (Referred to on p.188).

Figure 267: Ped-Catch applied from a central location on a radial grid. Note that pedestrian catchment is that of a circle of 800m radius (as one would expect).
10.5.4 Radial Grid – Density Distribution Surface (Referred to on p.188).

Figure 268: Distribution Density Surface applied to a simulated urban form, based on the results of the Ped-Catch analysis on the radial grid street configuration. This creates a volcano like hump, which is similar to a ‘bell curve’ in section. See section 6.5.1 for further discussion of this.
10.5.5 Rectilinear Grid – Ped-Catch Catchment Analysis (Referred to on p.189).
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Figure 269: Ped-Catch applied from a central location on a more typical rectilinear grid. Note that this does not produce a circular catchment, with only around 60% of the area that would be considered within 10 minutes walking distance (based on the circular catchment method), actually being within the Ped-Catch catchment.
10.5.6 Rectilinear Grid – Density Distribution Surface (Referred to on p.189).
Figure 270: Density Distribution Surface informed by Ped-Catch applied on rectilinear grid. The Bell Curve section is distorted due to the non circular pedestrian catchment area.
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10.5.7 3D Areas Measurement Technique Used On Simple Block Model
(Referred to on p.193).

Figure 271: Density Distribution Surface applied to a simulated urban form showing irregular urban skyline, informed by street layout and pedestrian walkability.

Figure 272: Volumetric measurement used to calculate building area in square metres.

Figure 273: Building shape changed with real-time area feedback.
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Figure 274: Building shape changed with real-time area feedback.

Figure 275: Building shape changed with real-time area feedback.

Figure 276: Building height changed with real-time area feedback.

Figure 277: Building shape and height changed with real-time area feedback.
10.6 Pedestrian Catchment Analysis – Verification

10.6.1 Pedestrian Catchment Analysis Using Students (Referred to on p.144).

Figure 278: Example of sheet given to test pedestrians. Pedestrians (university students) followed the red path, marking down time taken for each 200m section of the path, as well as answering other questions.
10.6.2 Pedestrian Catchment Analysis Examples Of Student Forms (Referred to on p.144).
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Figure 279: Over 30 possible paths were tested by students using the maps with mobile phones for timing. The maps were created using aerial photograph, with the ACAD manual Manhattan pedestrian catchment method.
Table 11: Results from the live testing of the PedCatch technique using RMIT University students. This table shows the results of the pedestrian verification experiment discussed in section 6.2.2. The 31 student’s movements were tracked for each 200m (Task 01) for the total of 800m of walking from the chosen start node. The average speeds were shown to be lower than the commonly used 1.3m/s (students averaged 1.2m/s) in part due to losing time at intersections waiting for traffic lights to change (task 02).
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Table 12: Results from the live testing of the Red-Catch technique using RMIT University students adjusted for time lost at traffic lights/intersections. This table shows the averages speeds of each student for each 200m section of travel (LHS), with the speed adjusted to time lost at intersections (RHS). The corrected average walking speed resulted in 1.31 m/s, which suggest that the students were in fact meeting the commonly used target average speed of 1.3m/s. This gives an idea of just how much speed and time is lost due to traffic lights and crossings of intersections, and suggests further research could be conducted into adjusting pedestrian catchment areas by simply speeding dramatically.

<table>
<thead>
<tr>
<th>Ped#</th>
<th>A-B</th>
<th>B-C</th>
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</tr>
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</table>

**AVERAGE** 150sec | 150sec | 150sec | 150sec | **AVERAGE** 1.35m/s | 1.15m/s | 1.21m/s | 1.35m/s | **AVERAGE** 1.44m/s | 1.20m/s | 1.24m/s | 1.39m/s
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Figure 280: Ped-Catch technique verified against observed pedestrian movements. LHS, Plan of manual Manhattan method of vector tracing adjusted for lengths using results from observed pedestrian movement in 10 minutes. RHS comparison plan showing student paths compared with Ped-Catch agent based simulation, compared with circular catchment method (800m radius circle). The observed student pedestrians and simulated pedestrians resulted in very similar catchment areas.
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Figure 281: Ped-Catch further verification study.
Catchment area of Nunawading station tested with Ped-Catch (LHS) overlayed with manual Manhattan method. The results show the Ped-Catch method to have far greater accuracy than the circular catchment method.
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Volume 3
Bibliography – Appendixes

A thesis submitted in fulfilment of RMIT University requirements for the degree of
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For a full interactive version of this thesis with additional animations, see:


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www.haw.com.au
10.7 Chapel Street North (Forest Hill) Planning Amendment (referred to on pp.159, 172, 244).

The following pages are extracted from the Chapel Street North Planning Amendment document produced by MGS. This document illustrates the modification to the Stonnington Planning Scheme after the defragmented analysis and design approach was used to inform maximum permissible building envelopes based on daylight penetration to the Melbourne High School Library, and to the Eastern footpath of Chapel Street, and for the protection of the historic silhouette of the High School. This process is discussed in Section 6.4.3 in greater detail.
Solar Access The provision of solar access and amenity is fundamental to the design of residential and commercial buildings, particularly in urban areas. Solar access and sunlight are essential factors in urban design and planning. The provision of solar access within new developments will have a significant impact on the overall sustainability of the project.

Development Objectives

To maintain and improve the solar access and amenity of Melbourne High School (MHS) and its surrounding buildings when viewed from key open spaces to the west.

