The Kind of Problem
a
City Will Always Be

A study on the epistemological state of urbanism and the kind of problem a city is

Authored By Takeshi Kominami

Submitted April 2013

The Kind of Problem a City Will Always Be

A study on the epistemological state of urbanism and the kind of problem a city is

A thesis submitted to Victoria University of Wellington as partial fulfilment of the requirements for the degree of Masters of Architecture.

Contents

Abstract

Epistemic Foundations; what kind of problem is a city?

Jane Jacobs in her seminal work *Death and Life of Great American Cities (1993)* titled a chapter of her book, *The Kind of Problem a City is,* and in it, discussed how a city should be understood as a situation of a complex nature. Observers of cities have, from as early as the Renaissance, attempted to identify the kind of problem cities are by comparing them analogically to a variety of subjects and artefacts. This has been done to discuss and extrapolate the issues surrounding what a city is in a multitude of ways and to better grapple the complex issue that the subject of cities pose. However a single explanation or analogy will likely ever satisfy the discourse as a fundamental framework.

The difficulty in reaching a single framework is twofold. Firstly cities and the way cities are inhabited, changes and evolves over time. And, secondly, and perhaps more problematically the way we think about them and come to *know* them also changes and evolves. To put simply, there are epistemological struggles in urbanism that require attending if the complex issue of a city is to ever be reconciled.

Empirical observation and interpretation of the city – an alternative technique at the time of Jane Jacobs writing of *Death and Life of Great American Cities*, is the recording of events and occurrences and looking at how and why these might arise. This is what separated Jane Jacobs from the common school of thought at the time. It was a departure from the overly simplified rational logic of the Modernists – a school of thought made widespread by its success but had extended passed its limitations. Jacobs had observed an underlying and intricately delicate balance that had evolved out of the complex connections in the diversity of the people and their spatial conditions within a city; a balance she called a "ballet of the street". To Jacobs the Modernists obsession of order through 'orthodox' planning and zoning that had sought to impose homogeneity over populations and areas simply did not observe or appreciate the complexity of cities and streets that created the very emergent qualities of healthy urbanity. Qualities that Jacobs had noted "ought to be cherished and celebrated".

This thesis therefore delves into contemporary techniques of understanding and observing cities particularly by digitally modelling and dissecting areas to better interpret and come to know the existing urban condition so that we may build better knowledge foundations for urban discourse. It will identify that through changing and diversifying paradigms and epistemologies of knowledge, our perception and our a posteriori ability to identify the kind of problem that cities are, is not static and that it develops and evolves from generation to generation. This is a necessary change that occurs in order to revaluate and solve certain kinds of problems and puzzles that pertain to the generation taking place.

The significant point that I argue is that such change, at an epistemological level, is inevitable and necessary. And as these evolving epistemic foundations can dramatically alter the significance and legitimation of the entire body of urban knowledge, then a continuing critical discussion of the contemporary state of epistemic urbanism or a philosophy of urbanism is a necessary task for identifying and framing the kind of problem a city is.

Furthermore, this thesis will outline methods of (re-)framing those foundations to better carry over constructive and applicable knowledge that will help build new and contemporary understanding of cities and urbanism. These frameworks and methods will be tested through hypothetical re-design of existing city fabric in order to help realise the applicability of new research techniques.

The thesis itself will be written in three parts (each two chapters);

Part I of this thesis (Epistemic Urbanism) is designed to review the epistemological foundations for the contemporary state of Urbanism in order to begin to *identify the kind of problem cities are*. The research stems from Jane Jacobs' Life and Death of Great American Cities and looks at how the epistemology of science the paradigmatic methods of, act as a proxy to the epistemic foundations of urbanism. This has in turn led urbanism to subscribe to the same [post-modern] concepts and methods of a posteriori thinking. This point of departure is significant if we are to explore avenues for constructing a framework of knowledge and investigation that reveal truths and understanding of our cities as a unified discourse. To accomplish such theoretical underpinning however will prove to be an ever-evolving process as the foundation for these frameworks are anchored within the epistemology of the present.

Part II of this thesis (Epistemic Tools) will outline how *framing epistemological knowledge* is primarily achieved through the adoption of structural metaphors which act as lenses to frame and reframe urban knowledge to a contemporary condition. The aim of framing this knowledge is to construct useful tools to better understand cities and advance further knowledge about them. The chapter will trace the expiration of the Modernist metaphors of machines and explain how they are no longer suitable for present day cities as cities themselves are becoming more complex spatially and technologically leading to an argument that the nature of cities is reaching an 'organic' state. On this basis it is postulated that a more bionic metaphor; that of the cyborg would offer a better suited framework for the framing of contemporary knowledge of cities.

Part III (Epistemic Space) adopts computer modelling for analysing spatial morphologies of present day built fabric. Dissections of computer generated areas of city will act as an experiment base for spatial investigations and the analysis will constitute a form of empirical material in which to base conceptual models and theories on. It will attempt to draw out new details and identify emergent qualities through the conjecture of space and form. Utilising the cyborg metaphor to understand morphological adaptions of the city will lead to new speculation and interpretation that may help to elucidate hitherto unknown information and knowledge of the built environment. It is hoped that speculative interpretation of spatial interventions applied to the model will draw out ways and means of *re-conceptualizing the kind problem that cities are*.

The mapping of knowledge evidence based analysis and information against evolving epistemology through the use of metaphor will be critical to creating effective avenues of better understanding the kind of problem cities are. This type of research will also uncover ways to create frameworks of knowledge that can be used to guide action and build a more coherent discourse.

Foreword

This research has stemmed from an interest in, and a search for, the nature of cities. Walking around cities, watching, listening, smelling, tasting, exploring, and daydreaming reveal a plethora of intellectual stimuli that I hope will one day lead to a stronger and heightened sensitivity toward urban environments, and as such, will lead to design that is more resilient and produce thriving and architecturally interesting spaces.

Cities and urban areas now represent the home of more than half the population of the planet. Yet, since the end of the Modernist era, there has been no single leading school of thought guiding the study of mankind's greatest habitation. This leads to a vast array of divergent thoughts and volumes of work on urbanism. And it is perhaps well for the study of Urbanism to be of different disciplinary specialities, but, as future architects the ability to reconcile all this information that at times seems unrelated and occasionally contradictory to each other is critical to the successful incorporation of a diverse amount of knowledge. It has therefore been my goal to seek out a single point of departure that connects these multitudinous studies of urbanism.

Seeking the epistemic outlines of urbanism and exploring through new and experimental methods of observation of the city has led me to find a way of interpreting the city from a multidisciplinary and unconventional conclusion. The research has taken me to philosophy and the area of epistemology to find the departure point where our ability to carry over concepts from one discourse to another allows sharing of conceptual frameworks. The unsurprising consequence has been the discovery that the post-modern condition is one of multitudinous epistemological points of departure for the legitimation of 'truth' on urbanism.

Working with an undefinable departure point has resulted in a rather ambiguous and unconventional method of seeking more information on cities but in order to uncover new information about the cities and produce new methods of investigation, experimental techniques I argue is essential. I have worked toward avoiding ambiguities by framing new understandings through metaphor but the unconventionality of this work is intentionally such that I can only hope that reviewers find the combinations of ideas and evidence that I have juxtaposed convincing or in any case a provocative theoretical argument. It is simply my hope that they will enjoy reading this thesis as much as I have enjoyed exploring the research.

As cities grow ever more complex, I think the conversation of epistemologies and legitimization of knowledge and frameworks especially in urbanism is an increasingly important. Furthermore as the post-modern condition prevails into the 21st century and the intellectual landscape continues to evolve away from the research of the past, continued attention and redefinitions will be essential.

Introduction

One of the main things to know is what kind of problem cities pose, for all problems cannot be thought about in the same way. (Jacobs, 1993, p. 558)

The kind of problem cities are, has been observed, thought about, and interpreted for generations. There are libraries and archives of documented information of the observation and experience of cities and through the experience of different people of different generations. Often the information that is read from books is accurate when gauged against the way we perceive and use cities but, more often than not, there can be conflict. Discrepancy can arise between knowledge's of cities. While a book or an opinion may perceive a city to be one thing or display a certain character, another's experience of the same or similar situation in reality, may not arouse the same way of thinking. It can also be possible that two people or parties can both experience a city and have conflicting opinions about what it is and how it should be regarded. These disagreements and conflicts are epistemological problems.

These epistemological struggles have dire consequences and implications on how to draw up strategies and plans about how cities should be and how we retrospectively look at historical arrangements of plans and spaces. If there cannot be agreement on how a city should look, feel, act, and be, it is then difficult to get things built, changed, or protected.

The last great urban epistemological revolution was fought between the modernists and the post-modernists. David Harvey in his book *The Condition of Postmodernism* describes Modernism as "the belief in linear progress, absolute truths, the rational planning of ideal social orders and the standardization of knowledge and production" and Post-modernism as "the privileging of heterogeneity and difference as liberative forces in the redefinition of cultural discourse. [It is the] fragmentation, indeterminacy and distrust of all universal or 'totalizing' discourses." (Harvey, 1992, p. 9) If we use these definitions to describe the shift in the conception of the intellectual and built landscape then we begin to appreciate that this was an important conflict of how a city should be thought about and regarded and simultaneously a revolution that transformed how things were designed and built. The epistemological shift has transformed not only the intellectual landscape in a way that has allowed a multitude rather than a leading school of thinking, but has allowed the built fabric of cities to evolve in complex and an almost organic fashion. Jane Jacobs lead the epistemological revolt to overthrow a monarch like school of rationalist thought that was ruled by frontrunners like Corbusier and Jacobs' nemesis Robert Moses creating a new type of city that would begin to evolve and function more like an organism than a machine.

In contemporary Post-modern urbanism, a multiplicity of knowledge and an intellectual landscape that has become fragmented has led to an embracement of different methods of thinking regarding the kind of problem a city is. To answer the question then, of what kind of problem a city poses, this thesis locates

an epistemological foundation of urbanism at the crux of identifying the kind of problem a city is. It is a subject that Jane Jacobs briefly began to tackle in her 1961 book *The Death and Life of Great American Cities*. What I have called the 'epistemic foundations' is significant because a posteriori knowledge of any kind is always entrenched in epistemology.

Contemporary urban discourse – often referred to as 'Post-modern' is a diverse field of theory. Unlike Modern urban theory and its 'grand narrative' with an epistemology grounded in enlightenment thought, Post-modernism is an epistemologically polyvalent minefield. This is likely because there is as yet, no single narrative that offers a departure point for the subject of urbanism to lay foundations for theory on. This Post-modern condition with its absence of a single point of departure often means urbanist's and urban theorist's base and attempt to legitimize their knowledge from a multitudinous epistemological base, and often, without scrutinizing their legitimacy.

Jacobs, while not overly concerned with the philosophic discussion, nonetheless identified in *Death and Life of Great American Cities* that a city was a problem in organized complexity. This is a scientific epistemology which was not the conventional foundation in the 1960s for either science or for urbanism, but was nonetheless a successful theoretical approach for investigating the city that has developed in the past four decades. Jacobs applied the principles of Warren Weavers 1968 report *Organized Complexity* directly to the city and stated how science, and more importantly, the *new* science of complexity can create a framework of thinking about cities.

In order to properly frame this 'new science' that urbanism subscribes to, the opening chapter of this thesis introduces how a divergence in epistemology has occurred and how the concept of paradigm shifts in science has given way to the questioning of scientific method. The divergence in rationalism and empiricism in the early Modern period also makes the epistemological backdrop more complex. This shifting of epistemologies and paradigms shifts create new and alternative ways of a posteriori thinking and understanding of the field of study. This is significant in identifying how the cognitive foundations of urbanism are not constant and require consistent re-evaluation on top of the already changing physical and cultural landscape. This change can be problematic because of the way it requires a new set of thinking about old ideas, concepts and disciplinary structures. A paradigmatic shift can also uncover new sets of problems, solutions, theories and experiments. This development requires a re-investigation of old methods and a re-framing of new results into a theory.

The second chapter will outline the new paradigm of complexity which in turn, helps explain why modernism and post-modernism have displayed a considerably different approach to urbanism. Explained in short, the scientific revolution of the 20th century from Newtonian simplicity to the new science of complexity has had a delayed but significant effect of urbanism (and architecture) that has changed the a posteriori thinking about cities. The embracement of complexity through its different

degrees of euphemisms such as diversity, mixture (mixed-use), and density, has seen a dramatic change in urban discourse.

The third chapter introduces urban metaphor to 'frame' and better understand and apply epistemology to urbanism. Although metaphors were once thought of as surface language, they are now understood as fundamental cognitive tools that can transfer knowledge from one domain of knowledge to another.

History has seen urban observers and designers use a multitude of figurative metaphors from Renaissance artefacts' of art to Modernist efficiency of machines to attempt to grasp and explain the complex kind of problem urbanism is. Thinking about cities through their different analogies has been both constructive and hindering in building frameworks of knowledge of urbanism.

Evelyn Keller Fox, an MIT biologist who welcomes the use of metaphors to assist in the framing of knowledge, comments "that much of the theoretical work involved in constructing explanations of development from genetic data is linguistic - that it depends on productive use of the cognitive tensions generated by ambiguity and polysemy, and more generally, by the introduction of novel metaphors" (Keller, 2002, p. 7). Keller's view offers a precedent in re-framing new empirical observations of development of the city into constructive explanations.

If we ask the question of what is the best analogical metaphor to frame and describe the problem a city is, it will be difficult to come to a conclusive agreement. The Modernists adherently pronounced the efficiency of cities through technological and mechanistic narratives and by doing so achieved more productive and consumptive cities. However, counter to this, stacking argument against the modernist type of methodology has seen a demise of the machine as an appropriate image for contemporary cities. Post-modern cities more recently have seen a surge in the ideals of diversity and growth through ecological tropes which has arguably supported more vibrant and cultural cities; but how long will this last?

Chapter four offers one such novel metaphor, that of cyborgism. While at first hand, the idea of cyborg discourse rouses fantastical imagery of combinations of machine and organism, the discourse of cyborgism is significant to urbanism because of the way it has become, as Matthew Gandy has described; "an ontological strategy for extending the limits to human knowledge as well as an apposite means of describing those phenomena that appear to reside outside of conventional frameworks of understanding" (2005, p. 26). In short, cyborgism as a metaphor allows new ways of thinking about the function of city and its relationship with its users and makers that extend beyond our conventional methods.

The final chapter under the heading *Epistemic Space; Investigation and Intervention,* will record a method of digital observation and intervention of a local site in the city. These experimental 'tools' are by no

means comprehensive, but are intended to create an alternative vision of the spatial environment as well as open discussion towards methods of fostering more complex ways of utilizing and occupying city space.

As future designers of cities, a re-evaluation at a fundamental way we perceive and approach the kind of problem a city 'is', will be a critical argument for the last chapter.

The intended purpose of three parts (five chapters) of this thesis is to first stimulate a re-evaluation at a fundamental cognitive level about the way we think about cities, second; re-investigate by empirical observation and experimentation and third; re-design the way we conceptualize our cities.

Chapter I
Probing the Epistemic Foundations of Urbanism

There's nothing more political than epistemological struggles. From debates about how to best arrive at truth to all of the critiques of Enlightenment epistemology, the wars of words and philosophies have enormous practical consequences; They are debates about what counts as knowledge and who counts as knower. (Sandercock, 1998, p. 74)

Epistemological foundations are critical to identifying the kind of problem a city is. Which epistemologies urbanists draw knowledge and thinking from is significant in how they reach conclusion and understandings about cities. This chapter sets out to explain how science has been the proxy discourse to fundamental approach to urbanism and the discourse of urban theory. Problems of epistemology have plagued discussions and have been argued about since the time of Plato and Aristotle and these epistemological arguments have major consequences on urbanism and the space of cities as it affects the very way we think about the spaces and the way they operate. There have been many schools of thought that have been the foundations of urbanism and with that urbanism has had many successes and failures.

