Designing for Complexity

A systemic approach to spatial relationships in high density housing

DESIGNING FOR COMPLEXITY

A SYSTEMIC APPROACH TO SPATIAL RELATIONSHIPS

IN HIGH DENSITY HOUSING

By

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ABSTRACT

The functionalism and reductivism behind post war modernist high-rise housing typologies like the slab block, failed to understand the impact of this highly condensed circulation on the social interactions of residents. Contemporary high-rise architecture typologies like the point tower still don't account for the complex social needs of inhabitants - providing isolated group activity spaces in lieu of addressing and elaborating the shape and form of the transitional spaces between the street and the unit door.

This thesis asserts that understanding the complexity of social needs and normative social behavioral patterns will inform an approach to design that will allow for a more humane and socially interactive environment. This thesis design explores Systems Theory, Pattern Language, recent precedents and tactics like clustering, layered gradients of privacy, visual buffering, transparency, texture and materiality in a high-density residential design for Toronto's rapidly intensifying core

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And finally, to my colleagues. No matter how great the conquered summit was, the climb would still be lonely were there no one to share the journey with. Thanks for the trip.

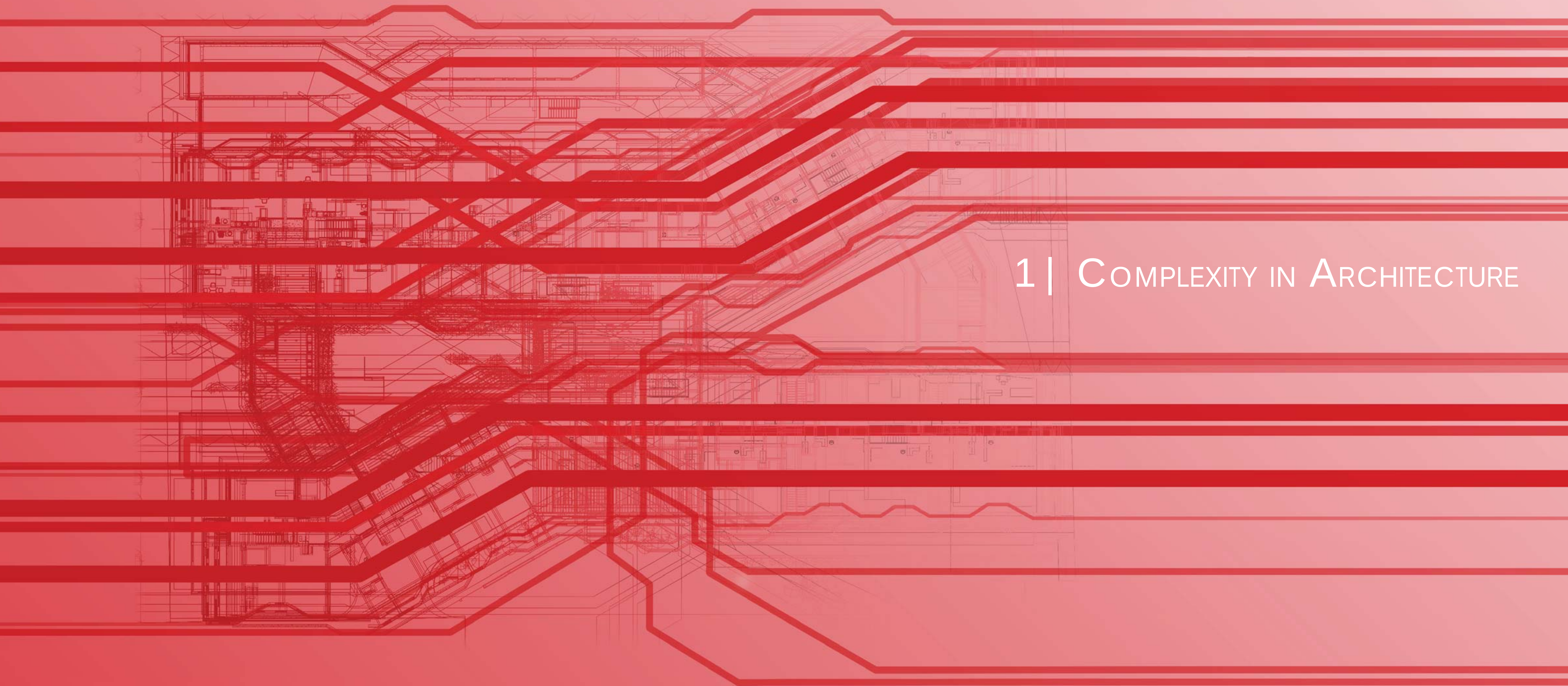
INTRODUCTION

Humans have shaped their understanding of the world from the beginning of the modern period through the lens of deductive analysis. Through deductive logic, all phenomena are broken down into their smallest constituent parts, analyzed and reconstructed to help build an understanding of how they exist and work. While this process is necessary for learning, it does require substantive control over circumstantial variables that relate to various phenomena. This level of control, in practice, is by and large only possible in a theoretical environment. Thus, a high prevalence of discrepancies exists between real-world realities and their theoretical existences. Differences stem from the fact that the real world is much more complex than the theoretical, where context provides an array of variables that significantly affect the outcome of any theoretical solution. From realization of this issue has emerged need for a more critical approach to scientific investigation of matter, one that is more sensitive to the complex nature of reality. The Systems Theory paradigm shift seeks to bridge the divide between theoretical knowledge and the complexity of reality that a deductive method alone is incapable of reconciling.

In reality human actions are motivated by a complex set of needs, which cannot easily be interpreted. All needs exist in a systemic relationship, which one's actions aim to address. The way in which humans interact with the built environment is, as with other actions, the result of the human motivation to address certain needs. Needs may be directly addressed in the built environment, as in the cases of shelter and of warmth. Needs may also be addressed indirectly through the build environment when built space acts as a facilitator that can help, or hinder, a need being addressed. Such is the case with social needs, where space is not a deterministic variable governing social outcome. In order for people to process information, it is necessary to deductively break down larger problems into smaller ones. In many cases, deductive analysis requires a level of scrutiny that necessitates contextual variants to be isolated for the sake of understanding a specific problem. Complications arise when these problems are engaged only at this isolated level of detail, where one must forgo context for the sake of understanding. This is also true of architectural design's engagement with human needs. The act of designing, like any other action, is one where the intent is to satisfy a specific need. However, a design solution that results when one has deduced a collection of problems from a set of needs can become a simplified checklist of requirements to be satisfied. The concern is that more often than not, design problems remain in isolation from one another, and are addressed as such, when in reality they are a set of human needs that exist in a systemic relationship. Put simply, the process of deductively addressing human needs conflicts with the complex nature of human needs. By engaging a set of problems without understanding the nature of their relationship, potential for multiple conflicts to occur within these solutions arises. While identifying needs is important, it is equally important to know how different needs are related, and are affected by others. Such knowledge can ensure that a solution that satisfies one need does not complicate or hinder satisfaction of another, and result in more harm than good.