To maintain and improve the solar access and amenity of Chapel St North and vehicular access and sunlight to the adjacent buildings.

To maintain and improve the solar access and amenity of the surroundings and adjacent properties.

To maintain and improve the solar access and amenity of the surrounds and adjacent properties.

Development Controls Methodology

3D modeling of the site and pedestrian routes was used to determine appropriate built form, landscaping, and development controls based on the development objectives stated.

The images and diagrams on this page are representative of the proposed development in the area and illustrate the concept of the project. They are not intended to represent the final design.

Chapel St North

This area is to be known as Chapel St North and is one of the proposed Character Areas in the proposed Planning and Development Strategy (2018).

DRAFT

Section 10.7
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

Section 10.7

Buildings & Works - Recommendations

Development Controls:

1. Preservation of Views to Melbourne High School (MHS)

- Enforce sight line controls that preserve views of the Melbourne High School from the gateway entry to Forest Hill
- Sighting entry to Forest Hill on Main Street and Alexandra Avenue

2. Preservation of Solar Access to MHS Library

- Reduction to Built Form Envelope to preserve solar access to main library of MHS during key daylight hours

3. Preservation of Solar Access to MHS Library

- Reduction to Built Form Envelope to preserve solar access to eastern footpath of Chapel Street

Materials:

- Mosaics

Use of materials:

- Architectural features such as tiles, mosaics and building envelopes may exceed the maximum building height by up to 4 metres providing they do not exceed 10% of the gross floor area of the top building level and do not noticeably protrude beyond streets.

- Mosaics and building envelopes such as architectural features, balustrades, mosaics and awnings may be constructed at a height greater than the height specified in the plan forming part of this Notice, where they do not obstruct key heritage views (refer to annexure control)

Setbacks:

- A permit may be granted for the setback to house below the boundary specified in the plan, where it can be demonstrated to the satisfaction of the responsible authority that the variation will not have an adverse effect on the essential spirit of the building or does not contribute to the overall design of the building and does not contribute to the overall bulk of the building

Overbalancing:

- All buildings and structures to be designed to:
  - Limit that their mass is not exceeding the mass in the same site with a height greater than the new building
  - Not noticeably overbalancing the Melbourne High School library main entrance

Vegetative Controls (Built form envelopes)

- If Knife-shaped leafs are incorrect and not substantial, then allowing the maximum allowable building height, should be with the builform envelopes illustrated in previous renders and drawings following in order for any development application to be considered.
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SECTION A-A
PROPOSED DEVELOPMENT CONTROLS

NOTES
1. No rise in this plan is to influence the consolidation of the heritage
2. Provision pursuant to clause 1 of the subdivision planning scheme.
3. The specified maximum limit will only be allowed where the proposed
development meets the design objectives and other provisions of this schedule.

CHAPEL ST NORTH

Figure 282: Pages from Chapel Street North Planning Amendment document produced by MGS
10.8 St Luke’s Church Site Plan (referred to on p.217).
Section 10.9

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10.9 St Luke’s Church Single Objection to Project (referred to on p.221).

Figure 283: Page one and two of email objection from SOS representative.

Re: St Luke’s Church.

Subject: Re: St Luke’s Church.

Dear Marcus,

Thankyou for forwarding the documents for examination.

I have just received them and shall have to read the documents. Following our discussion yesterday, I was convinced that the plans would meet with my approval.

But sadly, the images are quite alarming.

Are these the proposed colours? If so, they represent a stark contrast to the neighbourhood character, including the commercial buildings.

I also have some concerns regarding the site density, but I will await the provision of plans being issued by Council.

Marcus, at the public meeting that was held (for which I received no notification), were proposed plans displayed to residents in colour? Please advise.

Marcus, I will reserve further comment when I have viewed plans and reports in detail.

Regards,

Original Message ——
From: Harrison & White Pty Ltd
Sent: Tuesday, August 21, 2007 11:57 AM
Subject: St Luke’s Church.

Please click on the link to view the town planning report:

Please let me know if you have any problems.
Kind regards,
Marcus White

Harrison & White Pty Ltd
Sustainable Urban Design and Architecture
P.O. Box 5000, 1047
290 Albert Street
Brunswick, Victoria 3056

info@hew.com.au
www.hew.com.au

Original Message ——
From: Harrison & White Pty Ltd
Sent: Wednesday, August 22, 2007 2:51 PM
Subject: RE: St Luke’s Church.

Sorry to not to get back to you, I have been out of the office.

The colouring chosen in the perspective renders attempts to represent the design, though due to computer screens being calibrated differently, this may be deceptive, and appear brighter than what will actually be built.

The colour of the church roof is prepared to be a neutral white, which is the original colour for the Seasons of Light, chosen for religious reasons, but also to differentiate the church from the bright reds of the KFC and Hungry Jack, and the greens of Buntings.

We showed the design in full colour to the residents who came to the community meeting. Nobody raised any concerns about the colours.

Once again, I’m not sure how you missed your invitation for the meeting. Your property was certainly on the list for the letter drop... sorry about that. (The letter drop was done by volunteer parents.)

We would be happy to try to come and meet with us all our office in Brunswick and I can further explain the proposal if you like.