What is significant, however, is that science has and will constantly undergo transformative changes in methodology as the epistemological tides change. Since the Enlightenment and the Age of Reason, the development of scientific method has taken divided methodologies; that of rationalism and that of empiricism. Modernism had been founded on rationalist knowledge; the idea of a grand-narrative and objective truth. In contrast the Jacobs led the way for the rise of empiricism and smaller localised narrative units of epistemology in urbanism which has opened the door for Post-modern discourse to burgeon.

While supporters and proponents of the Modernist movement, standing by what Harvey would describe as "the belief in linear progress, absolute truths, the rational planning of ideal social orders and the standardization of knowledge and production," believed that there were objective and universal answers to solving the issue of what kind of problem a city is. Post-modern observers on the other hand such as Jacobs preferred "the privileging of heterogeneity and difference as liberative forces in the redefinition of cultural discourse and went onto lead a more contemporary science have come to question those

answers. Urban theorists who can recognize these epistemic differences can better realign their ideas (and ideology) to contemporary thinking.

The significant point of this chapter will look at how the epistemological foundations of urbanism (epistemic urbanism), has undergone massive struggles. Urban knowledge is now found not in universal answers but found by close observation that recognize localised anomalies and reveal different narratives about different conditions.

1.1

Epistemic Urbanism

Jane Jacobs in 1961 in her book *Life and Death of Great American Cities* was the one to highlight the point in the chapter *The Kind of Problem a City is* that urbanism at its epistemological foundations is scientific. This is not because urbanism *is* a science, but because the 'inherent nature' of cities happens to represent problems of a scientific nature. In other words, scientific a posteriori thinking ought to be at the epistemological foundation of urbanism if we are to create avenues of investigation that help yield truths and narratives about cities

However by looking at the theory of paradigms and paradigm shifts that was postulated by Thomas Kuhn in his work *The Structure of Scientific Revolutions* (1962), what we begin to understand is that science is not a single continuity of increasing facts and theories but an episodic model of discovery that is interrupted by revolution. Therefore the *kind* of science that Jacobs was referring to is of critical importance to uncovering how to better build frameworks of understanding within an ever-changing intellectual background. Jacobs underscored that "cities happen to be problems in *organized complexity*, like the life sciences." Organized complexity was a new kind of science in the twentieth century that represented 'a revolutionary change'. "New strategies for thinking [that] have developed mainly as methods of science" (Jacobs, 1993, p. 558) were the words used to describe this transformation of thinking about cities.

Jacobs was by no means the first urbanist to draw roots from science. Historically, if it can be assumed that architects can also be urbanists, Vitruvius demanded in an architect *fabrica* (craft) and *ratiocinatio* (theory). Ratiocinatio is a concept characterized by scientific content. In his work *De Architectura*, he established that architecture is a science that can be comprehended rationally and that a lengthy schooling in sciences and humanities is thus an essential part of an architect's training.

'Revolutionary' changes have occurred in urbanism because of changes in scientific epistemology and so the shared school of thinking with science, something which undergoes dramatic and revolutionary

changes and shifts means that what new frameworks we create to better understand urbanism will require devices to accommodate the volatility in epistemology. The occurrence of changes in science had significant consequences for urban discourse because the change relocates the foundations of urban knowledge and requires 'new strategies for thinking' for every change.. This look into the epistemological foundation of urbanism, offers a brief introductory insight to the volatility of the philosophy of science and this in return exposes the volatility of urbanism.

An Empirical Revolution

Planners and, architects...are not consciously disdainful of the importance of knowing how things work. On the Contrary, they have gone to great pains to learn what the saints and sages of modern orthodox planning have said about how cities ought to work and what ought to be good. They take this with such devotion that when contradictory reality intrudes, threatening to shatter their dearly won learning, they must shrug reality aside. (Jacobs, 1993, p. 11)

The difference between rationality, and reality, has been a great divider of knowledge for urbanism. Modernism was won over by the successes of rationality and in the belief of a priori conditions, but, eventually it failed to take into account that reality was not as simple as the rationality that was applied.

The Enlightenment, for Immanuel Kant, was the point in history when humanity put its own reason to use without subjecting itself to authority, particularly ecclesiastical authority. It was considered by Kant to be humanity's passage to adult status. (Kant & Translated by Nisbet, 2009) The Enlightenment with regards to history ushered in a revolution in mankind's ability to search critically for the truth about the world. Kant broadly categorised his predecessors into two main schools of thought; the rationalists and the empiricists. The rationalist school of thought adopted mathematics as their model of knowledge and the empiricist school adopting the physical sciences as theirs.

Modernism was a school of thought borrowing the methods of rationalism. Thus urbanism during the eighteenth and nineteenth centuries was largely a rationalist endeavour biasing strongly on the enlightenment split toward a priori based applied thinking. An endeavour that grounded universalities of knowledge on the premise that a priori principles could support such truths. However the tides of thinking began to change around the time of Jacobs in the 1960s and more strongly since the 1970s that the heroic model of rational man has been subjected to a bombardment of critique. It had opened up a "dual crisis in post-industrial society; a crisis of values and a crisis of knowing". (Sandercock, 1998, p. 63)

To add to this, we now live in a world where we are no longer convinced that there are any real examples of scientific a priori knowledge at all[1] and that empirical evidence is necessary when establishing knowledge. While Kant broadly separated empirical and a priori knowledge (referred to in his work as synthetical and analytical knowledge) as the two general epistemologies of the enlightenment (Kant & Translated by Meiklejohn, 2003), the emergence of a new understanding in physics and mathematics revolutionised the idea of scientific epistemology and invalidated the presumption that rational

---

[1] Not in the pure Kantian a priori form. A revision of scientific a priori in the 1920s by Hans Reichenbach states "[the theory of] relativity involves a priori constitutive principles as necessary presuppositions of its properly empirical claims, just as much as did Newtonian physics, but these principles have essentially changed in the transition...what we end up with, in this tradition, is thus a relativized and dynamical conception of a priori mathematical-physical principles, which change and develop along with the development of the mathematical and physical sciences themselves, but which never the less retain the characteristically Kantian constitutive function of making the empirical natural knowledge thereby structured and framed by such principles first possible." (Friedman, 2002, p. 174)

knowledge based on a priori knowledge alone was enough to support all knowledge especially once those models were translated into the urban kind. It was this turning point where the foundation of rationalism as totality was undermined. (Friedman, 2002)

Jacobs unlike the long line of architectural rationalists, was an empiricist by nature. Jacobs never identified herself as such but her continuous observation of the detailed life of the everyday transactions on the streets as evidence in her arguments against the rationalist projects of the modernist movement that were dissolving the rich balance that kept the vitality alive, was considerable proof that experience through observation and interaction was critical to her opinions. In Jacobs own words she said "I shall be writing about how cities work in real life." (Jacobs, 1993, p. 3) Her empirical thinking was further acknowledged through her analogy of a city as the same kind of problem as the physical or life sciences. Since the nineteenth century, the social sciences have in earnest been trying to replicate the methods of the paradigmatic physical sciences.

Observing, hypothesising, experimenting; and a sharp distinction between emotion and reason are the defining characteristics of empiricism; a method that has come to dominate western approaches to truth and knowledge of the world since the Age of Reason. (Sandercock, 1998)

The significant issue with this switch from a rationalist to empiricist approach to urbanism is that knowledge has gone from being something based on the idea that reason, leading to knowledge of cities can reveal universal laws applicable to all planning regardless of location, to multiplicities of knowledge's based on specific localized conditions and therefore a move away from grand-narratives to little narratives that would alter the way spaces are thought about.

The modernist and 'experts' had tendencies to identify the city from an ideological rationalist foundation. Jacobs and like-minded thinkers on the other hand, identified the city from an empirical observational and anti-theoretical perspective. The rigorous observation of the evident happenings, events, interactions and transactions on the streets was the departure from Modernism. The conclusive point being that experiencing of the street is critical to unveiling the truth of its nature. Purely rationalising the city relying on a priori justification and idealisation is no longer the ideal solution to identifying the kind of problem a city is.

Paradigms and Paradigm Shifts

Thomas Kuhn is best known for his highly influential and controversial 1962 publication *The Structure of Scientific Revolutions*. In this work, Kuhn's central idea was that the development of science is driven by adherence to what he called a 'paradigm'. The function of which was to "supply puzzles for scientists to solve and to provide the tools for their solution". These 'paradigms' however are occasionally punctuated by crisis when "confidence is lost in the ability of the paradigm to solve particularly worrying puzzles called 'anomalies'" (Bird, 2004, p. 1). These crises are followed by scientific revolutions that open a passage into a new paradigm of puzzle-solutions.

Kuhn, through his work highlighted part of the inadequacies of Empiricism and science in general as a method of objectively observing the world. His work is significant because he proposes science and the philosophy of, undergoes revolutionary change. It is a model that works by on-going mini-revolutions in order to find the best form of seeking out new theories about the world. Thomas Kuhn's *The Structure of Scientific Revolutions* in the *series International Encyclopaedia of Unified Science* sought to establish a defining position of the epistemological values of science. If we apply the same critical approach to urbanism, it would mean that Cities will not always be the same kind of problem.

Kuhn challenged the twentieth century prevailing view of scientific progress. He disputed the view that there existed a continuous increase in accepted facts and theories. He instead postulated an episodic model of science in which periods of conceptual continuity known as 'normal science' were interrupted by periods of 'revolutionary science'. During a revolutionary period, a change in deep epistemological concepts results in a new set of defining problems for science. This results in the loss of explanatory power of old concepts, and process of adoption (through gestalt mix) of practitioner succession and problems of priority. (Kuhn, 1996)

Within Kuhns new model, paradigms are seen as periods where there exists a prevailing theory or model of science that has been established within where occasionally scientists uncover new facts that aren't readily explained with the prevailing model or theories that have been established. These are called anomalies. Anomalies are set aside until they accumulate or prove too great, troublesome or numerous to ignore. At which a new theory or model of science will be established to accommodate and explain these anomalies. This establishment of a new model or theory is what is granted as a paradigm shift. (Kuhn, 1996)

Though Kuhn's work is one of the most influential pieces in philosophy of science, it was met with hostile reception and is controversial because it argues against the 'rules (of logic, of scientific method, etc)'

known as the *sine qua non* of rationality. "Kuhn's claim that scientists do not employ rules in reaching their decisions appeared tantamount to the claim that science is irrational" (Bird, 2004, p. 1)

Kuhn, alongside like-minded philosophers of science in their work "forced philosophic thinkers to confront for the first time the (alleged) fact of deep historical change [and] raised problems of enduring interest and gave a sense of historical concreteness and epistemological urgency to the long familiar but abstract logical and probabilistic problems of under determination of theory by observation" (Bird, 2004, p. 1). While philosophers of science have rarely doubted there have been changes in epistemological values, there have been tensions and divides to opinion as to whether these have marked evolutions in science or revolutions.

Through the work of paradigms, the volatility of scientific epistemology was exposed. Because scientific method acts as a proxy method to understanding urbanism, urbanism itself becomes exposed to the same volatility in epistemological paradigm shifts and therefore affects the approach to coming to understanding cities. The idea of paradigms and paradigm shifts I argue makes the foundations of urbanism volatile because of the way urbanist's employ science as a method of thinking about cities. This postulation requires a constant observation, re-evaluation, investigations and redefinitions at its epistemic foundations in order to maintain a contemporary stance.

1.4

Towards a Contemporary Epistemic Foundation

This is the crucial point; absolutely none of our beliefs is forever "immune to revision" in light of experience (Friedman, 2002, p. 173)

The Modernist ideology had based their work on the assumption of a stable and orderly world of knowledge. Cities therefore were designed as a rational and dignified subject. Post-modern philosophy, by contrast, tended to describe knowledge as essentially incommensurable. For some this was intoxicating, a world of unrestricted play; for others it was frightening, a world without ethics or purpose. This view, premised on disconnection and fragmentation has given way in the twenty first century to interconnection and complexity: ecologies; networks; programmes.

The problem with Modern Urban theory, Philip Cooke of Cardiff University claims, is that Modern urban theory is totalizing and that there is a "tendency toward reductionism and uni-dimensionality... What has to be theorized [in contemporary urban discourse] is, not a universalistic system, but a system of differences. This is difficult and modern urban theory failed to cope adequately with complexity" (1990, p. 332).

Within this change, modern urban theory is becoming exhausted, and that a new, more appropriate theorization of the contemporary city is waiting to be born. Furthermore, Cooke argues that post-modernism despite its critique on modernism in all its guises ranging from philosophy to architecture has no strong claim to be programmatic – to propose policies by which society might systematically be developed and advanced, and therefore it does not depart fundamentally from the much more programmatic modernism that it presumes to succeed. (Cooke, 1990)

This epistemological change from modernism attempts a dismantling of boundaries which make way for postmodernist attempts at permeability, and re-connectivity. Complexity based on interconnection, ecologies, networks, and programmes offers a programmatic solution to problem solving urbanism.

Tracing a line between scientific epistemic foundations and urban paradigms allow us to view from a historical point of view how an understanding of cities develop and how we approach and identify the kind of problem a city is and guide us to a more objective and critical observation and interpretation of the problem at hand. These foundations may and are likely to change, but if the epistemic foundations are clearly mapped and known then it is easier for the transfer of knowledge and to label it relevant and grounded or otherwise. Jane Jacobs clearly identified cities as problems in complexity which has offered a starting point for building new frameworks and foundations. If there is to be a serious search for the kind of problem a city is, there has to be some consensus on the epistemological foundations.

Chapter II
The Contemporary Paradigm of Complexity Science

Cities are best identified as problems of complexity. This chapter sets out to explain what complexity is and how it can be utilised to better identify and breakdown the problem a city is into constructive cases.

Science has over time become a proxy method to the way we observe urbanism. Complexity science is an empirical and arguably paradigmatic method of observing, investigating and theorising the world we live in that has developed since the beginning of the twentieth century. It has become an enormously useful tool in identifying the kind of problem a city is and how we might better understand it. Complexity science is the most contemporary tool for understanding how synergies and new emergent phenomena are created from dynamic relationships and interactions of things ranging from atoms to people.

As stated in the first chapter, this is significant as it identified how urbanism at its epistemological foundations can and has continually been cited as a scientific endeavour but that science at a philosophical and practical level is a continually changing and evolving subject.

While the first chapter identified that urban thinking is overseen by paradigms, this chapter will outline what separates this paradigm from the last and reports the significance of that change. Furthermore it will identify what impact it has had on urbanism.

2.1

Complexity - What is it?

There is probably no satisfactory definition of complexity, although it is generally agreed that complex systems consist of "many basic but interacting units" and are "systems in process that constantly evolve and unfold over time (Batty, 2007, p. 64)

Jane Jacobs used a brief summary of complexity of the time and thought of the new science as an awakening that changed "the mental methods we can use for probing the world" (Jacobs, 1993, p. 558). She quoted in length Dr. Warren Weavers essay on science and complexity from the *1958 Annual Report of the Rockerfeller Foundation* noting that the different fields and disciplines of science have been coming to grips with this new idea and way of thinking since the early twentieth century and the advancement of the idea of organized complexity have unveiled an "extraordinary quantity of hitherto hidden knowledge" (Jacobs, 1993, p. 564).

Charles Jencks in his polemic *The Architecture of the Jumping Universe* goes as far as to call it "a meta-narrative of the universe and its creation...likely to change every area of life" (1995, p. 7). What kind of a paradigm is difficult to accurately state and is debateable for the reason that it is still early in the transition or shifting state. It certainly does rearrange and give new perception to the entire outlook on the world and the way scientists think about many problems regarding the life sciences.

Complexity itself is the next scientific paradigm that moves beyond the Newtonian physics model; a model of science that has dominated the world for more than three hundred years. Newton offered an image of the universe as a machine, a clockwork mechanism; one which is ruled by linear cause and effect. One gear turns which makes a second gear turn, which makes a third gear turn and so on. This cause-effect relationship is captured by Newton's F=ma formula: Force gives rise to acceleration; cause gives rise to effect.