This thesis asserts that an understanding of the interrelated nature of human needs is critical if design explorations are to address successfully problems of design and satisfy human needs holistically. This systemic approach to addressing human needs results in a different functional definition of the design problem one that is more attuned to human needs, and can more accurately reflect the interrelated nature of needs, resulting in an environment that is more sensitive to the human condition.

The design of many high-rise urban apartments illustrates this hypothesis well. While the importance of social integration is well known, the overall design of such structures generally does not foster social interaction within the building perimeter, particularly within the core of downtown Toronto. This situation can be attributed to a conflict of social needs and privacy needs. The thesis design component will investigate the nature of this relationship and develop a solution for how these needs can best be negotiated systemically in built form.



1| Complexity in Architecture

The Evolution of Inhuman Architecture

As Gordon Pask has stated,

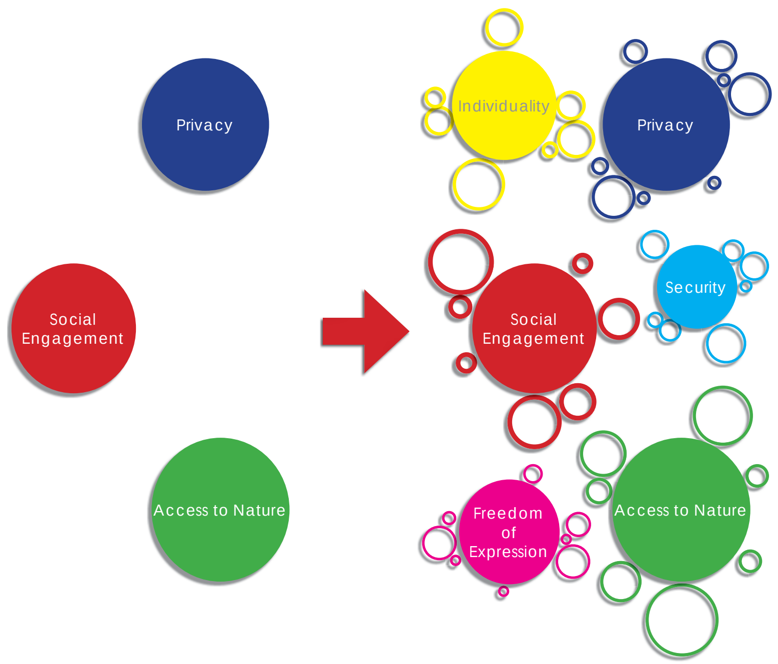
> *"The functions, after all, are performed for human beings or human societies. It follows that a building cannot be viewed simply in isolation, it is only meaningful as a human environment. It perpetually interacts with its inhabitants, on the one hand serving them and on the other hand controlling their behavior," (Pask, 1969, p. 494).*

Pask's interpretation of functionalism acknowledges the fact that while architecture facilitates specific activities, it is imperative that it remains sensitive to human beings and to their complex network of needs. In contrast to Pask's cybernetic perspective, the idea of functionalism was better understood in a utilitarian and mechanical light in the early 20th century, and formed the basis of what became 'International Modern Architecture' (Roth, 2007, p. 12). By adapting the scientific models of objective and rational logic to the design process, the complexity of life was reduced to a mere functional rubric governed by minimum standards and measurable quantities (Gleiniger & Vrachliotis, 2008, p. 45-46). The result, as Bachman points out is,

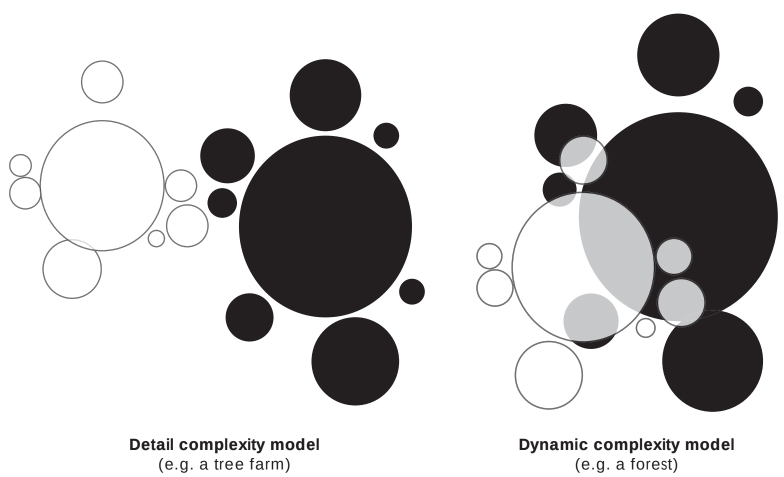
> *"...that architectural design has heretofore generally treated the deeply interrelated and dynamic characteristics of buildings as if they could be reduced to mechanistic problems that are readily amenable to physical manipulation as formal objects," (Bachman, 2012, p. 64).*

Modern Architecture has simplified the variables of the human condition, the programmatic function, and the context, as a means of creating a logical efficiency, which has resulted in a form that is focused on the functional efficiency of activities that it is intended to facilitate (Norberg-Schulz, 1968, p. 21). As Pérez Gómez notes, "Correlatively, practice has been transformed into a process of production without existential meaning, clearly defined aims, or reference to human values," (Pérez Gómez, 1983, p. 8). The relationship between who uses space – that is, their existential needs – and the intended use – that is, the functional requirements that a space is designed to facilitate – is fundamentally what allows architecture to remain sensitive to human nature.