Kind regards,

Marcus White

Harrison & White Pty Ltd
Sustainable Urban Design and Architecture
P.O. Box 5000, 1047
290 Albert Street
Brunswick, Victoria 3056

info@hew.com.au
www.hew.com.au

P.221.)
3. The lodgement of more than five (5) objections would result in the matter being referred to the Brimbank Council for deliberation. It has been placed on the public record on many occasions, and I reiterate the fact again, that I hold no confidence in the Brimbank Councilors to make fair, impartial and informed decisions in the community's best interests.

Over the years, I have gained a high profile as a public critic of the Brimbank Councilors, justified by substantial evidence. I hold, given that this development directly negatively impacts on my own property (in addition to the wider community), I would render my effort to seek Councilor support to be wholly futile.

The remaining points I make in relation to the roof colour are –
- The Applicant has indicated that the church "should make a statement" and the vibrant colour is intended to achieve that. However, the roof design, alone, will achieve the aim without the necessity to introduce a colour which is foreign to the community. Colours within the range of black/grey, green, terracotta, brown, would be in keeping with roof colours selected in virtually 100 per cent of properties across Brimbank.
- The Applicant referred to the yellow roof section used on the adjoining site, Shell Garage. However, this is used on the facias (flat surface), and does not represent the bulk of roof span that is proposed in the current proposal. The Proposed roof has an undulating feature and progresses upward to the peak, thus exposing a greater surface to surrounding properties. As an example, a very significant section will be visible from the interior main living areas of my home situated at 2 Westworth Drive, Taylors Lakes, and diagonally opposite the subject site.
- The religious significance of the colour Purple, should not be the primary consideration.
- The primary consideration must always be the acceptance by the community (and particularly the immediate surrounding community).
- The fact that 12 attending residents in a public meeting failed to lodge objections does not assume their approval of the colour. By my extensive experience in dealing with residents in the past, particularly of ethnic backgrounds, they are reluctant to "create waves" or public dissent. They are quietly accepting (even if they are not happy). Mr. Jan Malanek who heads opposition to the Kambah Quarry, and of German background himself, has explained to me that this reluctance to oppose "authority" stems from these experiences in other countries, where such behaviours are instilled. Mr. Morais has been frustrated, as I continue to be, of the general resident passive attitudes that allow Authorities to (illegally) interpret "silence" as "acceptance".

The Brimbank Council Town Planning Department has a greater responsibility in this "affluent" and "working class" community, to resist taking "at face value" what the lack of objections may (secondarily) signify, and instead, anticipate how the residents on the whole would view this church proposal's purple roof.

Many residents will "trust" the Council to make the right decision for them. The decision by Brimbank Council to approve the 61-unit development in Westworth Drive, has been clouded in controversy by the payment of campaign donations by the Developers, to those Councillors who supported his development. I could argue a very good case, that "trust" in Brimbank Council decision making based on the community interest, has been misplaced in the past.

Mr. John Rush
Town Planning Department,
Brimbank City Council,
92 Calder Highway,
Kilmore, Vic. 3766

Dear Mr. Rush,

RE: FORMAL OBJECTION – 1-5 EAGLE TCE, TAYLORS LAKES

Thank you for the opportunity to discuss the above application for permit with yourself together with a representative of the Applicant and the Architect on 31/8/07. I believe the meeting was very worthwhile.

It was my expectation that a compromise may have been agreed to the roof colour proposed, Royal Purple, as it is this element of the proposal which I continue to strongly object to.

The Applicant agreed to discuss this matter with the broader church community to possibly seek agreement to an alternate colour. As this matter has not been resolved to this point, and with objection period closing in the near future, I hereby lodge a formal objection, a process which I hope will be necessary.

Contrary to earlier advice, I have made the decision against "dramatically" local residents to gauge their views on the roof colour proposal and create objections for three reasons: -

1. As a self-employed business person, I do not have the time resource to devote to this exercise in the short time that is available;
2. My involvement in the representation of community involving planning issues is extensive and I believe, should suffice in this instance.

Examples include:
- Committee Member for Save Our Suburbs
- Community representative to the Victorian wide Planning Backlash Coalition of groups convened by Mary Droit
- Representation of opposition to the Sydney Urban Transit City and Master Plans process (also the Sunshine Activity Centre Master Plan) including many issues associated with Melbourne 2339 Policy
- Kooyong Creek mobile village proposal
- Bannings Development, Taylors Lakes
- Westworth Drive 61-unit development, Taylors Lakes
- Kambah Quarry site – concrete batching plant permit

Other community representation has included landscaping (including with Vic Roads) along major roads, traffic speeds, and various issues associated with Brimbank City Council management. I was a candidate in the 2001 Council Election.
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Figure 284: Three page formal objection to St Luke's development, from SOS representative.

Brisbane Regional Council Town Planning must make a responsible judgement in this instance. Failure to do so will result in:

1. Further criticism of Council’s ability to make decisions based on the best interest of the community; and
2. St. Luke’s Church will also be subjected to unwanted criticism and controversy by a neighbouring community who, I am certain, it would prefer to have dealt and co-exist in peace and harmony.

Finally, I should make a point regarding the landscaping. I welcome the inclusion of the underground water tanks. This initiative should be encouraged in all future developments. St. Luke’s Church therefore had an opportunity to landscape using different varieties of plants such as cedars, palms, exotics, etc., that require some watering initially but are generally not demanding upon maturity. The use of these plants would have set the site apart from the remainder of landscape in the general commercial environment, and could have achieved a “unique feature” which I understand the Church is keen to achieve.