As mentioned in chapter 1 however, Newtonian 'universal' laws were radically undermined in the twentieth century by an Einsteinian revolution in physics. Complexity and complex systems was another challenge to the tradition view of science. Mitchel Resnick in his book *Turtles, termites and Traffic Jams* describes this challenge "Rather than viewing the world in terms of one individual object acting on another in a neat causal chain, researchers are viewing the world in terms of decentralized interactions and feedback loops. They are studying how complex behaviours can emerge from interactions among simple rules, and how complex patterns can emerge from interactions among simple components." (Resnick, 1994, p. 13)

The biggest hurdle with regards to complexity is that it is still in a premature state and is to some "the emerging science at the edge of order and chaos, [and is] to others it is yet another fuzzy popularization of technical scientific theory or, perhaps worse, an entirely vacuous concept" (Proctor & Larson, 2005, p. 1066).

However this step in a progressive direction away from Newtonian models of science to decentralization, systems, and emergent phenomena that is called complexity represents to date, the most accurate identification of the kind of problem a city is. The point is not that Newtonian models are wrong; It is that Newtonian models are becoming or always have been inappropriate for trying to make sense of certain types of phenomena such as cities and urban conditions. New types of models are needed, operating at a different level from Newtonian models, focusing on the behaviours of systems.

2.2

Complex Cities

We may wish for easier, all-purpose cures, but wishing can-not change these problems into simpler matters than organized complexity, no matter how much we try to evade the realities and to handle them as something different. (Jacobs, 1993, p. 566)

Jane Jacobs' exact words were "cities happen to be problems in organized complexity, like the life sciences. They present situations in which half a dozen or even several dozen quantities [of variables] are all varying simultaneously and in subtly interconnected ways" (1993, p. 564). She described the city as not one problem in organized complexity, which "if we understood explains all". The city can be analysed instead into many such problems or segments which are also related with one another. The variables are many, but are not helter-skelter; they are interrelated into an organic whole. (Jacobs, 1993)

As a simple example Jacobs used the success of a city park to explain how complexity applies to the urban arena. She noted down a page of interrelating variables including design, who resides near the park, other uses in the area, mixture of age in the buildings nearby, size of blocks in the vicinity etc. What was most important however is how "the park is acted upon by other factors and how it reacts to them...Certain combinations stimulate the degree of influence from one another among their components ... although the interrelations of their many factors are complex, there is nothing accidental or irrational about the ways in which these factors affect each other" (Jacobs, 1993, p. 566).

Jacobs used this evidence as her point for trying to identify that the conventional way of identifying and solving problems of the city were outdated and no longer applied. Modernist planning in particular, had decontextualised and defamiliarised cities through a perceived 'purism' in the name of progress.

Jacobs attacked modernists and rationalist city planner for consistently mistaking the kind of problem a city is. Garden City planning Jacobs described as closed systems, as self-contained, two variable problems in hope of redistributing city populations and hopefully achieving regional planning. This in itself was not the problem, but how they applied this *system of thinking and analyzing to big cities* she decried.

Contemporary thought about cities and urban planning has shifted from an earlier emphasis on objects and separation of function to context, and what Nan Ellin calls 'programmatic hybridity'. Ellin closes in and supplants earlier twentieth-century pursuits of essentialism and purism, with emphasis on the need for acknowledgement of diversity, complexity, embeddedness (importance on local context) and an 'element of unpredictability' (Ellin, 2006).

Because"city diversity itself permits and stimulates more diversity...big cities are natural generators of diversity and prolific incubators of new enterprises and ideas of all kinds. Moreover, big cities are natural economic homes of immense numbers and ranges of small enterprises" (Jacobs, 1993, p. 190).

This is because a diverse city offers its users a range of subsidiary conveniences and choices that they want and need. Essential interdependencies of businesses and enterprises, or the ability to understand cities as combination of mixtures of uses and not separate uses, are important in creating reliable emergent phenomena.

We now know it is the immense number of the parts that make up a city, and the immense diversity of those parts that make up a city are a tribute to that city. It is the Interactions, transactions, events and happenings of those parts and people that make cities vibrant. To propose a city where the qualities of diversity and complexity occur is to propose a better urbanism.

Since the identification of the city as a problem in complexity, diversity has become a significant issue in cities. The advantage of diversity is that it offers more variables acting on each other creating a strong networking effect. It was concluded in chapter one that a modernists approach to urbanism is reductive and uni-dimensional, unable to respond effectively to diversity. Post-modern urbanism celebrated diversity but was not able to constructively frame diversity. One of the most important aspects about Complexity, is that it describes urban diversity with scientific efficiency. It greatly helps identify the kind of problem a city is and how to better understand what makes a healthier city.

Complex and diverse cities we can now say contain seeds of their own generation, with energy enough to carry over for problems and needs outside themselves. But with a growingly complex city, the issue of how to discuss this complexity remains. Identifying the kind of problem a city is, is only the beginning. Framing and understanding the problem requires renewed strategy.

Chapter III
Metaphors, Tropes and Cognitive Frameworks

The city is an assemblage of a multitude of elements, not the least of which is its architecture. Exclusive to those that have been systematically generated, the resultant forms of infinite variety, while at best categorical, evade formal language. (Hashimoto, 2010, p. pp2)

How old and new knowledge is best framed in a new paradigm is at best a challenging task. The purpose of a structural metaphor in urbanism is to create an image of the city that can be used to interpret and structure information as well as guide action. A clear image serves as a broad frame of reference and an organizer of understanding or knowledge that can enable one to order a substantial quantity of information about the nature of the environment. Like any good framework, such a structure gives the individual a possibility of choice and a starting point for the acquisition of further information.

Metaphors are by no means new in urbanism. But the way metaphors have been recognized has seen a dramatic change since the 1970s. Where they were once thought of as surface poetic language, they are now recognized as fundamental cognitive concept builders to help navigate in the world we live. If we are to structure urbanism within a framework of knowledge, metaphors offer a strategic tool in establishing a preliminary image to frame a large amount of information.

This chapter will seek to employ cognitive and linguistic tools in order to further investigate and design growingly complex urban frameworks of knowledge. This will be achieved by observing other fields of contemporary discourse including Biology, which are looking to Complexity as a new epistemic (foundational) paradigm but are at times struggling with how to 'carry over' (the Greek root of the word metaphor) some of the concepts of complexity into their associated fields. The observation of this struggle through the work of biologist Evelyn Keller Fox offers solutions to how urbanism may adopt a similar change of modern simplicity to contemporary complexity.

Fundamentally this chapter will explain how the investigation, perception and consequently design solutions in urbanism is not a matter of *if* metaphors should be utilized but a matter of *which* metaphor or trope is most appropriate.

3.1

Metaphor of the Everyday

Explanations without metaphor would be difficult if not impossible, for in order to describe the unknown, we must resort to concepts that we know and understand, and that is the essence of a metaphor - an unusual juxtaposition of the familiar and the unfamiliar. (MacCormac, 1985, p. 9)

Metaphors are pervasive in everyday language, thought and action. Despite this metaphors were once thought of as peripheral matter of language. They are now understood as an integral cognitive device that is fundamental at a deep semantic level and it is now appreciated that "our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature and more importantly govern our everyday functioning, down to the most mundane details" (Lakoff & Johnson, 1980, p. 3). This change is best recorded and outlined by George Lakoff and Mark Johnson in *Metaphors we live by* (1980). Lakoff and Johnsons primary point states that our ordinary conceptual system is fundamentally metaphorical in nature.

Our congnitive conceptual system is not something we are normally aware of, and therefore let it behave more or less automatically in most of the little things we do every day. For Lakoff and Johnson however, language is an important source of evidence for the conceptual systems of thinking and acting. "Primarily on the basis of linguistic evidence" states Lakoff. "We have found that most of our ordinary conceptual system is metaphorical in nature...we have found a way to begin to identify in detail just what the metaphors are that structure how we perceive, how we think, and what we do" (Lakoff & Johnson, 1980, p. 4).

Earl MacCormac argues a similar point:

> The essence of metaphor is understanding and experiencing one kind of thing in terms of another. Viewed internally, metaphors operate as cognitive processes that produce new insights and new hypotheses. Viewed externally, metaphors operate as mediators between the human mind and culture. New metaphors change both the ordinary language we use and the ways in which we perceive and understand the world. (MacCormac, 1985, p. 2)

Lakoff and Johnson divide metaphors into three main conventional types; structural, orientational and physical. Though it is noted that the three cannot be sharply delineated, it is useful in tracing the basic domain of the conceptual structure.

Structural metaphors are cases where one concept is metaphorically structured in terms of another i.e. argument is war. Structural metaphors often involve using a concept from one domain (war as a physical

or cultural phenomenon) to structure a concept from another domain (argument as primarily an intellectual concept, but with cultural content).

Physical metaphors involve the projection of entity or substance status upon something that does not have that status inherently. Such conventional metaphors allow us to view events, activities, emotions, ideas, etc., as entities for various purposes (e.g., in order to refer to them, categorize them, group them or quantify them.

A third kind of conventional metaphor is the 'orientational' metaphor, which does not structure one concept in terms of another, but instead organizes a whole system of concepts with respect to another. We call them 'orientational' metaphors because most of them have to do with spatial orientation: up-down, front-back, deep-shallow, central-peripheral. These spatial orientations arise from the facts that we have bodies of the sort we have and that they function as they do in our physical environment. Orientational metaphors give a concept a spatial orientation, for example, happy is up. The fact that the concept is happy is oriented up lead to English expressions like 'I'm feeling up today'.

What these various kinds of metaphor represent is a basic outline of how knowledge is being transferred from one domain of cognition to another. Similarly the use of metaphor can be extended into transferring knowledge from one domain of discourse to another.

3.2

Metaphor in Science and Biology

> *Making sense of what is not yet known is thus necessarily an on-going and provisional activity, a groping in the dark; and for this, the imprecision and flexibility of figurative language is indispensable.* (Keller, 2002, p. 118)

Metaphors offer cognitive solutions to framing the kind of problem a city is in a way that offers a mental map to the complex structure of information building. Using the life sciences; specifically (but not limited to) biology as a precedent study, the research conducted by MIT Professor of History and Philosophy Evelyn Keller offers an outline of how it may work best for urbanism.

To Keller, science is much more than empirical experiments and formal equations. Scientific work, she describes, is inescapably linguistic and in her book *Making Sense of Life*, describes the role of metaphors in genetic science as a constant process of "groping for words, concepts and new experimental handles" that is required to expand the field of particular study. The science of genetics has undergone three identifiable stages in evolution: classic genetics; early molecular biology; and post recombinant DNA Developmental biology. In each of these stages of history, genetic has introduced its own characteristic

way of framing the problem of development. For Keller, "much of the theoretical work involved in constructing explanations of development from genetic data is linguistic – that it depends on productive use of the cognitive tensions generated by multiple meanings, by ambiguity, and, more generally, by the introduction of novel metaphors" (Keller, 2002, p. 117).

The traditional view within (biological) science has been to ideally use literal and univocal language that corresponded to the entities and processes that make up the real world. The traditional cast on the use of metaphors and other linguistic tropes in science when language is not literal is seen as 'heuristic' and to be dispensed with as soon as possible. Scientists such as Hobbes and Locke believed metaphors and linguistic tropes were merely ornamental and even 'downright deceptive intrusions that ought not to be admitted in proper scientific discourse.' But Keller comments "most philosophers and even many scientists have long since abandoned the traditional view… Historians and Philosophers have increasingly come to appreciate at close observation of scientists at work, either in the present or in the past, revealing that they simply cannot function under such a harsh mandate" (Keller, 2002, p. 118).

For scientific research, the difficulty is typically directed at the elucidation of entities and processes about which no clear understanding exists. For scientists to proceed in areas where they have yet only glimpses, guesses and speculations, they require new ways of talking about what they do not know. For Keller, "making sense of what is not yet known is thus necessarily an on-going and provisional activity, a groping in the dark; and for this, the imprecision and flexibility of figurative language is indispensable" (Keller, 2002, p. 118).

Urbanism, in a struggle with growingly complex and evolving spatial conditions and for those that can only be speculated upon is a case of 'groping for words, concepts and new experimental handles'.

<center>3.3</center>

<center>*The Urban Metaphor - From Machine to Organism*</center>

Since the rise of the study of urbanism and its close affiliation to science, there have been many metaphors to describe and clarify the complex and complicated nature of the object and subject that cities and urbanism represent that have been adopted with mixed reactions.

Over the period of the twenty first century, the rise of the urban paradigm and its growing complexity means that to elucidate the entities and process of the growth it has meant that turning to metaphors and linguistic tropes is a significantly important process. The problem is not that there is no framework of understanding the city as a complex entity; the problem lies in that the frameworks that are being offered are fragmented and/or difficult to understand.

Take for example Michael Batty's rigorous and highly developed framework of contemporary urbanism; *Cities and Complexity* which, right from the introduction, utilizes difficult terminologies and concepts such as 'cellular automata', 'regional and local dynamics', 'mono-centricity', 'polynucleation and polynucleated structures', 'fractal geometry' and 'spatial morphology' – Terms that require a prerequisite understanding of complex concepts to begin to use the frameworks to construct ideas from. It becomes no wonder that the wider urban discourse has not come to complete grips with the nature of the complex city when such dialogue requires an appended dictionary. By providing appropriate metaphors, ideas and concepts, basic understandings are elucidated without the need for relearning a complex frameworks and concepts from scratch. However as discussed in Chapter I, not only to spatial conditions of the built environment change, but the intellectual environment also evolves deeming old metaphors outdated and can be more harmful than useful to creating suitable understandings. The shift from mechanistic metaphors of the Modern age, to more organic metaphors of urbanism in our technologicalized and Post-modern age, reveal much about the evolving epistemological environment.

The Metaphor of a City as Machine was intended to convey the idea of a city as primarily a functional construct, where the component parts and their overall arrangement are devised to maximise functionality, whatever the resulting overall form; and hence the slogan 'form follows function' (Marshall, 2009). The machine however, was not only a metaphor for architecture and cities; it was utilized as a much broader metaphor reaching out into science when Earth was once thought of as a machine. (Proctor & Larson, 2005). The idea of the house as a machine for living, originated from deeper epistemologies; a world view that saw the universe as determined, mechanistic and as rational as a machine. "That mental trap ambushed us because it was so successful – we mistook it for a total explanation ... we now know the counter-lesson: mechanistic behaviour is only one mode; the most simple, reduced and least characteristic one" (Jencks, 1995, p. 11). Eventually the machine metaphor became threatening to society as it came to be regarded as something rigid, inflexible and hence ultimately dysfunctional. Furthermore, rather than being seen as liberating humans from toil, the machine came to be seen as something brutish threatening to harm humans, with its awesome amoral power. Ultimately, the machine began to threaten people's very humanity, if somehow becoming 'mechanized' themselves, as part of a new mechanistic order (Marshall, 2009). *L'Homme-Machine* or Man as Machine began to deny man the existence of a soul and by extension, the city began its path to lifelessness.

One of the many pioneers in urbanism to oppose the mechanistic position on the functioning of cities was Patrick Geddes in his *Cities in Evolution* (1915). For Geddes, an organic approach to human-natured interaction in town planning through social renewal and productive efficiency was significant (Mehmood, 2010). Part of the problem indeed is to do with 'how a city is put together' in terms of process. If a city is a work of art or machine, then it is a designed object, but is not expected to grow or change. On the

other hand, if a city is an organism, then it may grow and change, but an organism is not designed (Marshall, 2009). The organic metaphor distinguishes itself from the machine metaphors and metaphors of organisms – and hence finds favour – because it captures the sense of a city as somehow flexible, sensitive and responsive, perhaps somehow in tune with its environment; something that is dynamic, subject to rhythms and cumulative adaptive change; and perhaps with additional comforting overtones of being 'natural' and hence wholesome and somehow right or fitting (Marshall, 2009).