One of the most prominent arguments against modernism was the prioritization of function and oversimplification of human need. However, while the variables with which design is explored have increased, in an attempt to increase sensitivity to the human condition, the design approach is fundamentally the same (see Fig 1.1). The reductionist approach, taken as the central framework by which architectural theory and practice attempts to create architectural form, has proven insufficient in understanding and meeting the needs of the human condition (Pérez Gómez, 1983, pp. 7-8). While is important to understand individual aspects of human need, it is also important to understand how they are designed to be addressed, and to understand the dynamic relationship of variables that comprise the complex system of human needs (see Fig 1.2). As with all other natural systems, these individual needs must be understood as an interrelated system that functions as a whole, and not as discrete parts (Pask, 1969, p. 494).



| FIG 1.1 | **Oversimplification of issues**
A response to the oversimplification of modernism, was to increase research into both existing and new areas of design theory and its practical application - examples of which are illustrated on the left and right respectively. However as illustrated the approach was based on a reductive understanding of these individual areas which does not address the complex relationships among the various study areas.



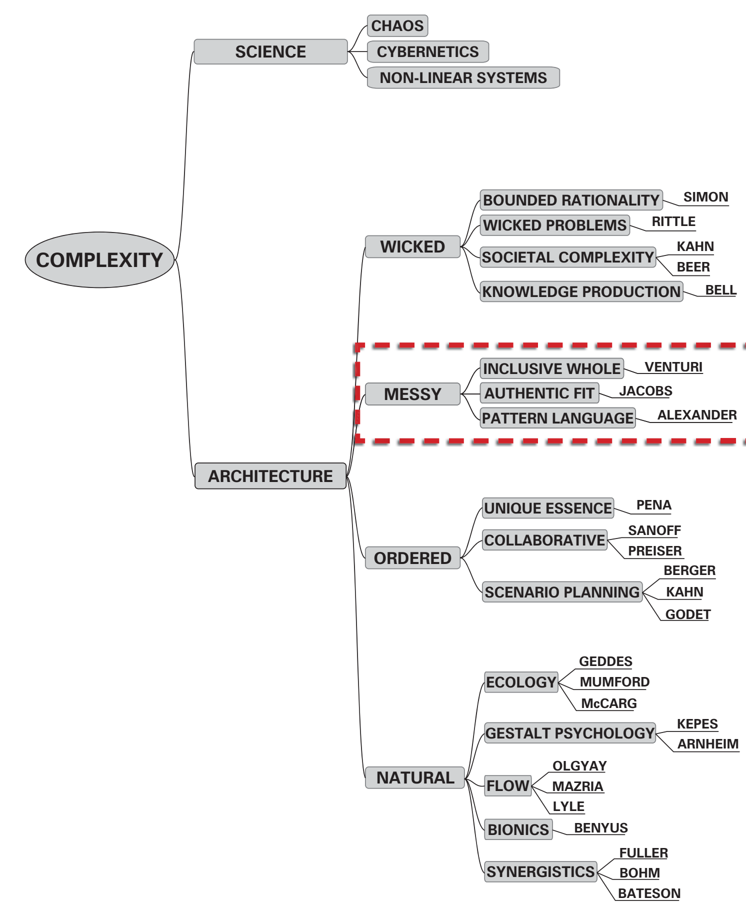
| FIG 1.2 | **Detail & Dynamic Complexity**
Detail complexity on the left versus dynamic complexity on the right. The detail complexity is the type of complexity, a reductive complexity, that is most prevalent in typical design complexity. He compares the two types to a forest and a tree farm to distinguish between the nature of their complexity.

Addressing Complexity in Architecture

There is no single theory that can decipher the human condition into a set of rules, that can be adopted by a medium. Generally, phenomena are simplified in order to understand them to and use the simplified variables as a framework for design – a process adopted from modern science. This merely creates a collection of variables that are difficult to group together in order to form a whole entity. It is a piecemeal way of thinking, one with unexpected and disastrous results (Flood & Carson, 1993). The difference between the sum of individual variables, and a synergistic whole entity understanding the complexity of the relationships between the parts. Although complex systems are difficult to understand, "design must embrace the unity and harmony that emerges when parts are combined in beneficial synergy," (Bachman, 2012, p. 14) in order to create environments that address the human condition holistically. For this reason, caution should be taken when engaging the need for complexity from a singular perspective in particular formal complexity. If perceived visual complexity is the only means of achieving complexity within the built environment, it can become another calculable simplistic strategy for design, another deterministic variable. This can be considered complexity for the sake of complexity as opposed to complexity that seeks to address holistically the human condition. What results is an artificial complexity, which instead of addressing the need for complexity, displaces it with formal complexity (Gleiniger & Vrachliotis, 2008, p. 55). Nikos Salingaros states that very few contemporary design approaches respond to both physical human use and human sensibilities, as they fail to address what makes humans feel psychologically comfortable, and insufficiently create environments that are conducive to carrying out their intended functions (Salingaros N. A., 2006, p. 222). This can be interpreted as the result of reducing complexity to a singular level of application when, to quote Venturi, "A valid architecture evokes many levels of meaning and combinations of focus: its space and its elements become readable and workable in several ways at once," (Venturi, 1977, p. 16).

In contemporary practice, the issue has become less of an argument for complexity in the built environment, and has instead become one that places emphasis on a better understanding of how complexity can be applied, and why. Salingaros identifies the approach that contemporary practice has adopted, in search for a new paradigm in architectural form, as one that irrationally applies complexity to form (Salingaros N. A., 2007, p. 132). Whether it be through the use of computational technology or the application of natural ordering systems, if architectural form is to be sensitive to the human condition, then the consideration given to the logic of the system should be comparable to its application and use. An architectural complexity that is intended to address human needs and human nature, is unequipped to do so if it is limited to a simplified visual complexity. Farshid Moussavi and Daniel López, elaborate further on a broader understanding of complexity in architectural form as defining human environments. Examining the needs of society, there is such an inherent diversity that if the built environment is to address the human condition, it must address the complexity of its needs. "As a function rather than an instrument of contemporary culture, architectural forms need to vary in order to address its plurality and mutability," (Moussavi, F., & López, D., 2009, p. 9).

Complexity as it relates to the human condition and to architectural form cannot be oversimplified if the result is to be a well-designed environment. An issue with architectural design is that, "instead of recognizing complexities, design investigation is generally rendered as normative problems," (Bachman, 2012, p. 62). Leonard Bachman has categorized complexity into four main groups of architectural complexity theories (see Fig 1.3). While



| FIG 1.3 | **Complexity Theories**
Leonard Bachman's taxonomy of complexity theories and theorists.

these models look at complexity in varied and distinct ways, all suggest that in one way or another, within architectural praxis, there is a need for a more thorough understanding of complexity as it relates to humans' response to their environment. An issue that is consistent throughout all of the four groups is that, in order for architectural form to be humanistic, complexity should be addressed holistically as a system, with an understanding both of the elements, and of the relationships between them.