The decision to use drought tolerant native plants is therefore disappointing. I understand, however, that this is Brisbane Council’s Policy, and I do not hold the Applicant responsible for what I believe, is limited vision on the part of Brisbane Council. At the appropriate time, I will challenge the Policy with Brisbane Council.

In conclusion, I note that discussions regarding the current proposal have been occurring since mid-2006. As you have explained there exists no statutory requirement for residents to be included in that process. Residents are therefore limited to only a very brief, insufficient period, for perusal of plans, consolidation of objections, meetings with Council and Applicants, and submission of grounds for objection.

It is my belief, that had residents been privy to that early discussion, a more satisfactory outcome may have been achieved, particularly in regard to siting, landscaping and colour selection.

On a more general basis, early involvement of the community could eliminate wastage of the significant resource input into preparation of plans which can ultimately result in necessary alterations or outright rejection. It is my view that perhaps good grounds exist to have the statutory requirements altered.

Thank you for your consideration of this objection, and the points put forward. I look forward to learning of the outcome in due course.

Yours faithfully,

[Signature]

cc. Mr. Nick Fox, Chief Executive Officer-Brisbane Council
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Section 10.10
Paragraph Meeting Minutes (referred to on p.218).

10.10 Parish Meeting Minutes

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**Harrison & White Pty Ltd**
Architecture and Urban Design

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**Section 10.10**
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.
10.11 St Luke’s Church Planning Permit (referred to on p.222).

Figure 285: Front page of Brimbank Council’s ‘decision to grant permit’ for St Luke’s project.
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Section 10.12

St Luke’s Church Public Information Minutes

1. Welcome

About ten residents came along to the information session, primarily from Eagle Terrace, and a few from Bellbird Ave. Three members of the St Luke’s Parish and H&W (SH 6-9 M). Councillors and council planners were unable to attend.

2. Presentation by H&W

H&W gave a powerpoint presentation of the proposed development, explaining: Situs planning, the Church building with detached Chapel, the carpark design & numbers and the way in which these were calculated, the water detention and retention, landscaping, Community Service Centre (Parish Hall), Residential townhouses, and Childcare Centre.

3. Support

There was support for the development of the site, with clear support for the Church and Chapel, Childcare and Community Support Centre programs on the site.

4. Concerns raised

There were two major concerns raised: the residential component, and traffic congestion.

4.1. Residential

The main issue of concern for around five representatives was the inclusion of townhouses, for which people seemed to have predefined ideas. H&W showed an image of the proposed (revised) residential design.

The main argument put forward by residents was that it could not be guaranteed that the development would not result in a decrease of their own property values.

They felt this risk would be exacerbated if the houses were occupied by investors and not home owners. It was felt market-appraised properties ran the risk of property damage and poor street appearance, and the area was not occupied with rental properties, and was not the character of the street. H&W stated it could not be guaranteed that they would not become rental properties.

One representative suggested two special townhouses could be more welcomed. H&W stated that the proposed houses were semi-detached houses that engaged with the street frontages and provided another housing model in an area typified by a diverse mixture of housing, both stylistically and in terms of size.

4.2. Traffic

One of the residents raised concerns about the number of cars parked for the childcare, suggesting that 60 cars did not seem like enough for a 150 child centre, as she was worried about car parking overflow onto Eagle Terrace. It was pointed out that the export traffic analysis stated was much lower than figures given by the traffic consultant, and that this was not a major concern.

Conditional: traffic concerns expressed by around ten of the residents on the effect of increased traffic flow on Bellbird Avenue. H&W explained that the export traffic engineering advice stated that this was not a major concern. They requested seeing the traffic report. They can access this now or they wanted to see it if part of the lodgement.

Concern was also raised regarding the proper arrangement of the carparking for the new mixed use of the carpark with the parking for the church. H&W explained the carpark would have a tarmac strip to reduce speed, and that it would be at night to prevent dark corners. The residents suggested this was not an issue that should stop the project going ahead.

The parish might consider an entry gate that could be closed at night if this became a problem.

It was also raised if the site vehicular entry from King’s Road was a possibility – H&W stated this had been raised prior with Council who had said this was not possible in any case.
10.13 MGS Architecture and Urban Design – Practice Implications (referred to on pp.27, 159, 164, 250).