Metaphors to date, have offered simplistic models to create cognitive frameworks of understanding the kind of problem a city poses. But as epistemological foundations undergo revolutionary changes; these models no longer represent the best analogy of contemporary cognitive underpinnings.

It must be remembered however that metaphors should not be criticized in terms of whether they or not they are true but as James Proctor has said "best interrogated in terms of understandings they afford and those they preclude" (Proctor & Larson, 2005, p. 1067). Metaphors in urban discourse and indeed the machine metaphor have driven spatial change, and so it is significant that the selection of metaphor requires constant re-evaluation to remain contemporary and meet demands of the city and its inhabitants.

Chapter IV
[Re-]Framing Urbanism as a Body of Knowledge

The current version of the everything-is-related-and-follows-certain-universal-laws approach incorporates the notion that information technologies have irrevocably and irreversibly reconfigured space and time. Now, there is no longer a perceived battle or need to choose between the city-as-organism and city-as-machine. Instead, it is perhaps the Cyborg City, or simply the Cyburg. It may no longer be possible, or irrelevant, to clearly separate the organism and the machine. (Gandy, 2005, p. 13)

Chapter four investigates an apposite metaphor for both the physical intellectual landscape of urbanism; that of the cyborg, to utilise for framing urban knowledge. The domain of cyborgism offers urbanism a unique lens in which to study and re contextualize the complex kind of problem a city is.

As identified in part I, the new science of complexity represents a change in the epistemological foundations of understanding and perceiving the contemporary urban condition. The discourse of complexity, while epistemic in nature is however, largely a scientific Endeavour. Jane Jacobs attempted to draw the connection between complexity and the city directly by using a park for example. And while this direct application may be successful if we observe each singular and individual object within the city with regards to complexity, the comprehension of the city in its totality becomes overly large with excessive combinations of variables. By laying out the complex details on a map we can better structure and access larger volumes of information. This can be done via structural metaphors that have the ability to introduce and carry over large quantities of knowledge. The metaphor as a tool as discussed in the previous chapter offers a cognitive concept builder that packages overly complex, or not yet fully comprehended situations that reside outside conventional frameworks of understanding into comprehensible models.

The city is a point in case of such overly complex and not yet fully comprehended situations in the new paradigm of complexity, and requires a situated metaphor that conceptualizes the entirety of the city and its discussions as a singular point of departure of discussion and framework building.

Cyborgism and the philosophy of cybernetics, is a rich vein of ontological and epistemological inquiry that responds boldly to the contemporary condition of post-modernism and the anxieties of post-humanism. As a subject it is "standing at the threshold separating human from post-human. The cyborg looks to the past and to the future. It is precisely this double nature that allows cyborg stories to be imbricated within cultural narratives while still wrenching them in a new direction" (Lenoir, 2007, p. 198). Using the cybernetics and cyborgism as a tool for epistemological inquiry of the city invites dualistic questions of the object and subject of the city. It offers to investigate the city as both mechanistic and organic simultaneously. Donna Harraway's *A Manifesto for Cyborgs* (1985) is a principle text for exploring the subjective nature of what the cyborgism has to offer. As a metaphorical tool for summarizing the complex issue that a city is, cyborgism carries many contemporary over and undertones that create a dynamic political and cultural terrain of theory.

Cyborgism as an idea and metaphor offer the most applicable solution to urbanism in the contemporary flux of epistemic urbanism. Cyborgism is a field that is dynamically large and contains many areas of study and discussion that has allowed an incredible 'ontological strategy for extending the limits of human knowledge as well as an apposite means of describing those phenomena that appear to reside outside conventional frameworks of understanding. This chapter limits the discussion on how and why it applies to urbanism and though tempting, will not begin to unravel an unending conversation on the depths and potential of cyborgism and its relationship to urbanism.

What makes cyborgism a powerful metaphorical trope is that it connects seamlessly the philosophical realm of cognition and epistemology to 'fleshy' realm of the concrete corporeal city. In this way, discussion about our cities may begin with empirical observation and connect seamlessly with the contemporary epistemic theory of complexity.

The Succession of the Machine by the Cyborg

For the world of our own making has become so complicated that we must turn to the world of the born to better understand how to manage it. That is, the more mechanical we make our fabricated environment; the more biological it will eventually have to be if it is to work at all...Our future is headed toward a neo-biological civilization. (Kelly, 1994, p. 2)

'Cyborg' is a term coined in 1960 by scientists interested in adapting humans to space flight through control and redesign of physiological and psychological regulatory systems. Since then, the term cyborg has been applied with a great deal of flexibility, and through this flexibility, it has seen massive expansion (Lenoir, 2007). We now live in a cyber-culture; a social culture that thrives on connection. Cities are technology and that technology is reshaping our social connectivity and the success or failure of connectivity ensures the reshaping of cities. This infinite feedback loop is a complex situation that is slowly being unravelled and analysed. Similarly computer networks have aligned people with technology in unprecedented ways and the intimacy of the human-computer interface has made it impossible to distinguish technology from the social and cultural business of being human. Cyber-culture is the name given to the process of becoming through technological means. Cyborgism is the name given to the discourse that blurs the boundaries of biological and technological entities and their associated systems. Both cyber-culture and cyborgism have provided an epistemological language and a characterised structure for late twentieth and opening of the twenty-first century. While as a contemporary theory, it offers a new conceptual perspective on an epistemic scale. If we were to locate the cyborg as an idea, we could say that it is clearly linked to fantastical combinations of bodies and machines, but is nonetheless a way of thinking about the world. As Professor Matthew Gandy has stated, "it is, in other words, an ontological strategy for extending the limits to human knowledge as well as an apposite means of describing those phenomena that appear to reside outside conventional frameworks of understanding" (Gandy, 2005, p. 26).

What makes cyborgism a fundamentally connected idea to the contemporary paradigm is that "it has developed out of several interconnected strands of thought as a trope of critical reflection which uncovers anomalies, fractures and tensions lurking within dominant modes of urban and architectural thinking" (Gandy, 2005, p. 26).

In the modernist paradigm for example, the role of chaos had no place. However the role of 'chaos in a post-modern contemporary mind set, takes on a very different significance from that associated with the modernist city. Rather than chaos acting as a negative force in urbanism, chaos is perceived as a field of evolutionary and radical experimentation leading to new vitalities. It is no longer seen as an anomalous

dimension to the urban experience to be problematized or excluded from analysis but "a rich vein of social and spatial interaction through which we may perceive signs of alternative or hitherto overlooked urban forms" (Gandy, 2005, p. 31).

What these forms lead back to is the formation of a new kind of theoretical body that of what Jacobs has described as 'an organic whole'. The metaphor of cyborgism acts as a lens for studying the organic whole of a city through a body metaphor. The metaphor operates as framing device performing much the same task as the machine metaphor acted as a framing device for modernism. While the modernists were not entirely misguided about the choice of the use of the machine, the city and its inhabitants are no longer perceived as simple clockwork mechanisms especially as cities grow more complex everyday with increasing populations and evolving technologies. The complex relationship of the built form and the people that inhabit and mould the city are a type of body that can now be called cyborg.

4.2

The New Body of Urbanism

> *When I noticed, Imperator, that many who have provided rules and scrolls of commentaries on architecture have not left orderly works but only incomplete drafts, scattered like fragments, I have decided it would be a worthy and most useful things to bring the whole body of this great discipline to complete order and, in separate scrolls, develop a register of conditions for each of its different subjects. Vitruvius* (McEwan, 2003, p. 7)

Vitruvius' *De Architectura* represents a written body of work that encapsulates classical architecture into a whole. Traditionally, the relationship of architecture to a body was defined through Vitruvius' first century BC treatise, *De Architectura*. The Vitruvian Man works as a metaphor for this body. It was a description of a human figure inscribed by a circle and square that provided a set of ideal geometric principles for building. However, during the nineteenth century and particularly within the rise of post-modernism, the body became distanced from architectural study and by extension discourse became fragmented. But as both digital and biological technologies [of the twenty first century] raise existential anxieties, the body has again become central in attempts to locate architecture's relationship to subjectivity and epistemology in our 'post human' condition. As "virtual reality myths and networked information technology promise to drastically collapse bounded wholes and replace them with electronic flows [and] the presence and stability of the body as a model have been replaced by proliferating simulacra" (Hight, 2008, p. 8) awareness of the disembodiment of reality is becoming apparent. And so it is within these anxieties that the body has been resurrected as a tool for grounding discourse. Only the traditional has been superseded by the bio-technological body. Cyborgism as a discourse offers urbanism a new such body. No longer geometrical or bounded, it is precisely the limitless and yet unknown form of cyborgism that offers unique opportunity for exploration while working as the body for architecture and urbanism.

Konstantinos Apostolos Doxiadis was a prominent figure of urbanism in the 1960s. For Doxiadis, a settlement was a constantly evolving organism, at once biological and technological. He talked of settlements in terms of a body, with nerves, arteries a heart and used growth and multiplication of cells as a model often referring to biological text books to clarify the behaviour of urban form. He created images of a dynamic biotechnological organism.

Similarly, during the same decade in Japan, Kenzo Tange, Kisho Kurokawa, Fumihiko Maki and the Metabolists, were emphasising the biological side of a biotechnological paradigm. In the United Kingdom Ron Herron, Peter Cook and Archigram were making architecture indistinguishable from communication and networks.

What was being emphasized was that cities grow and shrink, divide and unify, burst, die and regenerate in what appears to be a nature of their own. Studying medicine to better understand cities and their nature, as the Vitruvian advice would have been in the Classical and Renaissance era has been superseded by the advice to study complexity. But simply applying complexity to urban problems piece by piece like Jacobs did in her example with a park or street is only efficient in understanding individual situations. Framing the city piece by piece leaves us with the same problem as post-modernism - a paradigm without a constructive or strategic framework or line of action.

Cities, divided from their inhabitants, are a product of technology; a machine shell. The human inhabitants of cities are a product of the natural and ecological world. A city has *life* on account of its dense inhabitant population. A dense population can manage on the account of the infrastructure and architecture provided in a city. It is a symbiotic relationship of these two components that are for the sake of argument; inseparably a single entity. Cities are cyborgs. This application is similar to that of 1960s Japanese Metabolism, a doctrine proclaimed by architect Kisho Kurokawa and others that "demands an architecture in which man, machine, and space combine to form an organic body" (Wigley, 2006, p. 387).

This inseparability and embodied relationship of the machine and mortal life, buildings and bodies, was but a theoretical association during the modernist and post-modern era. One event however, made the relationship traumatically real on the day of September 11, 2001. The New York Twin Towers designed by Minoru Yamasaki *had* represented to post-modern theorists as the disembodied hyper reality of global finance. As hijacked air craft crashed into the buildings however, the points of impact appeared like gashes in the taut steel and glass skin turning the object of glass and steel and a symbol of the power of modern economics into a scared and crippled body. The horrifying reality of people and lives bleeding from the structure reawakened a discourse of the relationship of building and body as a single event (Hight, 2008).

What we can see from these examples is how a cyborg city can develop as a theoretical tool for exploring the complex problem a city is. Rem Koolhaas, a contemporary architect and urbanist adopts a surgical metaphor for describing urban and architectural spatial interventions. New York's makers, Koolhaas has described, have discovered an area of unprecedented freedom in the distinction between the interior and the exterior of building; "They exploit and formalize it in the architectural equivalent of a lobotomy – the surgical severance of the connection between the frontal lobes and the rest of the brain to relieve some mental disorders by disconnecting thought processes from emotions" (Koolhaas, 1994, p. 82). This is because in Western architecture there has been the humanistic assumption that it is desirable to establish a moral relationship between the two, whereby the exterior makes certain revelations about the interior that the interior corroborates. The "honest" facade speaks about the activities it conceals. But mathematically, the interior volume of three-dimensional objects increases in cubed leaps and the

containing envelope only by squared increments: less and less surface has to represent more and more interior activity. Beyond a certain critical mass the relationship is stressed beyond the breaking point; this "break" is the symptom of Automonumentality. (Koolhaas, 1994)

This surgical procedure on urban space that no longer serves the city to its full potential is evidence of the usefulness of the conception of city and discourse as body, and the ability to explore it through alternative lenses to re-evaluate urbanism and its space.

4.3

Cyborg Urbanism

Space no longer seems usefully understood through the traditional coordinates of the architectonic body (Hight, 2008, p. 9)

The realm of the born - all that is nature - and the realm of the made - all that is humanly constructed - are becoming one. Machines are becoming biological and the biological is becoming engineered. (Kelly, 1994, p. 1)

The city is not only a machine and hence the nature of a city can no longer be interpreted quite so deterministically as a machine. At the same token, the city is not a strictly a biological entity and therefore it cannot be interpreted as uncontrollable as an ecology. The city is a union of oil-dependent machine and sun-fed life. It is a unified complex system of organic and machine. The Vitruvian body as a metaphor for a body of (urban) knowledge has been superseded by the cyborg. The cyborg metaphor allows all metaphors to exist in hybridity. The juxtaposition of biological and technological in an undefined body permits an expansion of knowledge and ideas rather than reduction of ideology. What cyborgism offer is a new body metaphor for the work of urbanism.

For Anthony Vidler, the machine age was a time when the line between nature and machine, between the organic and the inorganic, seemed crystal clear. "Now, the boundaries between organic and the inorganic, blurred by cybernetic and bio-technologies, seem less sharp; the body, itself invaded and reshaped by technology, invades and permeates the space outside, even as this space takes on dimensions that themselves confuse the inner and outer, visually, mentally, and physically" (Vidler, 1992, p. 147).

For Vidler, the first machine age is clarified by what was a distinction of the house as a machine for living *in*. It could be said then that the city was also a distinction of those that live in the city and the city as a machine to live within. For the second machine age however, the house has become at once prosthesis

and prophylactic. The city has become in other words, and extension of the social collective body. What this means is that the cyborg metaphor allows for the simultaneity of concrete and imaginary perceptions of urban infrastructure so that the categories of the 'real' and the 'virtual' become interconnected facets of urban experience. The cyborg metaphor is, in other words, peculiarly suited to an understanding of the contemporary metropolis not only as an morphological entity entwined with various technical and aesthetic discourses, but also as an abstract and inter-subjective realm through which political and cultural ideas become constituted or 'fleshed-out' in parallel with the concrete development of the city.

The structural metaphor, as described in chapter three, is a case in which one concept is metaphorically structured in terms of another. In this case cyborgism as a structural metaphor assists in finding the right middle ground between complexity and urban knowledge. Because it offers the most advanced conceptual discourse that responds to contemporary epistemology of complexity while allowing a transition into observing, studying and framing the city to produce local and situated knowledge's, it unites and expands the city as machine and city as ecology metaphors to seek out the nature of the contemporary environment. The purpose for such a metaphor as stated earlier, is to create an image of the city that can be used to interpret information and to guide action. This image is one of complexity and locality framed by the discourse of cyborgism.

Matthew Gandy emphasises "those aspects of technological monstrosity which allow us to explore those contradictory aspects of modernity which can find no straightforward articulation. By enlisting the cyborg as a conceptual tool in urban discourse we can develop an imaginative response to the unknowability of the city and its power to generate cultural energies that ultimately impact on wider social and political processes" (Gandy, 2005, p. 42)

Complexity is a discourse of the theoretical. The city however is concrete. This polar difference is wonderfully brought together through cyborgism in its ability to identify and link the epistemological new science of complexity (through cybernetics) with its corporeal morphological outcomes in the social and technological organism that is a city. If we understand the cyborg to be a cybernetic creation, a hybrid of machine and organism, the urban infrastructures can be conceptualized as a series of interconnecting life-support systems. The modern home, for example, has become a complex exoskeleton for the human body with its provision of water, warmth, light and other essential needs. The home can be conceived as 'prosthesis and prophylactic' in which modernist distinction between nature and culture, and between the organic and the inorganic, become blurred. And beyond the boundaries of the home itself we find a vast interlinked system of networks, pipes and wires that enable the modern city to function. These interstitial spaces of connectivity within individual buildings extend through urban space to produce a multi-layered structure of extraordinary complexity and utility. (Gandy, 2005)

If we have identified that the epistemological foundation of contemporary urbanism and science has changed, our metaphors for framing and reframing old new knowledge's must be restructured. As Christopher Hight has acknowledged, 'space no longer seems usefully understood through the traditional coordinates of the architectonic body'. A new body; the body of the cyborg will help relocate knowledge of urbanism in the contemporary context.