Complexity and Systems thinking

To understand the nature of a phenomena, it is necessary to analyse deductively, its constituent parts. However, the parts do not exist, nor do they function in isolation, which necessitates an understanding of how the parts function in context. This is the essence of the evolutionary logic leading from reductionism to systems thinking: understanding how phenomena are affected, and exist, in the reality of their actual context, and understanding how they fit into, and are connected and balanced, within a larger system. Herein lies the paradigm shift, from a reductive or analytical deterministic thinking, that has redefined the modern world as a more complex world view, based on synthesis. Complexity theory and systems theory may be acknowledged as more accurate representations of the interrelatedness which connect people, objects and ideas in the world. The modern world has been understood based on a linear epistemology of reality, where cause and effect have a clear and determined relationship. Based on this understanding, phenomena and processes can be determined by understanding and deducing causal relationships among the most basic elements of a system. In the case of larger systems, this deductive logic describes the total system by breaking down its constituent parts and recombining them. Essentially, this means that it is the sum of the individual components that will result in the whole system. However, while this form of reasoning has proven effective when there are low levels of interconnectivity within a system, it becomes extremely limited and inaccurate with highly interconnected and complex systems. Systems theory and complexity theory understand that the relationship between elements in an organized interrelated group, a system, exist and relate to each other in a way that produces something that is greater than the sum of the individual constituent parts. Therefore, they cannot be understood through deductive analysis of the parts alone, but rather have to be understood in the context of the nature of the relationships of the parts, and how they contribute to the system holistically (Flood & Carson, 1993, p. 14).

In the realm of architectural discourse, complexity and systems theory have been dealt with in several ways, ranging from sustainability, to computational form finding, to the application of social sciences in design. From an experiential perspective, critical discussion of complexity in architecture began to emerge as a result of the extreme banality of modernism. The oversimplification of architectural solutions presented by modernism, results from the rationalist view of buildings as machines for living, and whose form was solely the product of the function, led to architects forgetting that buildings were meant to be used by people (Lang & Moleski, 2010, pp. 10-12). Human experience was omitted from the functionalist program and resulted in buildings to which humans could not relate. Compounded by this need for programmatic efficiency, it was the aim of architects to have functionalist ideals of architecture and urban form emanate and be expressed in society through manifestation of a rational urban form. Subsequent recoil from thinkers such as Jane Jacobs on urbanism and Robert Venturi on architectural form attested to the significance of a humanistic experience and the ability for humans to relate to their environment, which was to promote complexity of experience. It can be argued that one of the fundamental issues being addressed was a lack of sensitivity to human needs. While functional spaces were being designed to adhere to the functional requirements of a program, the designers were overlooking how human needs function in a complex system to include elements such as social dynamics, which would in turn change how spatial relationships would then be organized and further articulated. If architecture were intended to create space that is appropriate to human functions and sensitive to their needs, then spaces would best be designed systemically to respond to how human needs relate as a system. Further, as a basis for functionality, a thorough understanding of how human theories of needs work as a system, would be essential to creating environments that are not just suitable for human habitation, but that are also conducive to a positive experience of that space.

Oversimplification, Functionalism and Reductivism

One of the most iconic images marking the decline of modern architecture was the demolition of Pruitt-Igoe in 1972 (Roth, 2007, p. 560). While its demise was the result of timing and economics, much can be said and has been said, about the functionalist principles that were manifested in its design. In *Creating Defensible Space*, Oscar Newman highlights a clear distinction between the care received by small-scale shared and personal spaces, in contrast to the abuse directed at large-scale communal spaces, which offered no sense of identity to individuals or to the human collective (Newman, 1996, p. 10, 11). It can be said that functional efficiency of the design, which resulted in compartmentalization of space, ranging from exterior spaces, circulation, communal spaces, and shared utility spaces, to individual units, was not sensitive to the complex nature of the social dynamics between public and private spaces within the project.

Modern design principles were based on mechanical and utilitarian efficiency, largely in opposition to most human activities, which cannot be reduced to a simplified formula and applied universally to all building programs (Roth, 2007, p. 12). These efficiency-driven principles are not necessarily congruent with how the experiential nature of spaces exists symbiotically as a whole entity. One's perception of the environment, and ultimately the experience of an individual space, is not shaped independently by an individual space, but rather collectively, by the spatial relationships that are shared within the space and its context. This is one of the core ideas of space as presented by Bill Hillier when he states that,

> *"Very few of the purposes for which we build buildings and environments are not 'people configurations' in this sense. We should therefore in principle expect that the relation between people and space, if there is one, will be found at the level of the configuration of space rather than the individual space," (Hillier, 1996, pp. 29-31).*