10.13.1 List of MGS Jobs Using Rapid, Defragmented Techniques:

<table>
<thead>
<tr>
<th>Job #</th>
<th>Job description and description of technique.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0511</td>
<td>452 St Kilda Road (Aug 07): <em>Linked Area Analysis</em> and model information (Indesign)</td>
</tr>
<tr>
<td>0554</td>
<td>MSO (Melbourne Symphony Orchestra building) (2006): Aerial Perspective view - aerial photo mapping</td>
</tr>
<tr>
<td>0580</td>
<td>Chapel Vision Structure Plan (Jan 06 - Dec 07): linked CAD and model information (Indesign), <em>Ped-Catch</em>, <em>Parametric Picturesque</em>, <em>P-Radiance</em>,</td>
</tr>
<tr>
<td>0583</td>
<td>Album south primary school (2007):</td>
</tr>
<tr>
<td>0624</td>
<td>St Vincent’s Master Plan (2006): <em>Parametric Shadows</em>, <em>Subtracto-Sun</em></td>
</tr>
<tr>
<td>0698</td>
<td>Coles Balwyn (Jan 08 - present): CAD and Max modelling</td>
</tr>
<tr>
<td>06107</td>
<td>Carlton Housing Redevelopment (invited competition submission (Nov-Dec 07): <em>Linked Area Analysis</em>, <em>Quick Medium Density</em>, 3d modelling tools in cad and max, var. cad tools</td>
</tr>
<tr>
<td>0723</td>
<td>Officer Master plan (2008): <em>Housifyor</em></td>
</tr>
<tr>
<td>0724</td>
<td>Officer Town Centre and Subdivision Master plan (Jan 07 - ongoing): <em>Linked Area Analysis</em>, <em>Quick Medium Density</em>, 3d modelling tools in cad and max, var. cad tools</td>
</tr>
<tr>
<td>0743</td>
<td>Street Box Hill (2007): <em>Subtracto-Sun</em> plug-in for Station</td>
</tr>
<tr>
<td>0780</td>
<td>Portarlington (2008): Terrain contour – aerial photo mapping</td>
</tr>
<tr>
<td>0796</td>
<td>Volt Lane EOI stages 1 and 2 (Dec 07 - present): Indesign, <em>Linked Area Analysis</em>, <em>Quick Medium Density</em>, var. cad tools</td>
</tr>
</tbody>
</table>
10.13.2 Extracts From Interview with Director of MGS Architecture and Urban Design (Referred to on pp.116, 117, 164, 249, 250).

The following is extracted from an interview conducted with director of MGS.

Interviewee: Rob McGauran (RM)
Interviewer: Marcus White (MW)
Interview conducted Wed 6 Feb 11.30am at MGS office (12-22 Manton Lane Melbourne).

MW: Do you think other urban design offices would be any different in their analysis and design approaches?

RM: I think they [are]. Some see it as a visual exercise, I see it as partly visual, but part of a more multi dimensional exercise. It seems to me that it has to work with ambitions for flexibility over time for and being successful economically [...] and successful socially and neither of those necessarily have a physical dimension, but are really important and there are some who see their role as one that stops at resolving what it looks like.

MW: How do you deal with the cost to interest groups if there is a vested interest in the design ending up in a certain way, and that is outlined with who ever is there… the save our suburbs representative saying it effects our amenity but you don’t have any representation from future [residents] that aren’t living in the area [already]?

RM: I think you have a roll of advocating those positions, [...] whether it is for the eighty five year olds in nursing homes that need that support, or children that aren’t there [at community consultation meetings] that need play areas and safe environments, [...] I think you have to be able to articulate ‘what is the role of this place? Is it just a local place or does it have regional obligations and responsibilities that go beyond its place, that go beyond the interest groups of a few. It doesn’t mean you don’t try and understand what their concerns are, and see if there aren’t ways of acknowledging those [concerns] at the same time achieving broader objectives. I think that you have to be a good advocate for what is the ‘right solution’ and the right solution should often acknowledge that there has to be progressive change not instantaneous.

MW: Before the office was part of this research program, would you say that the firm’s urban design work was done in 2d?

RM: More of it was done in 2d though we did a lot of free hand sketching as well. More of it was done long hand.
Section 10.13

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MW: Has this changed?

RM: Yes that has changed, I think the general proficiency and understanding of how they [the staff] can use CAD to inform decisions has been substantially enhanced.

MW: Would the office normally do pedestrian connectivity analysis as part of their design approach? Has this changed?

RM: More often in those basic areas of way-finding and the 400 metre circle… there might have been an important potential view connection between A and B or a way of negotiating through an urban environment that we might have flagged… but I think that actually we had very few tools available to us that would effectively communicate and advocate why we needed to do those things.

MW: Has that changed now?

RM: Yes I think so, it's not necessarily running the program [Ped-Catch] though there will be times that I think we will, to demonstrate the benefits of A versus B, it has brought into much sharper focus… you can picture the outcome of proposals because we have seen how the program [Ped-Catch] works. It has become a piece of research that continues to bolster your background knowledge. Some of these techniques you will use recurrently for each project like sun carver [Subtracto-Sun] whereas other I think a checking device used from time to time or a means by which you go to show somebody else why it is important.

MW: Have the techniques changed the office’s ability to address issues of sustainability?

RM: Yes, there is no doubt, in terms of a range of the issues that they [the staff] have, accessibility with your topographical tools [Gradiator], and I think amenity in the public realm and the private realm with the sun carver [Subtracto-Sun] etc. have definitely and continue to be the most often utilised of the [techniques] that you have developed.

MW: Has the research changed the way the MGS staff work in any way? Approach problems differently?

RM: The major thing it has done is have a champion of inquiry, I suppose, in the office in the form of your good self [Marcus White], it has encouraged [staff] to engage in a way that has been much more targeted to what they
need to do for [specific] projects and that if they went to generic courses for instance at the [architect’s] institute which are often pitched far too low, so it’s given them a relevance of that has in turn encouraged them to test things more... and in a variety of ways

MW: Does it affect the way they approach design?

RM: Definitely. Because they have been in that position [where] having those tools available to them over time and seeing the outcome of that testing over time again is raising their competency and their acuity when looking at a place to how they might respond to that place.

MW: The status of urban design in Melbourne, do you think there are problems with the implementation of Melbourne 2030?

RM: The major problem was that they didn’t have the implementation program in place when they introduced the policy.