Chapter V
Dissecting the Cyborg Body

Figure 1. Topological anatomy i.e. the skin of a prominent Wellington city landmark. A later dissection [fig4,12,14] of the skin reveals morphologies that were not present in the buildings conception thus showing the 'growth' or 'evolution' of its morphology.

This final chapter discusses how the aid of alternative visualisation techniques can reveal changes and morphologies in the built landscape over time. Specifically this chapter will hopefully demonstrate that through new and [re]newed methods of representation and observation through the use of computer modelling, new spatial understandings can give rise to new academic discussion. Expanding on the previous chapters, Chapter V seeks to find how epistemology and the framing of epistemology can inform and be informed by these alternative visualisation techniques and aid investigation and speculation of the city fabric and its morphology.

Figure 2. 1632. "Anatomical Lecture" Rembrant. Anatomical history dating from the Renaissance has revealed a plethora of hitherto unknown information and produced invaluable working knowledge regarding the body. Transference of this type of discourse could be used as a framework of studying the city and help advance understanding of urban morphology and urban 'anatomy'.

Part of this investigation extends the metaphorical concept of the city as cyborg in order to experiment with new functions and design of city morphology. The dualistic ontology of the cyborg offers new opportunity to detach the subject-object relationship to concentrate on the idea of the anatomical body of the city; i.e. the physical and corporeal structures and makeup of a city fabric from its more cultural and psychological facets.

The opportunities that arise from the metaphorical concept of cyborg is the adoption to anatomy and dissection.

Anatomy and dissection was "the eighteenth century paradigm for any forced, artful, contrived, and violent study of the depths". Knowledge of the interior of things ultimately involved a reassemblage of the whole (Landes, 2007, p. pp96). Anatomy, in its literal, tactile, corporeal sense of cutting and dissecting, as well as its metaphoric sense of dividing, separating, analysing, fathoming permeated ways of thinking about, and representing, all branches of knowledge has produced a science of the body's structure and functioning that has been invaluable to medicine.

Andreas Vesalius' *De Humani Corporis Fabrica* when it was published in 1543 revolutionized the way the human body was perceived. It presents one of the first careful and true illustrated representation of the

Figure 3. A highly detailed model of section of the city was produced as a specimen for urban dissection

internal organs and complete structure of the dissected body.

If we are to assume that the new metaphorical body of the cyborg city is to be understood in its structure and functioning, a dissection is a logical place to begin. When the health of cities are discussed, it is not uncommon to hear such phrases as 'the life of a city', 'the heart of a city', arteries and veins and the use of other such analogies to explain the organic functioning of a city. This anthropomorphising of the city and its metaphorical analogy to our bodies allows a cognitive door to better understanding the makeup of the fabric.

While architecture may have undergone, and continually undergoes critical and rigorous diagnosis through the use of dissection in the form of sectional drawings, the city has not yet seen a dedication to its internal structures and workings in nearly the same manner as architecture.. Therefore in a similar fashion to anatomical illustrators, this research look to dissect into parts of the body of the city to identify and distinguish organs and structures that are integral to the healthy functioning of the urban fabric.

Figure 4. Andreas Vesalius' illustration from *De Humani Corpis Fabrica*; Vesalius was able to correct hundreds of misconceived anatomical ideas by carrying out human dissection; something that was considered sacrilegious at the time.

Figure 5. The specimen was exploded and cut to explore the skin and its detail

Cities, over their lifetime, come to form corporeal representation of epistemic changes. A city is an ongoing experimental project. Every intervention another experiment overlaid on top of another. This overlaying has produced an urban body that is unique to its locale. To talk about space-time is significant in this situation as the same location and space has seen epistemic changes in paradigms over time. Each generation from that paradigm has layered their experiments on top of that urban body updating and adapting it to the needs of the time. Each transient generation carries their own epistemic ideals and inscribes, sculpts, inserts, and removes their interventions into the body of the city. Each contemporary epistemic ideals are different from their predecessors and that difference and change, whether dramatic or insignificant, will be reflected and represented in the body of the city through the interventions that we call the evolution and morphology of architecture and its all important supporting infrastructure. To take the idea of the corporeal body of the city and empirically observe through a process of anthropomorphised architectural dissection has revealed morphological anomalies and entities that would have otherwise been unidentified.

It is therefore the goal of dissection to explore that representation and unveil it morphological identity, which, overtime will lead the way to better understanding its needs, ills, and direction.

While the projection of the body onto architecture or the city opens a minefield of theoretical debate on the philosophical implications, this chapter seeks to unveil what empirical knowledge maybe hidden beneath the skin of the city by using anthropomorphising the city.
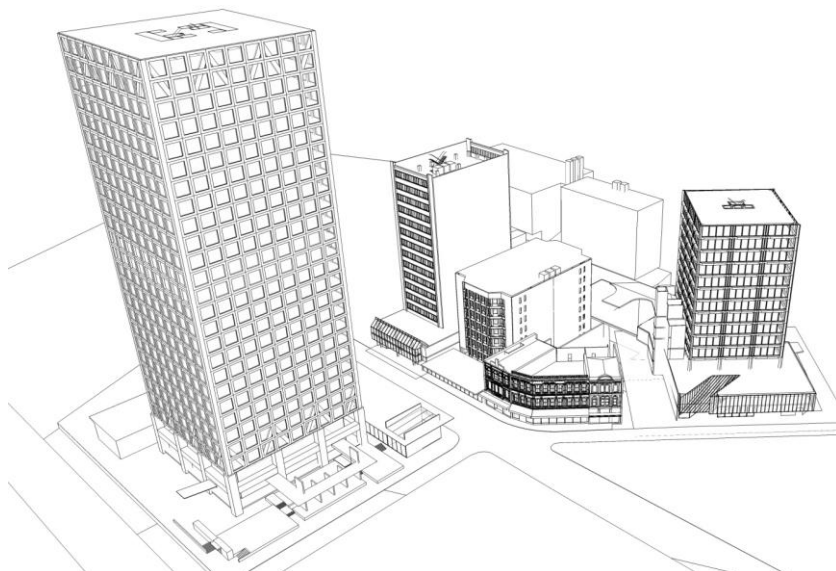
Figure 6. Digital specimens and models are a necessity to be able to dissect, explore and discuss the idea of urban space and it functioning.
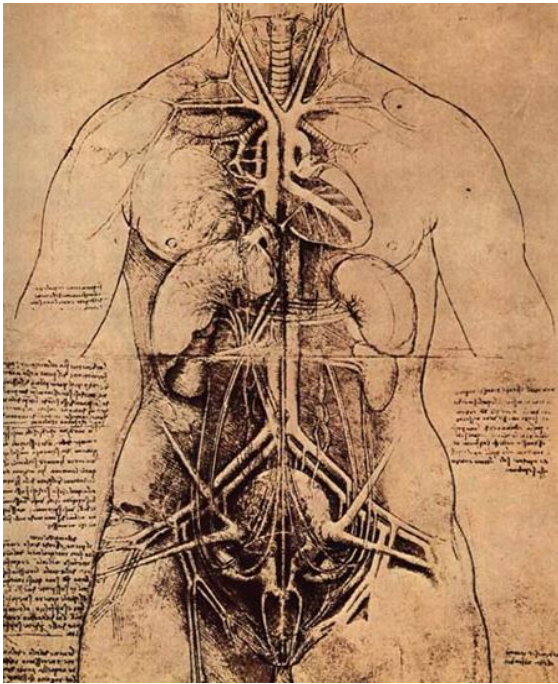
Figure 7. Leonardo Da Vinci was the first to produce representations of dissections from multiple view points as to show specimens in detail.

The city as body is not a new concept. It is an idea that dates back to at least the Renaissance. Le Corbusier in the 20th century also considered this a way of conceptualizing the workings and functioning of the city.

However pre twentieth century, the ontological and epistemological foundations of culture were very different (as discussed in part I). The re-working of that empirical knowledge therefore would have been dramatically different to a contemporary discussion.

While the concept of projecting the anatomical body on city is no longer considered a legitimate way of retrieving empirical knowledge, I believe that it may uncover new insights that would have otherwise been overlooked.

Much the same as if Jane Jacobs had not written about the vitality created by the small details on the streets of New York, the Modern Movement may have in ignorance obliterated what was left of the Greenwich village.

Unlike Jacobs' representation of the city through her writings, I propose in this investigation an acknowledgement of an empirical observation of the city through modelling techniques and experimental illustration.

Figure 8 Digital x-rays and semi-transparent imagery assisted in the ability to look deep into urban space.
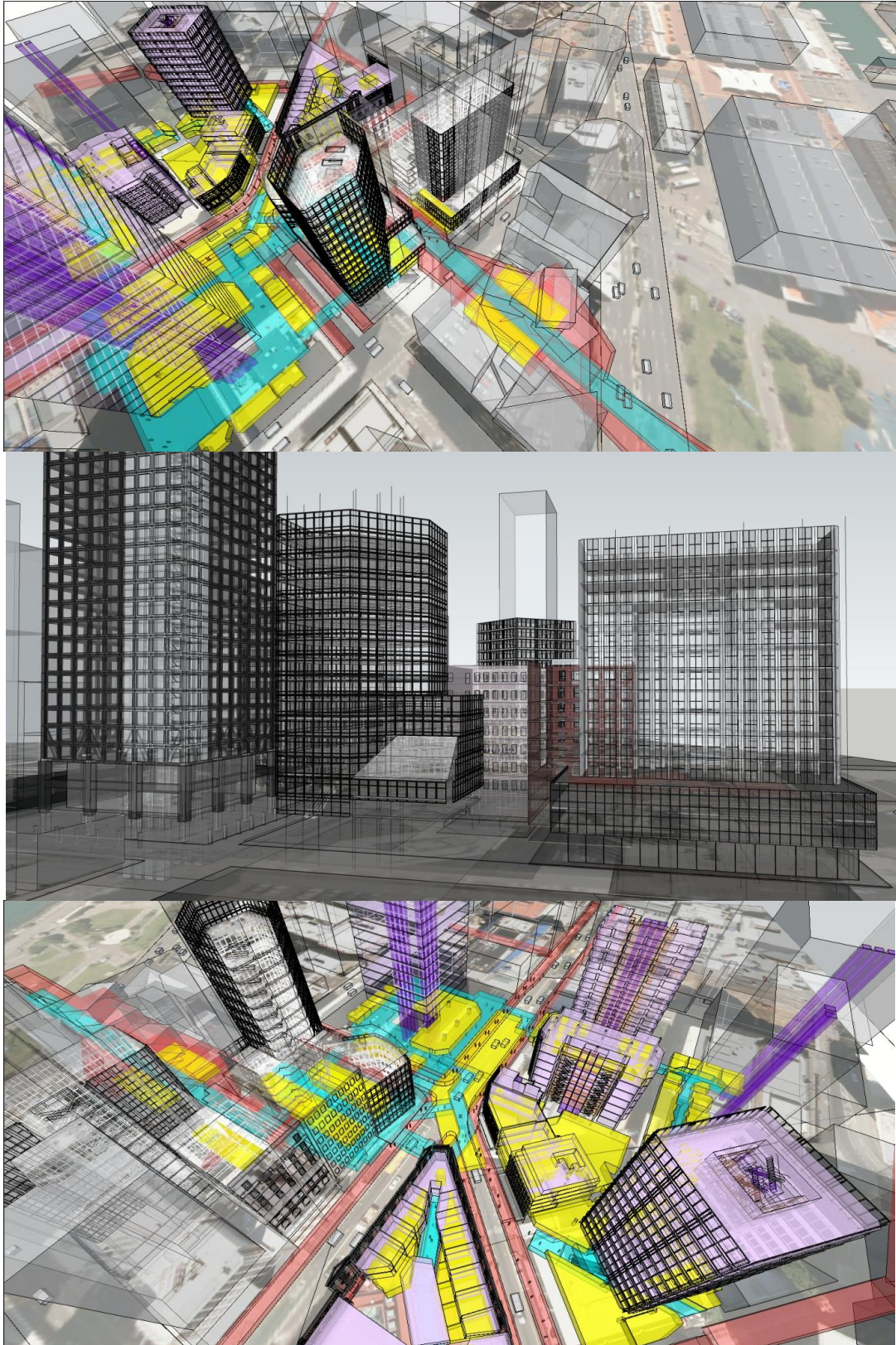
Figure 9. Like the ethereal motion of internal organs and the movement of the supply of blood around the human body, the urban body shares critical flows of inhabitants through and around spaces. Animations [see attached CD] have allowed a new ability in representation of architectural and urban modelling allowing a critical aspect of urban functioning to be observed that has not been captured in conventional plans.

The Art and Science of the Dissected Body and Medical Imagery

The impact that accurate medical imagery has had in the field of medicine through the ability to relay information produced from performed dissections to a wider audience, has transformed medicine. From the sixteenth century information recorded about the internal workings of the body has assisted the collection, distribution and advancement of medical knowledge. Leonardo Da Vinci and his sacrilege pioneering of medical dissection and recording is often credited with three conventions of anatomical illustration that is today an important text book representation of dissected bodies; Rotation of specimens so that the same portion of anatomy can be viewed from multiple points of view; Transparency and overlaying of exterior and interior parts of the body; And transverse section which provided an architectonic understanding of the relationship of the whole to individual parts. These advances helped to produce drawings of what could be, or should be, happening inside the human body. Prior to such reproduction many inaccurate drawings and diagrams were produced leading to misinformation, misunderstanding and misdiagnosis. To produce accurate drawings from real dissections of the real state of the body leads to modern medicine. Even today, medicine is highly dependent on accurate imagery.

Modern medical tools and equipment has seen the advancement of imagery where perhaps the most penetrating, tactile vision existing today. The use of medical scanning and probing devices, from X-ray machines to magnetic resonance imaging and ultrasound allow an unprecedented degree of insight into how natural bodies work without physical dissection and thus allowing doctors and physicians to understand how bodies function while alive and in motion.

The Futurists seems to have been the first to address this technology's potential for a new art of transparency. Laszlo Moholy-Nagy borrowed a quotation from a 1912 Futurist statements that read:

Who can still believe in the opacity of bodies, since sharpened and multiplied sensitiveness has already penetrated the obscure manifestations of the medium? Why should we forget in our creations the doubled power of our sight, capable of giving results analogous to those of X-rays?

While architecture has produced volumes of critical discourse on representation, drawing and images, urbanism has been relatively unconcerned with this area. This chapter looks at how Anthropomorphising the body of the (cyborg) city, and undertaking dissections can reveal deeper undersigned morphologies that can be of significance. That can be further discussed and documented. It is ahapter that has hitherto been missing from urban discourse.

In anatomy, the ecorche is a flayed skeleton made either from real cadavers or other materials. In art, it is a two- (in the case of drawings) or three dimensional (in the case of plaster or bronze casts) representation of the human body, in which the envelope of skin and fat has been removed. It is used to depict the surface muscles with anatomical correctness. Artists used ecorches as a check on their life drawings, and they offered surgeons a reminder of what they had dissected and guided future operations. (Landes, 2007, p. pp97)
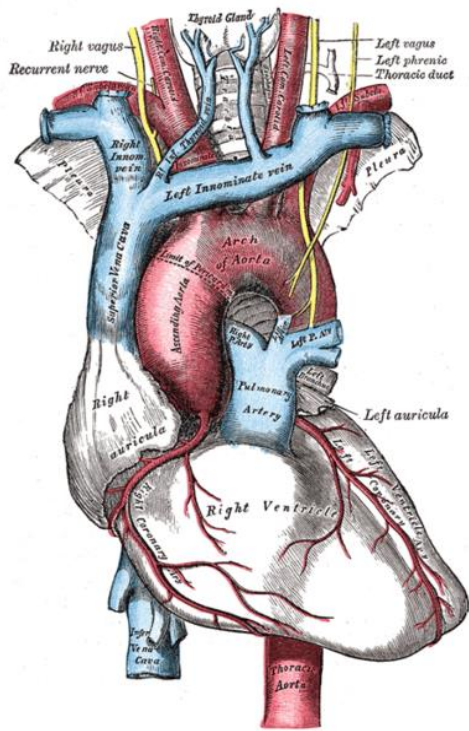
Figure 10. Illustration of a heart from the book *Gray's Anatomy*. Medical imagery has been invaluable to medicine and revolutionizing the way human anatomy is understood.