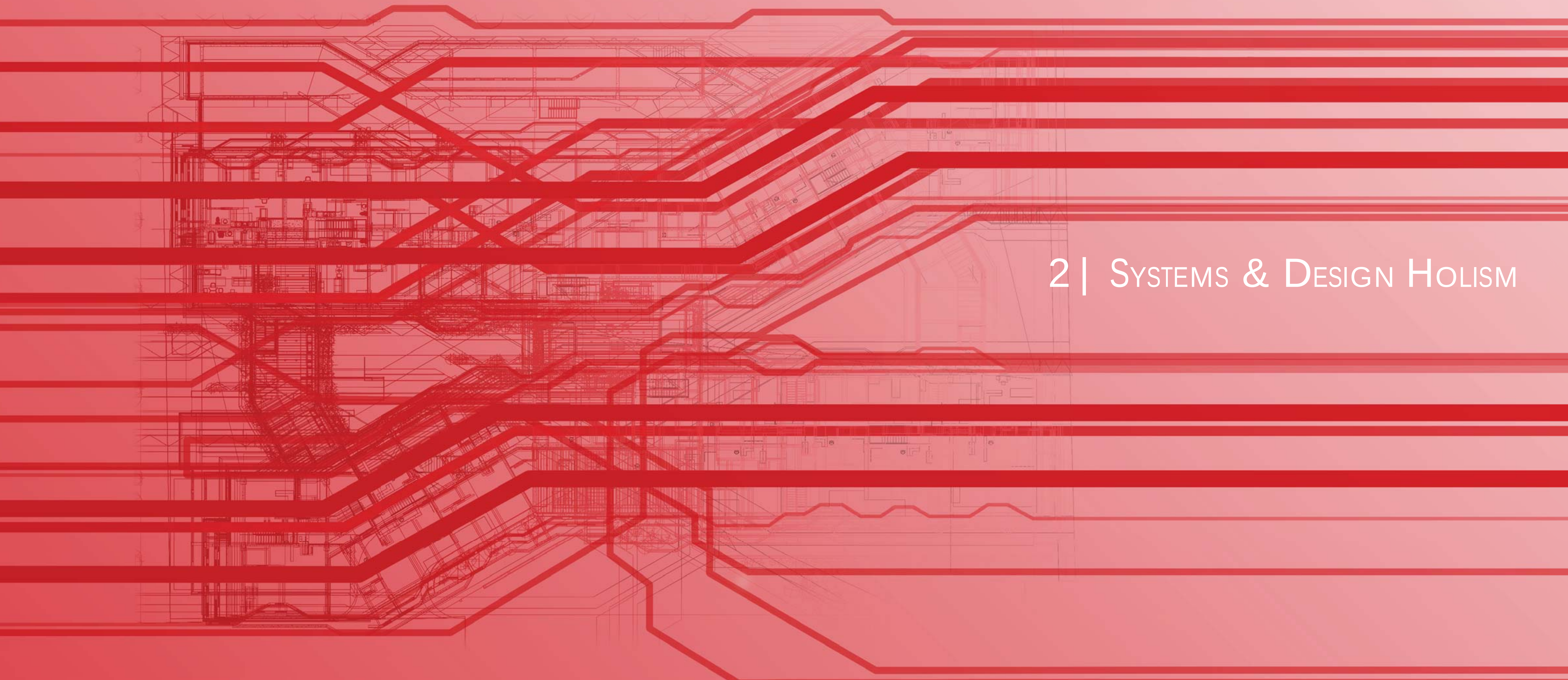
While the significance of spatial configuration is evident in places that share direct relationships, whether through physical or visual proximity, it is also true where physical relationships are not immediately obvious, but are accumulated in the experiential narrative of a place. Sussman and Hollander consider the narrative that we generate by progressing through a space essential to the experiential quality that makes spaces great. It is this embedded narrative which makes the difference between a space where people want to be, take pride in and call their own, and a place which is lacklustre and left abandoned.

> *"It [narrative] suggests one more way people consistently look for orientation and connections to their environment [...] Every plan and urban design has the potential to acknowledge and respond to this trait in some way or another, or as is frequently the case in built environments today, ignore it. One could make the argument that it is the inherent lack of a narrative quality in many of the post-war American suburbs, that gives these areas their feelings of placelessness and anomie," (Sussman & Hollander, 2015, p. 134).*

Due to this interrelated nature of spatial experience, it is impossible to design a space successfully without considering how the space acts as an element, within a larger spatial system, that contributes in various capacities to the overall experience of the place within its immediate and wider context.

The nature of any individual space is such that it is perceived as one part within a whole system of spaces, and is not experienced independently. To design a space in a way that is sensitive to how humans perceive and experience space, the design process should be approached in a way that responds to the complex nature of spatial perception, and which is engaged as a systemic whole, as opposed to a collection of parts. As in the example of Pruitt-Igoe, this systemic approach may have resulted in greater sensitivity to arrangement and scale at both the individual and the collective spatial level than did the rationalistic, programmatic compartmentalization of spaces.

The oversimplification of human needs results in the oversimplification of the built form, which in turn results in spaces that do not respond to the complexity of human need. Inasmuch as it is necessary to simplify a problem to better understand it, a design solution must be understood within the context of the system of needs it is intended to address. Individualistic schemes are not viable for long-term use, since they will continually require ad hoc retrofits to remedy the problems that are caused by friction among collections of individualistic solutions. This interpretation brings to light the advantage of systemic solutions that understand how human needs work in concert, to define the big picture problem holistically.



2 | Systems & Design Holism

Architecture as a Human Product

There exists a contradiction in the nature of human beings and that of the natural world. Human beings exist as a part of nature but unlike other organisms, we act outside the equilibrium of nature's laws. This presents a paradox, in that human nature, the innate behavioral patterns of human beings, is in part mutualistic with the natural world while also being at odds with it. The dichotomy manifests in the way that human society exists in the natural world. We humans are part of the natural world, and the way in which we adapt to it should acknowledge that. "In general we may say that architecture is a human product which should order and improve our relations with the environment," (Norberg-Schulz, 1968, p. 22). In contrast there exists also our other, innate desire, which compels us to understand the eternal. This demands more of our environment than nature can offer and ultimately defines architecture as, "…what nature cannot make," (Kahn, 1965, p. 305). In this respect, architecture can be defined as the medium which shapes our environments to meet the needs of the human condition. It balances the aspects that define us as natural beings, and the functions that define our intellectual consciousness.

Christian Norberg-Schulz highlights the fact that, "Architecture is a human product that mediates the relationship between man and the environment which in turn influences us and determines our mood" (Norberg-Schulz, p. 22). Both Norberg-Schulz and Robert Venturi acknowledge a lack in complexity of architectural form as a major contributor to architecture's incompatibility with human sensibilities. Venturi in particular states, "Orthodox Modern architects have tended to recognize complexity insufficiently or inconsistently in their attempt to break with tradition and start all over again. They idealized the primitive and elementary at the expense of the diverse and the sophisticated." (Venturi, p. 16). The ironic twist of modernist functionalism is that, a building is not truly functional if not designed in line with the needs of the people who will occupy and use the space. This necessitates an approach to the ideas of functionality from a human-centric perspective, as opposed to a program-centric definitive view.