RM: They haven’t harvested many of the beneficiaries of M2030 in being their advocates... the people who have gone to live in the city and enjoyed that. We have 10000 more residents in the city... they have spoken with their feet. And similarly in inner urban areas, where there has been good public transport yet we haven’t heard those people acting as advocates to the benefits to the level that I would have anticipated. You get the occasional baby boomer down at dockslands, but rarely the occupier of the one bedroom unit in Richmond on Bridge Road, or the many unit occupiers in St Kilda... [which is] a pity.

MW: M2030 pushes for urban consolidation, what are the factors working against this densification?

RM: One is land availability, and the packaging of land to make it available to development, Secondly the issue of construction costs for taller buildings which in many parts of Melbourne exceeds the house and land costs of traditionally developed free standing house or town house so there is a problem of price competitiveness in many locations. A third is the inability, particularly in the middle ring for local governments to understand their regional role in providing density, Camberwell being an obvious example. But they are not alone in that, and as a result of that are pushing densities down where they should be pushing them up, often on the basis of a neighbourhood character that is defined by the smallest element in the street rather than the unseemly 1960s residential block intervention or what ever might have occurred. The Save Our Suburbs / NIMBY push back from local
communities who value the character of the free standing family home irrespective of whether they are planning for future residential communities or are well matched with that form of housing.

... I think it is a concern about the unknown and a concern about change and a concern about the loss of their culture or their sub-culture that they individually value. The problem is that often the major advocates or stopping change are in themselves older, rather than younger, but not so old that they are needing support facilities, and they are usually disinterested in the broader city as a whole and their role in the city as a whole, and much more concerned with their place as a microcosm.

MW: The change in culture, is that because flats / medium density is more often than not occupied by immigrants?

RM: Well it comes from a range of different things... more often it is a case of being territorial, the St Kilda triangle is in part about territory... the other reasons for it are harder to pin down.. I think there is an edginess of people and culture they don't understand and the impacts that they will have on both their power base and their value system... come from that and concerns that they are going to be noisy...

MW: During one of the information sessions that were held in the MGS office, Mark Alan from Vic Urban suggested that there is too much written detail in structure plans and that there should be more demonstrable images and envelopes instead of just words and plans. “What is it supposed to look like”... what are your thoughts on this comment?

RM: I think that is right, I think structure plans for the most part are still written by planners and they are obliged to sit within a planning scheme structure which is very strongly words based set of regulatory tools, I think there is a lot of merit in moving towards a much more visual and in effect simpler to interpret set of planning tools for structure plans. Though that is not always going to be the way to do it because there will be areas of things like land-use, economy social mix, community infrastructure etc that might or might not have a physical dimension... I think that the emphasis at the moment is too many words and too few pictures and just too big a document generally.

MW: What do you think is missing in the theory and practice?

RM: I don’t think we understand enough about sustainability and how it can best be delivered in a comprehensive sense, and I’m talking here about things as divers such as access to food and its implications for urban places. And I don’t think we have our funding systems and our regulatory systems aligned to ensure that we get that sort of armature, what is the right sort of public domain or the right sort of ecological footprint or the right
sort of economic footprint? Issues such as the timely provision of the right sort of jobs and obviously a commitment to transport that will enable practice to be as effective as it needs to be.

MW: Are urban designers able to communicate proposals adequately to the public?

RM: Not many. Often a lack of conviction, secondly a lack of understanding of the individual programmatic needs of types of land-use, and why it is important to hold your ground, thirdly a lack of real understanding of urgency of the need. Then I think there is the clear problem of absence of tools that can help communicate [information] in ways that are assessable to the community, whatever that community is.

MW: Have the techniques helped in the selling of designs to clients?

RM: Yes I think so. You wouldn’t say to everyone… I think they are of more use to an expert client than they are to the community at large, because they are design tools, not so much about providing access to laypeople to the design process.

MW: Do you think that councils and clients understand the circular catchment analysis method?

RM: I don’t think they [councils] have [questioned the technique] which is worrying in itself, but I don’t think they have taken it very seriously either. It has been a bit of a [case of] ‘so what’, at a statutory level a planner says if it inside a 400m circle I have to consider it [a design proposal] differently, whereas outside the 400m I consider it [in another way]. And that dumbing down approach is unhelpful… most think that it is irrelevant other than government policy says that you can do a different level of intensity [within 400m]

MW: Gauging from your presentations to clients, council planers and generally public, do you think the Ped-Catch technique is better understood?

RM: Yes I think they do, and we saw that with the Mega-mile project that it [Ped-Catch] had a resonance with them in demonstrating why a particular urban move was important for them to pursue, which I think was important, so I think they do.

MW: Did they end up doing that [the proposed pedestrian link]?
RM: Yes, they have done the deal, they have got the link.
MW: Do you think they would have done that [the link] without that [Ped-Catch]?

RM: Probably not. Because they needed a decision to be made because development was occurring and I think that the opportunity would have gone before they, [the Whitehorse Council] got to the point of conviction.

MW: Would the time frame for urban design and master planning be enough for the level of analysis and design that is needed for sustainable design?

RM: Yes if you had the understanding of what government was committed to...

MW: Do you think the use of the advanced 3D & 4D analysis and design techniques coming out of the research has affected the speed of design response?

RM: Yes, I think the competencies within the office in managing the software even, has dramatically improved, it is going to be a constant problem of training new people and skilling people up all the time but there is no doubt for those that have been involved.