As was discussed earlier, cyborg discourse applied to the city that the "metaphor allows for the simultaneity of concrete and imaginary perceptions of urban infrastructure so that the categories of the 'real' and the 'virtual' become interconnected facets of urban experience. The cyborg metaphor is, in other words, peculiarly suited to an understanding of the contemporary metropolis not only as an morphological entity entwined with various technical and aesthetic discourses, but also as an abstract and inter-subjective realm through which political and cultural ideas become constituted or 'fleshed-out' in parallel with the concrete development of the city." These discussions are critical in that it does not become entrapped into 'reductionism' and 'uni-dimensionality' of modernism and that it allows a deeper and more structured discussion of complexity within the spatial city.
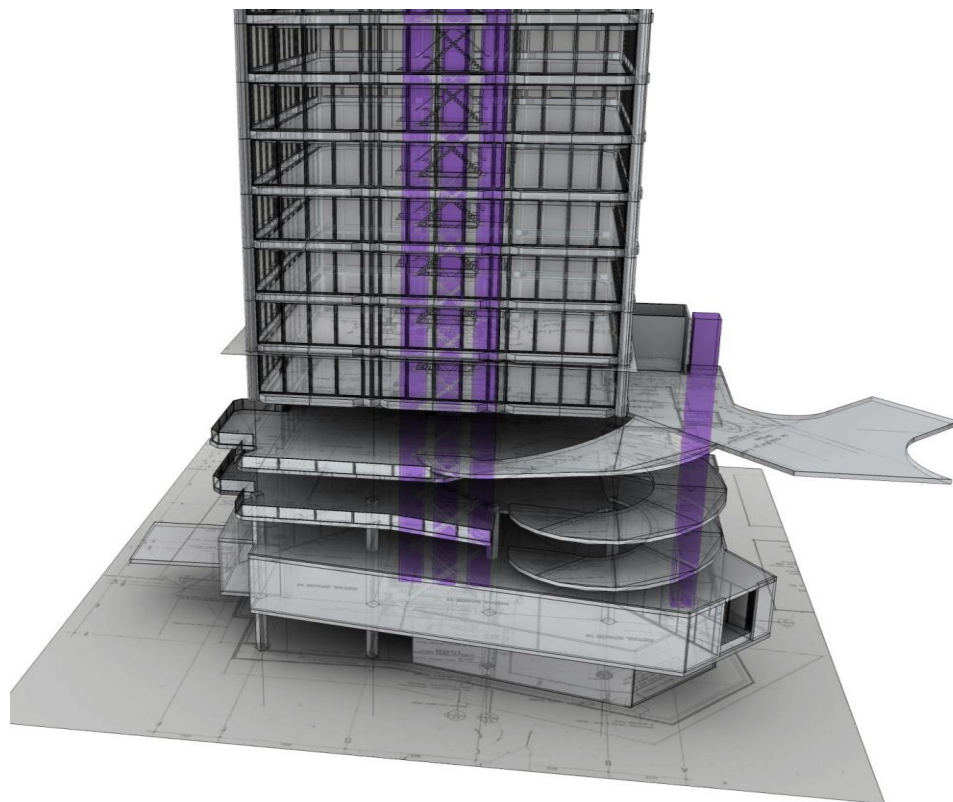
Figure 10. Many buildings act like vital organs creating places of activity to help the healthy functioning of city. Breathing in the necessary outside populace extracting out valuable productivity and breathing out spend the spend populace.

Limitations of Conventional Representation; Mapping to Modelling

The studying of spatial morphologies has been an important tool in understanding the evolution of cities for many decades. Whether it has been from the popular figure ground analysis, aerial photography, maps or more recently GIS modelling, the way parts of cities are interconnected, built on, utilised and transformed to make patterns appear on the landscape has informed urbanist's on the nature of the growth of the physical built urban form.

The extra spatial dimension of modelling over mapping reveals a much richer simulation of what is occurring within the built fabric of the city. While mapping can represent a third dimension of height or density by tone or colour as often is, this certainly more of a 'coding' exercise in mapping which can be ambiguous and abstract.

Modelling reveal morphologies that will not appear in mapping exercises

The mapping exercise that has been undertaken for this research, has built multi-dimensional digital models of a sample area of Wellington city to identify three dimensional spatial morphologies of public and semi-public and private/corporate space.
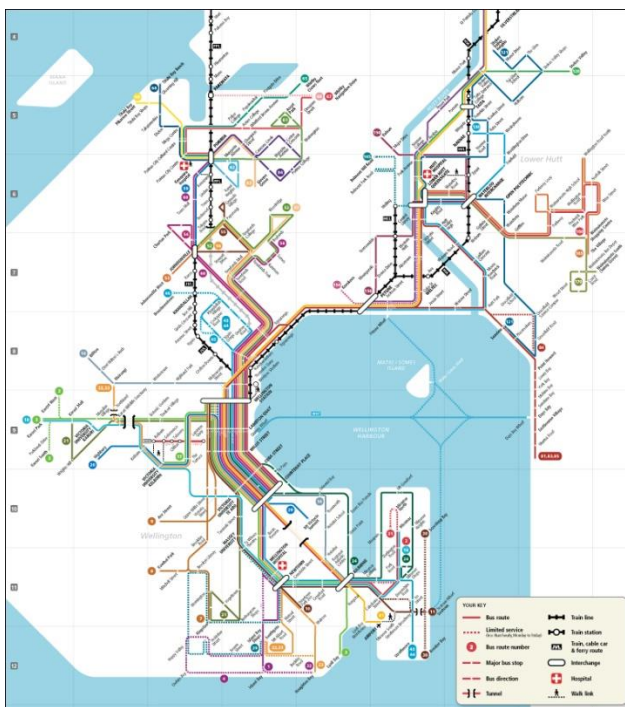
Figure 11. The specimen is not a self contained unit, but an intricately connected location with a wider distribution of connections. This interdependency of a wider network is a significant attribute to the complexity, diversity and vitality of the location.
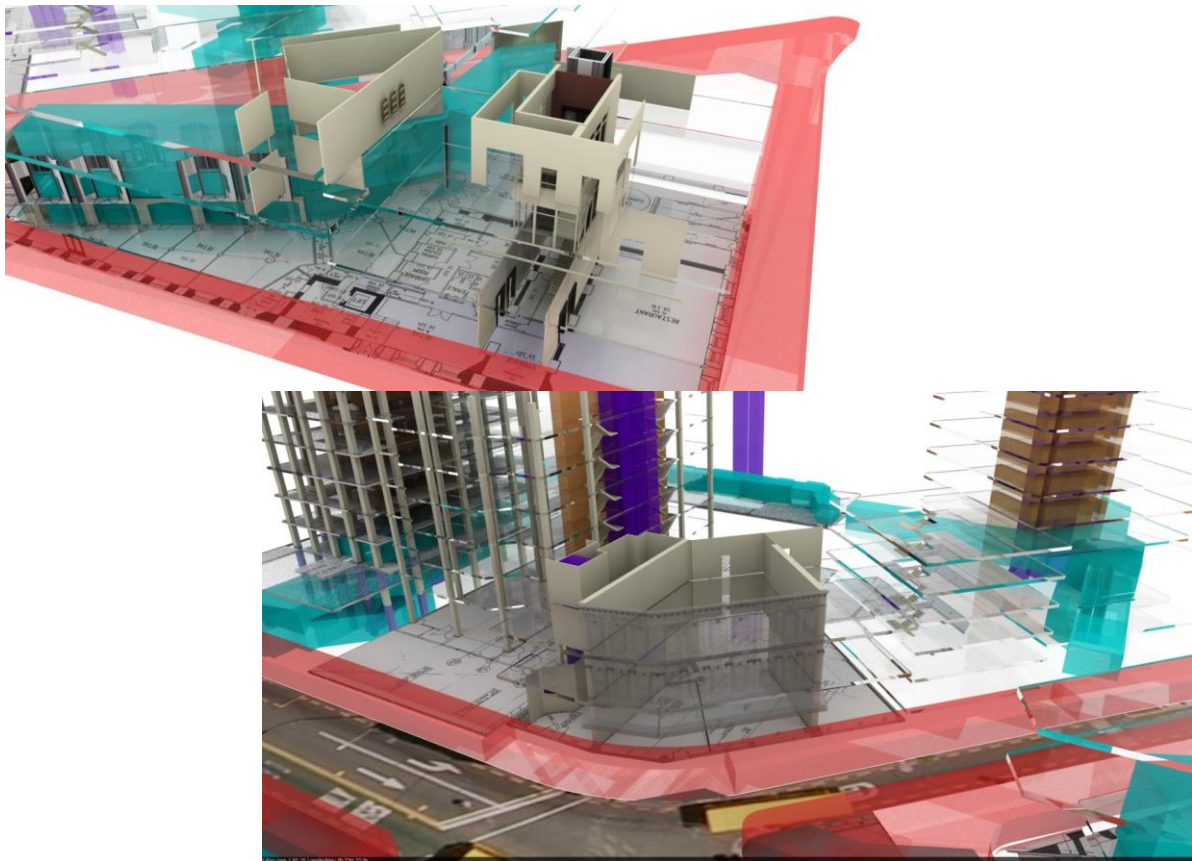
Figure 12. Physical structural anatomy
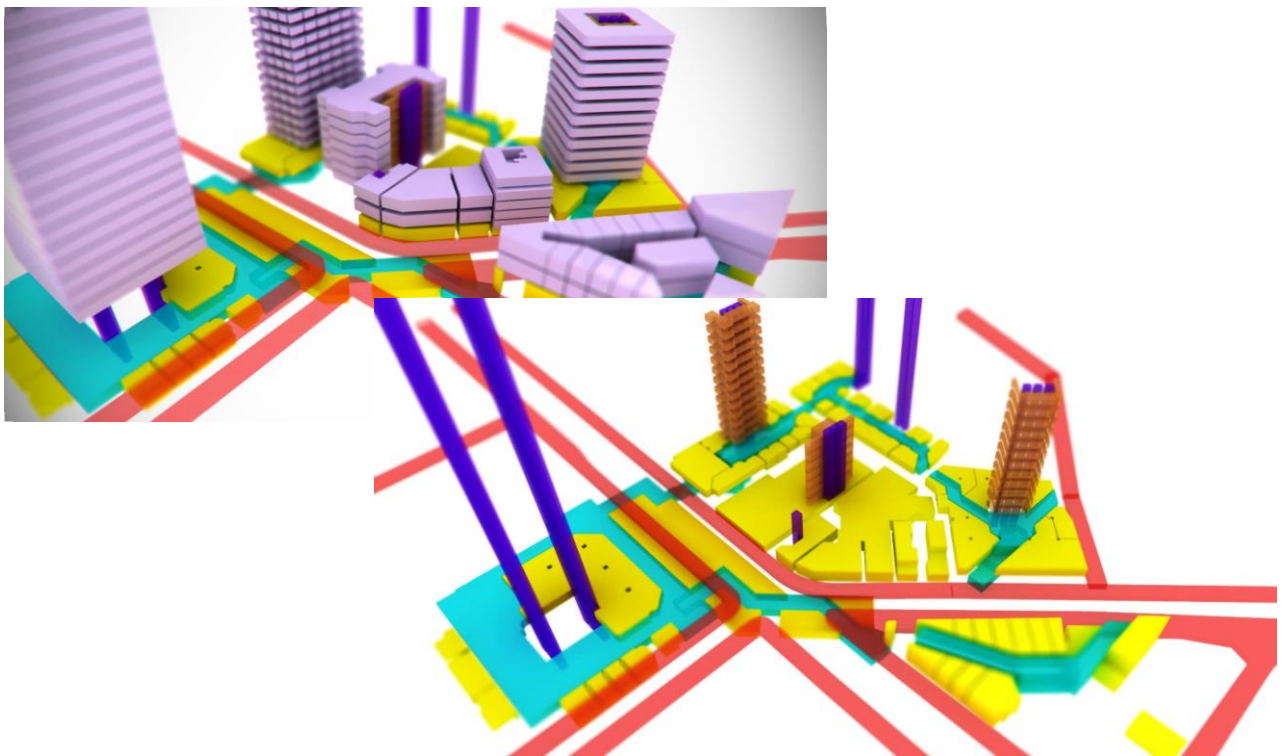
Figure 13. Spatial Anatomical Structure. The different colours represent different spatial usages including pedestrian, vertical access, retail space, commercial space and building services.

5.2

Diagnosis - the anatomical structure of the city

This type of investigation is not intended to lead to deterministic conclusions but explore what potential empirical knowledge from dissections may unveil. Thus far, it has unveiled a complex interrelationship of existing architectures into one spatial element. These complex interrelationships can be interpreted as morphological anatomy of the city.

The street is unarguably the life blood of cities; the core arteries and veins. It is in the streets where the important movement takes place. But the observations that have been undertaken for this research have unveiled a secondary anatomical infrastructure. One that exists within the buildings and architecture, an infrastructure that assists the streets by taking its utility where streets are unable to go

This type of exploration can identify morphologies, patterns and characteristics that have already evolved within the body of the city.

Furthermore, the unconventional representation allows us to look at a multidimensional perspective that goes beyond the conventional, and explores the hypothetical.
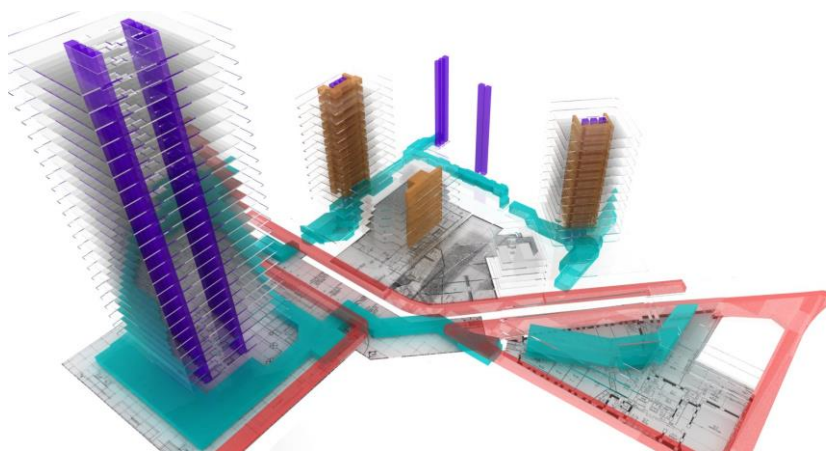
Figure 14. The blue anatomical structure reveals an internal connectivity of several different buildings of varying ages. This type of morphological change is still in its infantile stages.

A continuous modelling of the same area over several generations of buildings could potentially reveal evolution of spatial morphology and monitor dynamic changes in a living city. This could be utilized to catch potential problems or identify possible solutions for other problem areas in the future.

6.1

Prognosis [reprogramming Jacobs to go Vertical]

While Jacobs used the word 'problem' as an identifier for the complex issue that a city is, the word 'problem' is probably better interpreted as possibilities and potential that have been underutilized. This chapter is a brief exploration of the idea of extending the possibilities and potential of the street and its 'ballet' by applying Jacobs in a multidimensional manner. Specifically it is a testing of modalities of the vertical. It aims to devise mechanisms to enhance ubiquitous diversity; an exploration of urban diversity applied to multiple dimensions of the city in order to create a more opportunisitic urban prototype. It is an experiment that takes advantage of the opportunities of the anatomical infrastructures of the city that have already established themselves and were uncovered and discussed in the diagnosis.