> *"Forms, spaces, and surfaces can also nourish people psychologically by promoting a sense of well-being…The way something is built and the way it looks (i.e., its form language) have a major impact in whether humans feel comfortable or not inside and around such a building…A building that is built in a way that its visual appearance discourages or hinders human activity can be said to be effectively 'dead', since no-none wants to use it," (Salingaros, p. 235).*

Complexity can be defined as, "the state of having many parts", or "the features of something that make it difficult to understand either in part, whole, or the relationships that govern the whole." The human condition, from any perspective, is layered with complexity. To appreciate the relationship between humans and architecture, an understanding of the complexity of human needs and nature is critical. One of the most widely used theories that attempts to describes how human behavior and needs are associated is Maslow's Theory of Human Motivation. This theory seeks to categorize the various psychological and physiological motivators for human actions and reactions. His theory offers at a basic level, a list of conditions and prerequisites that are essential for the holistic well-being and happiness of an individual. What is important to understand is that, while human activity is motivated by the desire to satisfy needs and as a human activity, the design and construction of an architectural artifact is motivated by a complex of different needs. In most cases, architectural form is a construct designed to facilitate human activity and so, theoretically, its complexity is inherent. It should also be noted that there are many different types of complexities that are embodied in a work of architecture, from the contextual and technical components of construction variables, to the functional aspects of the building program. While all aspects must be synthesized for the building to materialize, some aspects are more important than others in determining how space is to be experienced.

Experiencing Spaces as a Whole

All needs are addressed through the environment whether physically, psychologically, socially, or otherwise. The human relationship to the environment is complex, and needs are addressed systemically where various factors work collectively for an outcome. The environment affects individual human experience and is part of an equation resulting in our behavior, which consequentially affects our social behavior and experience. It is a cyclical process, in which one influences the other and cannot be understood without the other. Different variables, such as comfort, light or sensorial qualities, while separate from each other, all contribute to the overall spatial atmosphere. This in turn influences our behavior, based on our experience of a place, from which we form memories and associations. Everything up to the present plays a part in what becomes a history of experiences that will ultimately inform future experience. Simply stated, new situations are experienced in relation to those of the past. Similarly, in a building, individual or autonomous spaces all contribute to our experience of other spaces, which are perceived or understood in the context of the building as a larger, autonomous system. We inhabit a space, and our experience of that space is the result of both the individual collection of qualities that exist in its immediate environment (e.g. the people, the climate, the objects etc.), as well as those in its wider context, namely other adjacent spaces. A result of this relativity of spatial experiences is that, if one compares a similar pair of spaces in two separate buildings, there is greater potential to favour one space over the other, based not on the space independently, but rather based on associating it with other spaces within its respective building. We perceive and associate quality of the whole and the parts, not one or the other. As Lang and Moleski remark, "Any theory of function in architecture must recognize the relativity of experience. Meanings depend on the experiences that we have in everyday life," (Lang & Moleski, 2010, p. 41).

Maurice Mearleau-Ponty's understanding of phenomenology is also consistent with how humans understand the world through the framework of the self and the body, the consciousness of others as well as the effects of the environment, and how all of these perspectives create a cumulative understanding of the human consciousness. He addresses the experiential learning process of each case in detail in his book *Phenomenology of Perception*. One's understanding of the world through phenomenology is based on experience, and we experience the world through the self and our body, through the understanding and reinforcement of ideas of others' consciousness and through perception of natural phenomenon. We understand what something is, and understand similar ideas because we apply our initial knowledge of the former to that of the latter. We learn and are able to understand, through our experiences. This process is applied to our sense of perception and our understanding of the world (Merleau-Ponty & Landes, 2014, p. 413). These accumulated experiences of the self, of others and of the larger environment, can be considered from a phenomenological perspective, integral to human nature. It also requires human-centric design to be sensitive to the complex nature of human perception, if design is to produce environments to which humans can relate.

Through architecture, humans create their own or adapt to the existing environment. If architectural design is to address the human condition, it is important to understand its function within the system of human needs and patterns of human experience. Further, as a common denominator the designer can attempt to understand both the direct and indirect impact of how needs can be addressed, at both the individual and the social group level.

The role of the environment is particularly significant within the focus of this discourse, for, as previously stated, architecture is the result of humans shaping the environment to "satisfy" (Max-Neef, Elizald, & Hopenhayn, 1992) their needs. In reality, humans exist in space and all phenomenon are experienced in space. Therefore, while the act of building directly addresses environmental satisfiers, such as shelter and security, the individual and the social group contexts are indirectly related to the environmental setting, and all are interdependent components of spatial experiences. This becomes clear in examining Max-Neef's Human Development matrix, where his existential interactive needs are all environments, that facilitate the axiological (fundamental) needs. Understanding the role that an environment plays in all three needs contexts (environment, individual and social), and how our human nature is programmed to satisfy needs, will begin to illuminate possibilities for the development of architectural strategies that are more sensitive to the complexity of the human condition. Human needs, as seen through either the theory of motivation or development, despite their differences do acknowledge that human needs exist and that they are satisfied in a complex interrelated system. Needs are affected and met, not in isolation, but in relation to other needs in the whole system.

Mary Joyce Hasell and Reed Benhamou have proposed a framework to engage the human-environment relationship as a supra-system. Based on James Miller's *Living Systems Theory*, their theory defines human activity as a system, which creates artifacts. The relationship between activity and artifact is characterized as two systems of design. Based on Francis Ferguson's perspective of design, the activity system is described as an organic design approach, which is human-centric and based on sensitivity to environmental context and behavior. Alternatively, the artifact system is described as an inorganic design approach: a system of design focused on the manipulation of the artifact. The difference between the two models can be illustrated by the rational governing of the placement of windows in a façade. In an organic model, the window would be located based on views and access to light. Here, placement enhances the experiential qualities within the space. This model is more intuitive, dynamic, adaptable and amenable to a more free-form approach to articulating space. The model is exemplified in the work of architects such as Wright and Sullivan. In contrast, in an inorganic model the placement would be based on symmetry or on some other ordering system. The approach is described as rational and idealistic, is more static, and based on regularity or modularity, as is demonstrated in the ideas of architects such as Palladio and Gropius. Hasell and Benhamou's recognize the value of both organic and inorganic systems, and argue that a holistic system approach to design would balance both systems, and can result in a design that is functional and sensitive to human needs.

These theoretical frameworks were intended to be scalable based the extent of the environment the artifact is designed to support, i.e. a space at the scale of the individual or group, a building at the scale of an organization, or an urban area at the level of the general society. In this way, the building scale can be compared to a microsystem within the macro-system of a city, in the same way that a space might relate to a building. In looking at the building as the artifact in this context, understanding how one space relates to another becomes critical not only within the building, but to other spaces within the city as a larger system. Although it is important to understand how an individual space functions, and is experienced, it is also important to consider how the same space functions, and is experienced in relation to the context of its broader systems, to ensure that it supports the human activity or needs that it is intended to satisfy. This perspective brings to light the significance of spatial relationships within a system of spaces. Within the context of a city or of a building, spaces can be organized into interrelated spaces that contribute to the overall experience of the place. In the context of this thesis, such an approach to the design of the artifact will be explored through creation of a system of public and private spaces to promote social interaction throughout the building and within its immediate vicinity in the city. The intent is to investigate how public spaces in buildings can function as a holistic system, in order to address the need for social interaction, as the primary need being addressed, by ensuring that these spaces, or artifacts, are designed to be conducive to the systemic way that social interaction is satisfied. “Public spaces,” in this case, refers to the open spaces across the site, accessible to the general public, as well as the shared or communal spaces accessible only to residents within the main part of the building. “Private spaces” here refer to individual spaces within the residential units or work spaces in the commercial areas of the building.