I think it is speed and quality of response, the [techniques] have brought into sharper focus the underlying principles of say of Melbourne 2030 about liveability and its impact on three dimensional decision making, so in itself it has brought about the better alignment between the way we think about places and the [design] response.

The technical proficiency has been improved by using those [techniques] so the quality of the presentation has also improved, And they have broadened their other presentation techniques as a result of that additional skill.

So, yes it has sped up design responses and yes it has improved the quality of responses.

MW: What is the level of integration of the input by consultants?

RM: We work very closely with [consultants] with a team of people who can work with us and we can test [designs] with at the same time again our understanding of what tool they use is informing our decisions too.

MW: It would be unlikely to have a lighting engineer working out [solar penetration] during sketch design? Would you ever have access to a lighting engineer at planning level?

RM: No. I think you have to be selective about who is important at that stage, I would argue that it is much more important to have a social engineer or property planner, or the transport structure planners, because we can [now] model radiance to a good enough level and we know enough through our [Subtracto-Sun] about relationships between things that you start to get a proportion sense as well about how you can structure environments…
MW: So you are broadening the scope of the architect

RM: Yes, it is giving you a little bit of knowledge, [...] enough knowledge early on to use their [additional consultants] inputs only where you identify where it is very important, to the design solution.

MW: Do you think that there is an issue with the number of design iterations when using consultants?

RM: Yes there is, because they all want to charge a lot for every iteration they look at, and often we perceive [this is] disproportionally to their input.

MW: Do you believe that there are problems with the current fragmentation of the disciplines when it comes to urban design?

RM: To a point yes. I think an urban designer has to be an ‘expert generalist’, that it is really important that they have an understanding of the built environment and I don’t think the other disciplines can inform densified urban places as well as somebody who comes from a designing building background but with a good general understanding of the other disciplines and their roles.

MW: What, if anything do you think this research adds to the knowledge of the profession? And the theoretical discourse of urban design?

RM: Well I think what it is doing is, its giving a visual expression to written objectives within the broader debate about the future of Melbourne as a city that align between the research and Melbourne 2030 commentary. It is a very important one to explore, as much as anything, to get a debate going about what is the importance of that particular objective in a physical sense or otherwise and in questioning the physical responses for example are we hitting all the buttons that we need to. So I think it has had not only a significant role for us [MGS] but I think potentially for that broader debate.
10.14 Focus groups: Meeting minutes (referred to on pp.28, 97, 119, 123, 174).

10.14.1 Focus Group: Minutes 0002 - City of Whitehorse/Stonnington City Council/ Melbourne City Council/ City Of Yarra
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

### Section 10.14

Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

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**Focus Group: Minutes 0004 - Maroondah Council / Greater Dandenong Council / Frankston Council / Maribyrnong Council / City of Whitehorse**

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**FROM:**
- Marcus White
- Rob Mcgrauran

**MGS**

**To:** Marcus White
- MW 9769 7117
- M 0422 4295 1984

**MGS**
- Rob Mcgrauran

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**Multiple Research**: Transit Cities GM meeting

**Present**
- Rob Mcgrauran
- Marcus White

**Applies to**
- Residential
- Retail
- Industrial
- Commercial

| No. | Issue | Description | Action | Date
|-----|-------|-------------|--------|------
| 1   | Background | The presentation was a result of an invitation from Paul Heaney (Manager, Planning and Building) for the weekly Transit Cities GM meeting and as part of the council's working group discussion. | | |
| 2   | Introduction | General introduction and explanation of what it was I was doing. An attempt at explaining the Embedded process. | | |
| 3   | Feedback | Rob Heaney (GM, Frankston) was interested in the report. | | |
| 4   | Interest | Rob Heaney (GM, Frankston) was interested in the report. | | |
| 5   | Who is it? | Brief introduction. Showed Water Gate apartments. | | |
| 6   | The Tools | Overview of the tools and response to the challenges of contemporary urban planning | | |

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City of Whitehorse

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10.14.3 Focus Group: Minutes 0004 - Maroondah Council / Greater Dandenong Council / Frankston Council / Maribyrnong Council / City of Whitehorse
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

**Section 10.14**

**Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.**

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**Focus group: Minutes 0005 – City of Melbourne**

### Table: City of Melbourne

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### Additional Information

- **Minutes 0005 – City of Melbourne**
- **Thinks:**
  - Rob Adams: Steph's multi-modal transport presentation. **A sensational piece of work, well done** – Rob Adams
  - **Informed discussion:**
    - Rob described some research he was undertaking with JAM (City) relating to planning height limits and the relationship with public space. They're doing some good research through analysis of the case studies. Amsterdam made some interesting points about the relationship between public and private space, especially with the speed at which they are designed.
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

11. Accuracy of Models & strategies
   - The accuracy was questioned on the model of existing buildings for "Expert Witness" use at VCAT (Victorian Civil and Administrative Tribunal). It was noted that the information in our examples had been a combination of 2D, LIDAR data, and a survey of buildings. It was suggested that additional 3D surveying would be the best way of avoiding issues of accuracy.
   - The feedback focused on the need for clearer instructions and more detailed data to support the model. It was recommended that additional data collection methods be considered to improve accuracy.

12. Feedback Pedestrian circulation
   - The feedback emphasized the importance of pedestrian circulation in urban design. It was suggested that the model should include more detailed data on pedestrian movement and circulation patterns.