Diversity has become a growingly important key word in urban discourse since Jane Jacobs. For American cities, she claims, all kind of diversity in intricately mingled mutual support are a creation of an incredible number of different people and different private organisations. Each with vastly differing ideas and purposes, planning and contriving outside the formal framework of public action. This creates cities that are congenial places for this great range of unofficial plans, ideas, and opportunities to flourish, along with the flourishing of the public enterprises. (Jacobs, 1993)

Her success has helped nurture more vibrant and culturally sustainable public arenas. The goal is to utilize this urban discourse and philosophy to help architecture become more diverse and generous toward more complex cities.

The benefits of casual interactions, often among strangers, can be described as "like pennies dropped in a cookie jar, each of these encounters is a tiny investment in social capital." (Ellin, 2006)

The urban dissection and investigation has revealed sub-infrastructures that weave and interconnect much of the architecture on the site, but is it possible to expand these morphological anomalies to create a complex multi-dimensional urbanism?

City diversity, by morphological observation, occurs primarily at street level. This experiment offers an insight into what ubiquitous diversity may look like.

As highlighted in chapter II, we identified that "a lively city scene is lively largely by virtue of its enormous collection of small elements" and that diversity in a city leads to vitality and more importantly "city diversity itself permits and stimulates more diversity" (Jacobs, 1993).

Jane Jacobs was always conscious of the happenings of the city and wrote of the vitality and diversity (or lack of). Chapter IV created a visual picture of this and highlighted its successes and shortfalls.

Cutting into the city has unveiled the internal form, revealing morphologies and urban structures that are otherwise unmapped. The structures that are anatomical infrastructure are a natural morphology (not part of a master plan). There is more potential however in the latent unformed spatial areas of the internal city that is of primary concern.

But what is more important is how these diverse numbers of parts interact with each other that make each interdependent. "The diversity, of whatever kind, that is generated by cities rests on the fact that in cities so many people are so close together, and among them contain so many different tastes, skills, needs, supplies, and bees in their bonnets...When distance inconvenience sets in, the small, the various and the personal wither away."

A Re-Conceptualization by way of Re-Visualisation

> *Our old ideas about space have exploded. [In] the past three decades ...entirely new spatial conditions, demanding new definitions, have emerged. Where space was considered permanent, it now feels transitory - on its way to becoming. The words and ideas of architecture, once the official language of space, no longer seem capable of describing this proliferation of new conditions.* (Koolhaas, 2003, p. pp1)

This concept delves into a virtual stimulation of typology to develop new morphologies of space. The prototypical skyscraper of modernity, of which the State Insurance Tower is, is the pure expression of the organization of work as offices. It is "the optimized form to archive and connect workers who archive and connect data." (Abalos, 2010) Architects such as Mies van der Rohe pioneered the rectilinear prisms of glass and steel, artificially climatized, and organized in rings around a communication and service core. And though it has been become as familiar, and the typology as abundant, as cities themselves, Verticalism and the contemporary city in vertical terms has only just begun. Offices and office workers are no longer the only occupant of high rise architecture. We are now seeing vertical university campuses, vertical museums, vertical libraries, vertical laboratories, vertical retail, vertical convention centres, vertical recreation, conceptualizations of vertical farms as well as all of these mixed with residential, hotel, and office typologies. These mixed buildings can become authentic cities in which the building elevational section has become what the city plan represented until now.

In chapter V, a morphology that was identified as a quasi-infrastructure provides a new physical structure to begin to mould. Jacobs' work has been an underlying analysis to providing solutions to healthier streets. Is it possible to apply the same programming tools to created better architecture?

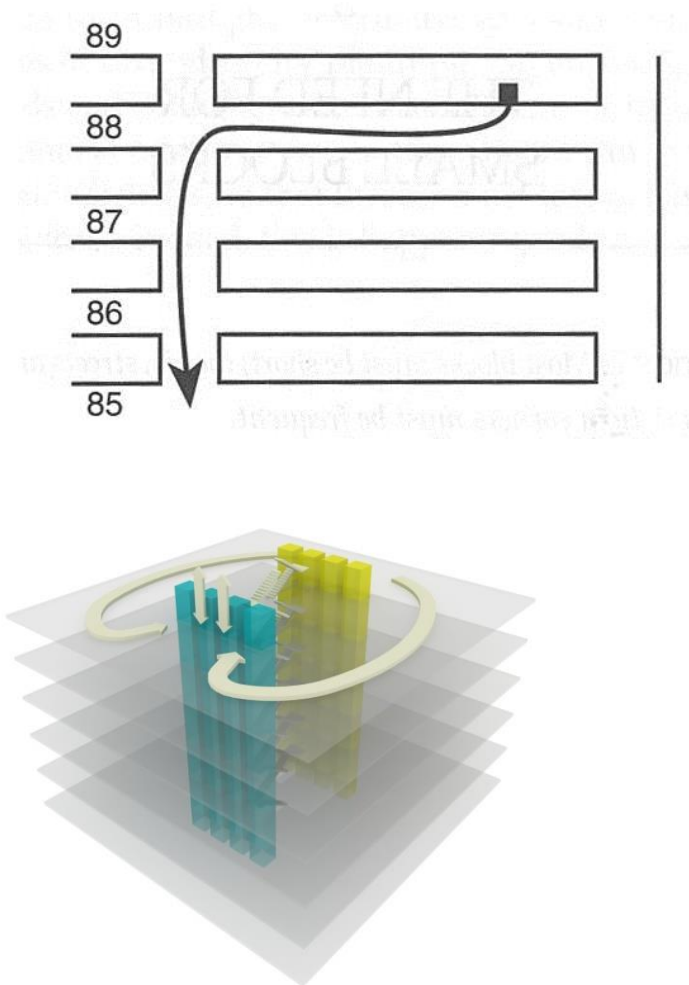*Stimulating Secondary Diversity Vertically - A playful experiment*

In the chapter *The Generators of Diversity* of *Death and Life of Great American Cities*, Jacobs discusses secondary diversity as "a name for the enterprises that grow in response to the presence of primary uses, to serve the people to the presence of primary uses".

Primary use in the observed area is business. Secondary includes those business that meet the demands of those working in business including hospitality and retail.

The design I propose creates a secondary diversity within the mass of the large buildings, recreating diversity at multi-dimensions.

Figure 15. Traditional floor plates are a stack of slabs that maximise floor space by limiting connectivity to the core

This experiment deals mainly with the conventional logic of floor plate architecture – logic invented for the twentieth century. Floor plates stacked upon another constructed vertically around a lift/services core has been the staple for high rise architecture since its conception in the nineteenth century and its full deployment in the twentieth century. Similarly to the mass production of cars in the early twentieth century that transformed cities and altered the logic of scale and movement, the elevator has exploded the potential of cities. It has been an extremely successful model for architecture since its conception, but as we move toward more complex social and economic structures, space has to accommodate these new evolved organizations. The problem with the configuration of conventional stacked floors is that inter-floor play and interactions are severely limited which makes space limited to the floor space. Users must utilise elevators. Stairwells are provided but for safety precautions must be tucked away within the core and sealed by fire safety doors, which make it unpractical as an architectural accessory.

The lack of inter-floor play reduces spatial connectivity. Jacobs discussed an analogous problem at street level with city block sizes.

In Jacobs' book Death and Life, diagrams expressing the opportunities created from smaller city block sizes were included. While she did not think of this as a network diagram, but it may certainly help. Kenzo Tange said "Creating an architecture and a city may be called a process of making the communication network visible in a space" (Wigley, 2006, p. pp388).This design, explores the effects of mis-reading and mis-applying those diagrams architecturally and vertically. Assuming the current streets exist as elevator connections and stairwells.

If we re-interpret Jacobs's idea of city block sizes as an analogy of vertical floor plates and elevators we can begin to apply urbanism on an X, Y and Z dimension rather

Figure 16. A simple modification to create inter-floor play would be to create publicly and easily accessible flight of stairs.

than the traditional X.Y. scale. If we look at the first diagram, it is a plan of several city blocks but if we read it as an elevational section we can read it as floor-plates and vertical shafts.

This type of vertical street lets us play out urbanism on more than just the street level. There is an opportunity to really push the boundaries of urbanism and architecture where they each become each other.
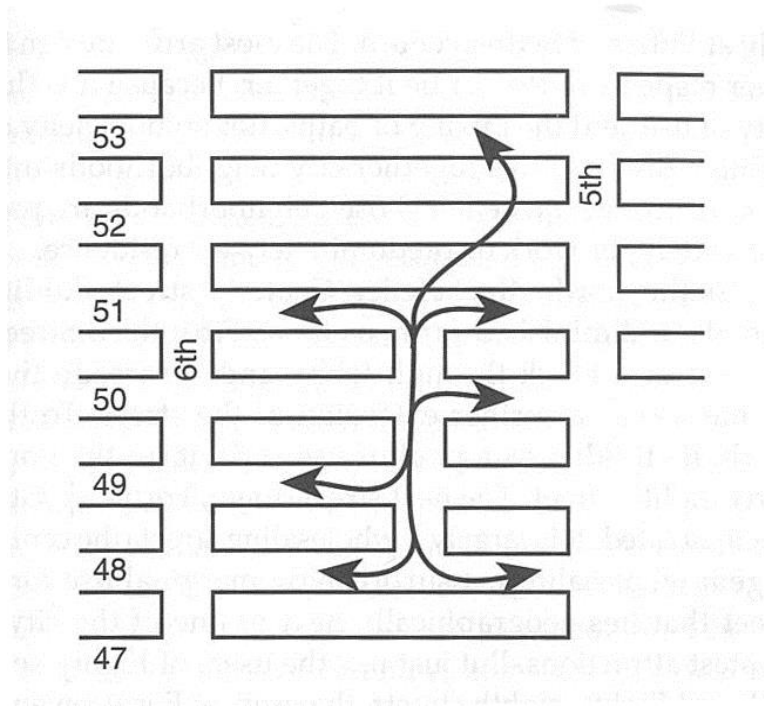
Elevators and central cores of high rise buildings offer a similar situation to a main street. To travel from one floor to another requires travelling through the main core. If smaller block sizes mean shorter travel distances and higher frequency of users, can a similar method applied to floor plate sizes and travel between them mean higher usage diversity?

Morphological Anatomy

This design does not seek to create building, it seeks to exemplify the inner workings of cyborgism and its anatomical morphology.

The design seeks to encapsulate, embrace, clarify, test, and redefine the current theoretical bounds of urban discourse.

Fluid Space

Creating a fluidity and permeablity of space to create smoother transition and more connectivity,

Figure 17. A more laborious system would be to stagger the floor-plates. This would allow a more efficient vertical street. This would allow tenants and users of the building to intermingle in new dynamic ways.

stronger communication and new unrestrained morphologies. The potential for new complex spatial morphologies becomes ubundant, in which new innovative spatial dynamics can thrive.

6.3

The New City Taking Shape

This design has been a re-conceptualisation of the potential and possibilities of the vertical city. It has been a discussion of an emergent city. One that takes its own shape. The new conceptualisation of the city will require understanding spatial connections and connectivity crossing urban and architectural scales in much finer detail in order to understand more complex relationships. This experimental testing has shown urbanism can exist at a different scale and a different dimension to traditional conception of urbanism. By no means does this concept attempt to propose an economical, efficient, or even viable solution to urbanisation. It merely entertains visuals methods of expanding and representing hypothetical models and exploring the idea of complexity and diversity through cities to visualize possible scenarios. Ideally the goal been to use Jane Jacobs as a departure point to see the expansion of her idea of streets of vitality into a multidimensional realm. The idea of streets existing externally and internally within architecture substantially expands the possibilities of urbanism. What is theoretically being offered in this investigation is possibilities of re-conceptualising what a city could into, in order to prepare language for morphologies that are at this stage only at infantile phase.   What is being investigated is the causality of

morphological anatomy. This design proposes that this can be achieved through fluid space and strong multidimensional connectivity
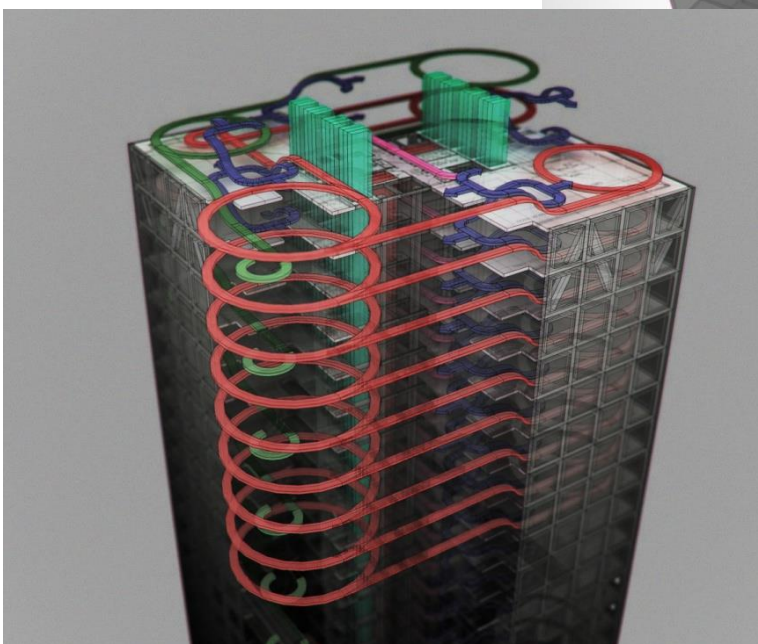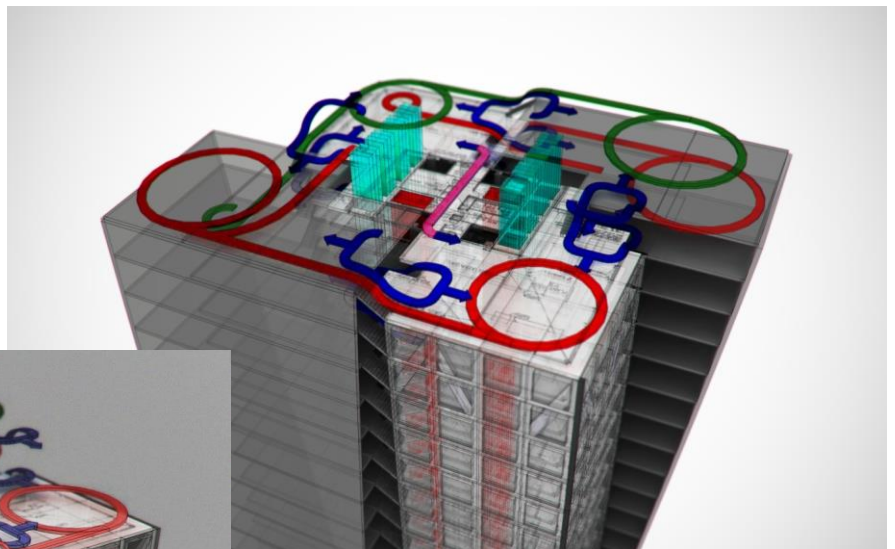
Figure 19. The white area represents existing typology. The black area represents experimental intervention. The design itself is a very simple gesture of shifting the floor plates vertically half a stud height. This type of gesture allows a fluidity between floors creating new dynamic interflow relationships that allow the movement and interaction of tenancies that have been roughly postulated in colour.
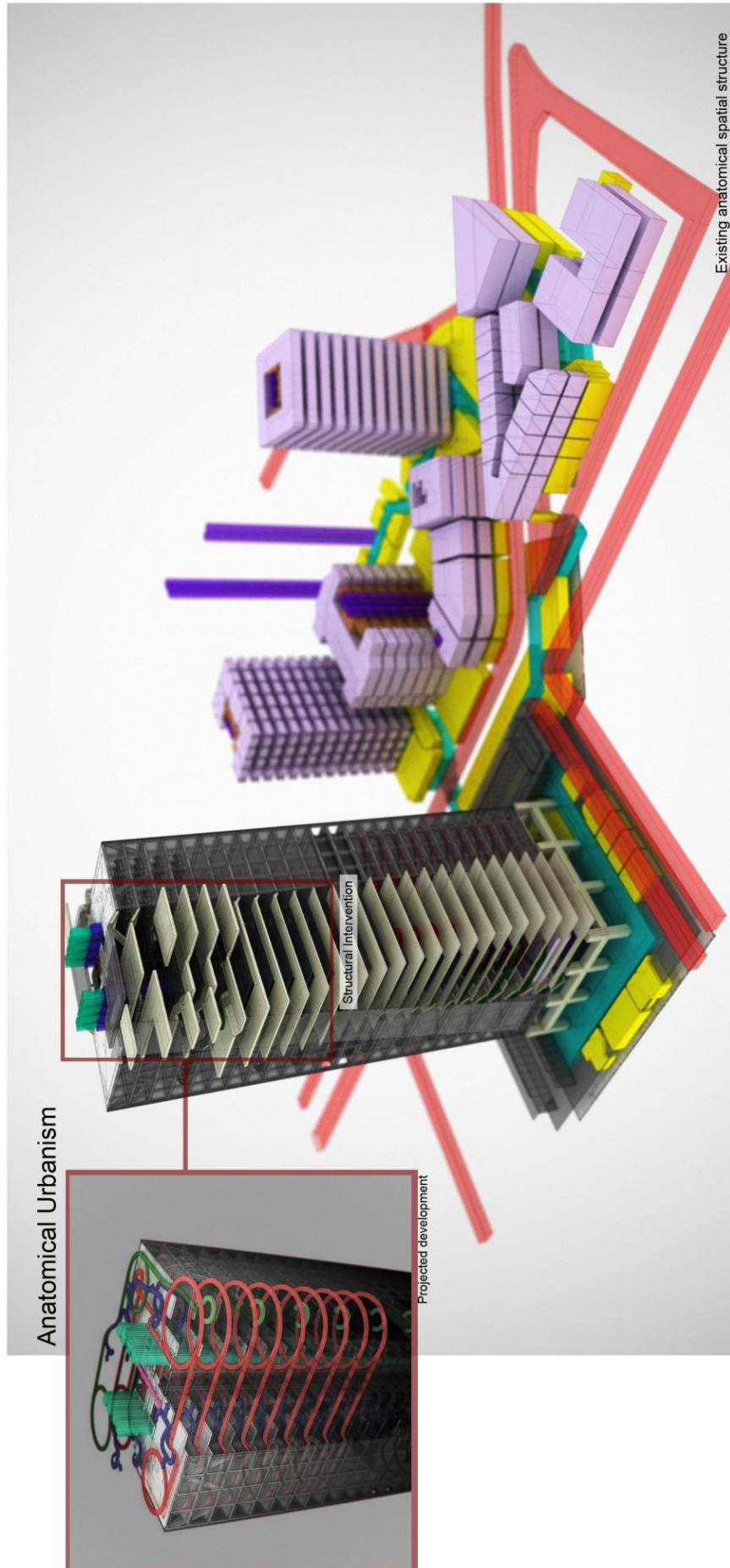
Figure 18