While it is important to have elements in a system be organized as a complementary whole, it is also critical to ensure that the building, or artifact, which is effectively a system of systems, be organized in order to create mutualistic relationships among its constituent parts. Within the context of public and private spatial systems in a building, this can entail ensuring proportional relationships between both the quantity of public-to-private spaces, and the experiential quality, that the spaces afford. Quality becomes important, as this determines the vibrancy and viability of the space to be a place that people find comfortable and where they desire to be. Ultimately, if a building is viewed as a system, then all of its subsystems and elements contribute to the overall experience and function of the place for people to occupy and live in. As an example, the functional role of corridors, as elements of a typical modern flat slab building is to connect all units and to connect each individual in the building. They are arguably the most public areas within the building, but their physical dimensions and design do not benefit the social life of the building. If the different spaces in the public spatial system (e.g. corridors, amenity spaces, etc.), are better integrated among each other and with the private spatial system, then the relationship between the units will correspondingly change. This creates a different emergent spatial dynamic between what is public and what is private, which ultimately creates a greater potential for serendipitous encounters, and can thereby increase the probability of meeting the social needs for the residents of the building and by extension its surrounding context.

From a systems perspective, the functional definitions of various spaces in the building system may create an emergent functional definition of the spaces. In the case of the corridor, as opposed to it being a space for people to move between specific destinations in the building, it can become a conduit for experiencing life within the building. The corridor then becomes essentially an internal street, supporting a social life within the building. A change in the functional definition can also change the way in which the space is designed, resulting in a corridor that may become drastically different in terms of experience. This idea could then further be extended to the surrounding context, to allow connections, whether visual and or physical, to the life of the city, thus creating a similar mutualistic relationship between the life of the building and the life of the city.

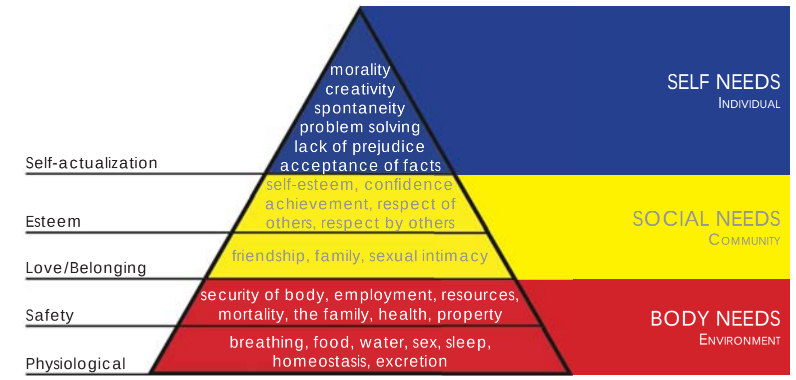
The systems approach discussed by Hasell and Benhamou was intended to be applicable as a practical and theoretical framework. In applying this framework to the thesis project, the two systems can be framed in a manner such that they are then translated into a design problem. In applying the framework, the systems will be defined as: functions of human social needs (the activity system), and a design addressing of the spatial configuration which is sensitive to the experiential function of built space (the artifact system).

Activity System: Human Social Needs

While humans and the way that their needs are satisfied can be relative, it must also be acknowledged that their patterns of behavior are dictated by the same cognitive processing. Human nature is defined by the common psychophysical characteristics of human beings, which in this sense include human needs. In one way or another, humans are programed to satisfy their needs. In order to understand how architecture can respond to human need and act as a satisfier it must, "first look at how people are built – not only mechanically but also mentally, subconsciously, and then design or plan for these requirements and tendencies," (Sussman & Hollander, 2015, p. 157). What can be inferred from this is that a greater understanding of human need is insufficient, as satisfiers can vary. What is critical, is to understand how humans are programmed to satisfy their needs, and to design in coherence with their innate patterns or human nature.

In contemporary thought, we understand human needs not as deterministic, but rather as subjective and situational. Things that we acquire and use are essentially a means to address needs. Our actions are fashioned to address needs, not individualistically, or as in a series of check boxes, but systematically. Theories of human need recognize the fluidity of discrete needs, and propose that they are addressed in most scenarios together in a system where more than one need is satisfied. There are two main theories of human need: Abraham Maslow's theory of human motivation and Manfred Max-Neef's human scale development theory. One of the key differences between the two theories is the premise by which human needs are met.

In Maslow's theory, the system is hierarchical where different needs groups are satisfied in a sequence (see Fig. 2.1), while Max-Neef's theory proposes that there is no hierarchy, and that needs are satisfied in a more integrated framework (see Fig. 2.2). Max-Neef further states that, "the satisfiers do not operate in a linear fashion but rather in a matrix allowing multiple relationships between needs and satisfiers, which are in themselves in a state of flux" (Max-Neef, Elizald, & Hopenhayn, 1992, p. 199). In a criticism of Corbusier's application of Maslow's Human Needs theory, Murray et al. have noted that understanding human needs as a hierarchical system has resulted in architecture that is focused on needs that can be directly linked to the built environment, that is as a "shelter", as opposed to, "a synergic satisfier that influences the satisfaction of all human needs," (Murray, Pauw, & Holm, 2005, p. 6). However, Maslow's theory does acknowledge that, within the hierarchy lower needs do not have to be fully satisfied for the upper level needs to be addressed, as this allows to some extent, the possibility of addressing needs in a nonlinear fashion. The theory states that, "no need or drive can be treated as if it were isolated or discrete; every drive is related to the state of satisfaction or dissatisfaction of other drives," (Maslow, 1943, p. 1). This suggests that while two theories are distinct there is a common understanding that wellbeing is achieved, not through focusing on specific needs independently, but by focusing on needs as a collective system.



| FIG 2.1 | **Maslow's Hierarchy of Needs**
Diagram showing needs grouped by individual, social and body needs categories.