13. Feedback general
   - It was noted that the model could be used to inform large-scale plans and the "rural" model’s small-scale urban plan for a place like Stonnington.

14. Feedback speed
   - The feedback was requested to be able to model up to a speed and look at impact in 3 to 4 different proposals for different data as quickly as you had just shown would be incredibly useful.

15. Feedback cost
   - It was noted that "too easy to put in too much data." It was suggested that the feedback was added to industry standards. It was suggested that the tools were the sort of things that were needed, but they could be costly.

16. Feedback Geography
   - It was noted that "too easy to put in too much data." It was suggested that the feedback was added to industry standards. It was suggested that the tools were the sort of things that were needed, but they could be costly.

17. Feedback council model use
   - It was noted that "too easy to put in too much data." It was suggested that the feedback was added to industry standards. It was suggested that the tools were the sort of things that were needed, but they could be costly.

18. Feedback council model use
   - It was noted that "too easy to put in too much data." It was suggested that the feedback was added to industry standards. It was suggested that the tools were the sort of things that were needed, but they could be costly.

19. Feedback communicating in public
   - It was noted that "too easy to put in too much data." It was suggested that the feedback was added to industry standards. It was suggested that the tools were the sort of things that were needed, but they could be costly.

20. Pedestrian Route
   - It was noted that "too easy to put in too much data." It was suggested that the feedback was added to industry standards. It was suggested that the tools were the sort of things that were needed, but they could be costly.

21. Feedback later investigation
   - It was noted that "too easy to put in too much data." It was suggested that the feedback was added to industry standards. It was suggested that the tools were the sort of things that were needed, but they could be costly.

22. Of the techniques give a much clearer understanding of what they [the strategic]
10.15 Publications and Awards

10.15.1 Research Awarded an Honourable Mention in AA-Unbuilt Completion and Published in Architecture Australia (Jan/Feb 2008).

Project by Cameron & Marcus White using the Rapid, Defragmented Approach (referred to on p.235).

Urban planning strategies to encourage increased residential density around transport nodes or open spaces often use simplistic 400-metre and 800-metre radius circles to encourage more intense development within five- and ten-minute walking distances. Resulting density models take the form of tiered wedding cakes. Like our tiered taxation systems, the mathematics is simple but overall fairness is questionable. Tiered models correlate crudely to smoothly graduated phenomena and inevitably produce distortion, inequity and disputation at the thresholds. Harrison and White’s project proposes densities (and hence heights) based on more sophisticated modelling that simulates real walking times, allowing for street layouts, throughfares, intersections and topography. The demonstration project, centred on the precincts around Mitcham and Nunawading stations in Melbourne, results in a persuasively responsive urban massing model. The process rewards routes and arcades leading towards the nodes, generating a texture of narrow directional blocks close to the activity centres while allowing lower, deeper block formations in the diagonal (NW, NE, SE, SW) sectors. Most intriguingly, the articulated form-model generates a public space texture reminiscent of those old-world cities evolved from centuries of pedestrian movement. The richness of form derived from one simple correlation of accessibility and building density is persuasive and suggestive of further application. This truly computer-aided design technique is commended to all with a commitment to planning, rather than simply legislating, our cities.

Figure 286: LHS of double page spread.
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.

Figure 287: RHS of double page spread.
10.15.2 Research Awarded For Canberra Biennial in the Athletic Village Design Ideas Competition, Published in BMCE Magazine.

Project by Cameron & Marcus White using the Rapid, Defragmented Approach.
10.16 National and International Conferences and Exhibitions

10.16.1 Conference Paper For the ‘International Conference on Sustainable Urbanism: A New Paradigm In Urban Change’ - Texas A&M (College Station, Texas): April 1-3, 2007

Title: ‘The plan is an inadequate tool for planning’

Figure 290: Image of university, and me presenting paper.


Title: ‘The plan is an inadequate tool for planning: Enhancing the urban design process through the use of 3D+ digital tools directed towards sustainability’. (Extension of Texas A&M paper):

Title: ‘Densification, Pedestrian Catchments and the Battle for Middle Earth. Can Agent Based Pedestrian Modelling be Used to Inform Urban Morphology?’

(The IFHP is the International Federation for Housing & Planning founded in 1913 by Ebenezer Howard.)

10.16.4 Conference Paper for the ‘Re-Housing’: U A L International Housing Conference, October 5th-8th, 2006 (Melbourne Town Hall & Capitol Theatre)

Title: ‘The Lovenasium – A 4D housing case study’.

10.16.5 Conference Video for the RAIA National Conference Saturday 21st April (Melbourne Convention Centre)

National Tour - Cross-Over Package

Mark Burry (RMIT & SIAL), With Tom Heneghan (University Of Sydney) & John Hockings (Architectus)

Figure 294: Flyer for RAIA national conference.

10.16.6 2006 Homo Faber: an Exhibition Looking at the Role of Models in the Architectural Design Process (Melbourne Museum)

Figure 295: Flyer for Homo Faber exhibition.
10.16.7 Presentation for the ‘Embedded Practice Symposium’ RAIA (Melbourne)

Figure 296: Flyer for Embedded Practice Symposium.

10.16.8 2008 Homo Faber: an Exhibition Looking at the Role of Models in the Architectural Design Process (Melbourne Museum)

Figure 297: Flyer for Homo Faber exhibition.
Informing an integrated and sustainable urbanism through rapid, defragmented analysis and design.