Anatomical Urbanism

Structural Intervention

Existing anatomical spatial structure

Projected development

Figure 20

CONCLUSION

This three part thesis is a body of work that considers the kind of problem a city is. It cites Jane Jacobs as a point of departure to explore the best method of identifying what kind of problem a city is. It does so by challenging deep cognitive assumptions of our knowledge about the city and what is or might be thought of as 'common sense' in urban thinking. Jacobs by challenging orthodox modernism offered a different perspective of the city than her predecessors and has thus far has proved to be a reliable teacher for how to observe a city through empirical means. While Jane Jacobs introduced through insightful research and observation that complexity science is the best method for identifying the kind of problem a city is, this does not necessarily mean that this will always be the case. i.e. consistently challenging the grounded theory and gauging it against the fabric of the city is a necessary process for finding the contemporary crux of urban knowledge because urban spatial structures as well as the collective way the world is perceived is constantly changing and evolving.

This work has identified that for urban discourse to be grounded to its contemporary condition, its epistemological base must be the first port of call. How we come to know what we know is the primary point of departure. Once the epistemological point of departure has been established, a framing, or as the case may be, a re-framing of knowledge may be assisted by the use of metaphor as a focusing lens and a framing device. The contemporary reception of metaphor as a legitimate tool in allowing researchers to grasp new concepts is critical to offering a framework to the complex problem that cities are. The final part of the thesis looks at spatial aspects of urbanism and creates tools for observing and recording the multidimensional morphological aspects of a block of a city. The design concept being offered is a look at how the capacity of a city could be extended multi-dimensionally, and titles this morphological aspect as 'a city taking shape'. This empirical exploration of morphology is an important process of gauging the theoretical concerns of contemporary discourse.

Part I

Epistemic Urbanism

Empiricism and the recognition of scientific revolution has allowed and fostered an alternative model of contemporary science called complexity to emerge and flourish through the twentieth century. Modernisms' failure through its uni-dimensionality and rationalist methodology was unable to cope adequately with the empirically observed paradigm of complexity. Post-modernism welcomed complexity as a critique of modern epistemology. However the post-modern movement was not able to properly frame or utilise complexity into a constructive discourse. There now exists opportunities in the

contemporary condition to frame and mould complexity into a constructive instrument for studying urbanism.

Chapter two, discusses complexity, its nature, and its ability to describe urbanism. Identifying cities as problems of complexity helps to identify that lively, resilient cities are products of diverse, complex environments.

Part II

Epistemic Tools

Part II discussed how to best frame urban knowledge. Metaphor was shown as a legitimate and necessary tool for framing urbanism. Though it may be thought of as a fallible means of discussing something so important as cities, changes and advances are occurring in cities that must be talked about and theorised though new narratives. This can be achieved by through the ambiguity and novelty, but yet constructive, use of metaphors. More significantly however, is that Cyborg discourse was identified as a contemporary solution.

The difficulty with comprehending the kind of problem that a city is, is not that there is no framework of understanding the city as a complex entity, the problem lies in that the frameworks that are being offered are fragmented and/or difficult to understand.

Chapter IV introduces the idea of cyborg discourse as a structural metaphor in designing strategies of investigation of cities. The contemporary world is a place where the realm of the born and the realm of the made are blurring and becoming one. I.e. machines are becoming biological and the biological is becoming engineered. The city is something both made and alive. Or as Kevin Kelly has better put it, "the world of our own making has become so complicated that we must turn to the world of the born to understand how to manage it" (Kelly, 1994, p. pp2). Traditionally cyborg and cyborgism is an ontological and epistemological tool for philosophically questioning the post-human condition. It concentrates on the blurring of the human body and mind with technology. For this study, I have entertained an unconventional borrowing of the concept of cyborgism by expanding its scope. Identifying the city as a dualistic relationship of a body of two components; the fabric of the city as technologic skin and the inhabitants as the soft biological organics.

The adoption of this kind of metaphor allows for a new epistemological strategy of studying the city through the embodiment of information and knowledge.

Part III

Epistemic Space

Chapter V picks up from the idea of a city as cyborg and investigates the inner (interior) dimensions of the urban fabric. By studying the 'anatomical' morphology and subjecting it to methods of investigation; specifically dissection, it is possible to begin to speculate on delicate but critical aspects of the functioning of urban space. For too long, urbanists have largely ignored the complex spatial elements of the interactions of multiple architectures and infrastructures interacting and becoming co-dependent on each other to provide the 'ballet of the streets' that give vibrancy to places.

While at first, 'dissecting a city' may seem trivial, but dissection has revealed a significant amount of information about bodies, notably the human body, that has reshaped our knowledge to better understand the object/subject that is being studied.

In the small and preliminary dissection undertaken for this study, an interlinking quasi-infrastructure was identified. Part III described the investigation and design concept. The idea is to stagger floor plates of traditional high rises to create better spatial flows between levels. These spatial flows (fluid space) allow inter floor play that could potentially lead to different tenancies to interact and form unique relationships. These relationships could form new patterns that lead to different spatial needs and layouts that the existing typology.

The Kind of Problem a City Will Always Be

Epistemologies, Observations, Frameworks and Strategies

For the advancement of urban discourse to take place, it must first search for its epistemological foundations. Without first understanding how knowledge is known, then there will always be struggles over who's knowledge is more accurate or relevant to contemporary urban discourse.

Jane Jacobs, with her empirical knowledge and her reactionary stance of orthodox planning, broke down the oppressive epistemological walls of the Post-Enlightenment thinking of Modernism. And while no leading school of thought has yet taken Modernisms place, it has offered an opportunity for and paved the way for new empirical methods of learning and developing ideas.

Furthermore, urbanism is not a standalone discourse. Sciences, and other spheres of learning have much to teach and their frameworks offer substantial headway into discovering dynamically evolving truths about our cities. There are no longer dogmatic rules that segregate domains of learning and knowledge

and there are tools i.e. linguistic metaphors which offer a new found freedom in sharing domains of thinking.

The use of cyborgism as a lens for framing and studying urbanism may at first appear eccentric, alien and science fiction, but the richness of the cyborg concept allows a negotiation of multiplicities of spaces and practices simultaneously; one of which is anatomical dissection, and in so doing so develop epistemological strategies for the interpretation of urban life which come closer to the contemporary condition than those approaches which long for the mechanistic or deterministic simplification of their object of study.

At a time when cities are breaking away from the homogeneity of modernism and learning to take their own genuine shape, it is paramount to learn to understand its direction so that we as designers are better able to support and guide its growth. The deeper we question and critically engage with contemporary epistemological struggles, the better we will come to understand the contemporary condition, the better we can mould our cities to our real needs and demands.

Bibliography

Abalos, I. (2010). Verticalism (The Future of the Skyscraper). In M. Mostafavi, G. Doherty, & H. U. Design., *Ecological urbanism* (pp. 610-615). Baden: Lars Müller.

Agrest, D. (1988). Architecture from without: Body, Logic, and Sex. *Assemblage, No.7*, 28-41.

Batty, M. (2007). *Cities and Complexity: Understanding Cities with Cellular Automata, Agent-Based Models, and Fractals.* Cambridge: MIT Press.

Baudrillard, J. (1994). *Simulacra and Simulation; translated by Faria Glaser.* Ann Arbor: University of Michigan Press.

Bird, A. (2004, Aug 13). *Thomas Kuhn.* Retrieved Nov 2010, from Stanford Encyclopedia of Philosophy: http://plato.stanford.edu/entries/thomas-kuhn/

Cooke, P. (1990, Vol. 15 No. 3). Modern Urban Theory in Question. *Transactions of the Institute of British Geographers, New Series*, pp. 331-343.

Ellin, N. (2006). *Integral Urbanism.* New York: Routledge.

Frascari, M. (1991). *Monsters of Architecture.* Maryland: Rowman & Littlefield Publishers Inc.

Friedman, M. (2002, June Vol.69 No.2). Kant, Kuhn, and the Rationality of Science. *Philosophy of Science*, pp. 171-190.

Gandy, M. (2003). *Concrete and Clay: Reworking Nature in New York City.* MIT Press.

Gandy, M. (2005). Cyborg Urbanization: Complexity and Monstrosity in the Contemporary City. *International Journal of Urban and Regional Research Vol. 29 March*, 26-49.

Goldsmith, A. S., & Elizabeth, L. (2010). *What We See: Advancing the Observations of Jane Jacobs.* Oakland: New Villiage Press.

Harvey, D. (1992). *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change.* Oxford: Blackwell Publishers Ltd.

Hashimoto, J. (2010, Summer). Redifining Collectivity. *JA: The Japan Architect*, p. Editorial.

Hersey, G. (1988). *The Lost Meaning of Classical Architecture.* Cambridge London: MIT Press.

Hight, C. (2008). *Architectural Principles in the Age of Cybernetics.* New York and London: Routledge.

Jacobs, J. (1993). *The Death and Life of Great American Cities.* New York: Modern Library.

Jencks, C. (1995). *The Architecture of the Jumping Universe.* London: Academy Editions.

Kant, I., & Translated by Meiklejohn, J. (2003). *Critique of Pure Reason.* New York: Dover Publishings, Inc.

Kant, I., & Translated by Nisbet, H. (2009). *An Answer to the Question: What Is Enlightenment?* Penguin Books.

Keller, E. F. (2002). *Making Sense of Life.* Cambridge: Harvard University Press.

Kelly, K. (1994). *Out of Control: The New Biology of Machines, Social Systems, and the Economic World.* New York: Basic Books.

Koolhaas, R. (1994). *Delirious New York: A retroactive manifesto for Manhattan.* New York: Monacelli Press.

Koolhaas, R. (2003, 11 06). *The New World: 30 Spaces for the 21st Century*. Retrieved 02 28, 2011, from http://www.wired.com/wired/archive/11.06/newworld.html

Kruft, H.-W. (1994). *A History of Architectural Theory From Vitruvius to the Present.* New York: Princeton Architectural Press.

Kuhn, T. S. (1996). *The Structure of Scientific Revolutions.* University of Chicago Press.

Lakoff, G., & Johnson, M. (1980). *Metaphors We Live By.* Chicago London: The University of Chicago Press.

Landes, J. B. (2007). The Anatomy of Artificial Life: An Eighteenth-Century Perspective. In J. Riskin, *Genesis Redux: Essays in the History and Philosophy of Artificial Life* (pp. 96-116). Chicago: Chicago University Press.

Lenoir, T. (2007). Techno-Humanism: Requiem for the Cyborg. In J. Riskin, *Genesis Redux: Essays in the History and Philosophy of Artificial Life* (pp. 196-220). Chicago: Chicago University Press.

Lynch, K. (1960). *The Image of the City.* Cambridge: The MIT Press.

Lyotard, J.-F. (1984). *The Postmodern Condition: A Report on Knowledge (translated from French by Geoff Bennington and Brian Massumi).* Manchester: Manchester University Press.

MacCormac, E. R. (1985). *A Cognitive Theory of Metaphor.* London: The MIT Press.

March, L. (1998). *Architectonics of Humanism.* West Sussex: Academy Editions.

Marshall, S. (2009). *Cities, Design & Evolution.* London New York: Routledge.

McEwan, I. K. (2003). *Vitruvius; Writing the Body of Architecture.* London: MIT Press.

McEwen, I. K. (2002). *Writing the Body of Architecture.* Cambridge: MIT Press.

Mehmood, A. (2010). On the History and Potentials of Evolutionary Metaphors in Urban Planning. *Planning Theory*, 63-87.

Perez-Gomez, A. (1983). *Architecture and the Crisis of Modern Science.* Cambridge and London: MIT Press.

Proctor, J. D., & Larson, B. M. (2005). Ecology, Complexity, and Metaphor. *American Institute of Biological Sciences Dec. Vol. 55*, 1065-1068.

Ramachandran, V. S., & Hubbard, E. M. (2003 No.8). The Phenomenology of Synaesthesia. *Journal of Consciousness Studies*, pp. 49–57.

Resnick, M. (1994). *Turtles, Termites, and Traffic Jams.* Cambridge: MIT Press.

Sandercock, L. (1998). *Towards Cosmopolis.* New York: John Wiley & Sons.

Vidler, A. (1992). *The Architectural Uncanny: Essays in the Modern Unhomely.* Cambridge: The MIT Press.

Whiteside, G. (2010, Apr). *Toward a Science of Simplicity.* Retrieved Sep 2010, from TED; Ideas worth spreading: http://www.ted.com/talks/lang/eng/george_whitesides_toward_a_science_of_simplicity.html

Wigley, M. (2006). Network Fever. In T. Keenan, & W. K. Chun, *New Media Old Media* (pp. 375-397). New York: Routledge.

Wittkower, R. (1998). *Architectural Principles in the age of Humanism.* West Sussex: Academy Editions.

Table of Figures

All images, unless otherwise referenced, are the property of the author.