Max-Neef provides a breakdown of the system of human needs that will be proposed here as part of the framework for an investigation of how social need should be addressed relative to other needs. In his theory he states that needs are met in three specific contexts: (1) with regard to oneself (Eigenwelt); (2) with regard to the social group (Mitwelt); and (3) with regard to the environment (Umwelt) (Max-Neef, Elizald, & Hopenhayn, 1992, p. 200). This framework can be viewed as three categories of perceptual understandings, which are fundamental in the development of a human's phenomenological understanding of the world, and are arguably foundational to human nature. Maurice Mearleau-Ponty's phenomenological perspective of how humans understand the world through the framework of the self and the body, the consciousness of others, as well as the effects of the environment and how all these perspectives create an accumulated understanding of the human consciousness, is consistent with this framework. He addresses the experiential learning process of each case in detail in *Phenomenology of Perception*.

From a phenomenological understanding of human nature, Max-Neef's contextual breakdown of human needs makes logical sense and it is also coherent within a cognitive framework. From the perspective of Ann Sussman and Justin Hollander, as biological creatures we are a part of nature, and to better understand how to design for human nature and behaviours, we must first understand human nature relative to human biology. The closer in tune the built environment is with the way human beings are designed to exist and function, the better suited it will be to ensure overall human wellbeing. While phenomenology looks at experience and understanding this view is founded on a

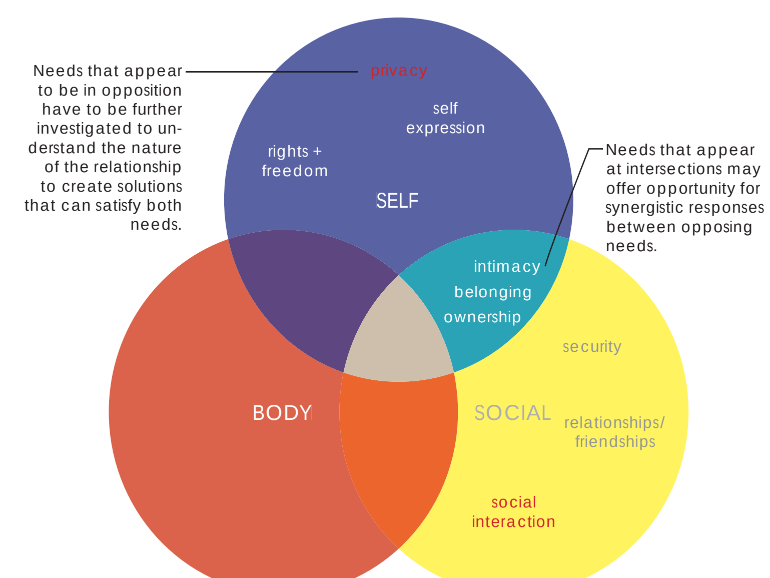
| FIG 2.2 | **Max-Neef's Needs Matrix**
Diagram showing needs grouped by individual, social and biological needs categories.

Needs According to Axiological Categories	Needs According to Existential Categories: Being	Having	Doing	Interacting
Subsistence	Physical Health Mental Health	Shelter	Feed Procreate Rest Work	Living Environment Social Setting
Protection		Rights Family	Co-operate Take Care Of Cure	Living Space Social Environment Dwelling
Affection	Self-Esteem Solidarity	Friendships Family Partnerships Relationships with Nature	Make Love Caress Express Emotions Share Take Care Of Cultivate Appreciate	Privacy Intimacy Home Spaces of Togetherness
Understanding	Curiosity Astonishment	Method	Investigate Study Experiment Educate Analyze Meditate	Settings of Formative Interaction Groups Communities Family
Participation	Adaptability	Rights Responsibilities Duties	Become Affiliated Co-operate Share Interact Express Opinion	Settings of Participation Interactions Parties Associations Communities Neighbourhoods family
Leisure	Curiosity Imagination Tranquility	Games Parties Peace of Mind	Day-dream Brood Dream Give Way to Fantasies Remember Relax Have Fun Play	Privacy Intimacy Spaces of Closeness Free Time Surroundings Landscapes
Creation	Imagination Inventiveness Curiosity		Work Invent Build Design Compose	Productive and Feedback Settings Workshops Cultural Groups Audiences Spaces for Expression Temporal Freedom
Identity	Sense of Belonging Consistency Differentiation Self-Esteem	Religions Customs Reference Groups Values Norms Historical Memory	Integrate Oneself Actualize Oneself Grow	Social rhythms Everyday Settings Settings which One Belongs To Maturation Stages
Freedom	Self-Esteem	Equal Rights	Choose Be Different From	Temporal/Spatial Plasticity

psycho-physiological framework based on the premise that, "the more we understand how human beings are...the more creatively and successfully we will be able to design and plan for them," (Sussman & Hollander, 2015, p. 1).

The significance of Max-Neef's theory is that it proposes that human needs can be satisfied in varying ways, interpreting as ideal solutions as those that satisfy needs synergistically, as a whole system. To quote Bachman, "To deal with complex systems then, it is clearly necessary to deal holistically with overarching patterns of their behavior and not surrender to intuitive, first order, superficial, or mechanistic manipulations of separate pieces of the puzzle," (Bachman, 2012, p. 38). The three contexts proposed by Max-Neef are congruent with both the human phenomenological and cognitive understanding of the world, and can serve as a framework of human nature and patterns by which to satisfy human needs. While this approach might be used to address human needs in a holistic manner, the role of architecture has yet to be determined in this equation. In order to design in a way that is sensitive to human needs, the environmental context can be employed as a common denominator, by which the needs of all three contexts can be satisfied. Ultimately, we exist and function in space and every aspect of life is affected by the environmental setting. This fact is reinforced through environmental science, which has proven that the environment does affect our individual wellbeing and social behavior (Kopec, 2006, p. 54). However, understanding the role of the environment is only part of the solution.

The environment must be engaged in relation to all other contexts of the system of needs. What is clearer through Max-Neef's theory is that, through the visual matrix of needs and satisfiers, it becomes clear that the environment, and by extension architecture plays a direct role in the actualization of all needs. Human action is motivated by human needs, as both Maslow and Max-Neef's theories suggest, and a building is also the result of an action motivated by a program of needs. However, to apply either theory to an architectural solution can be difficult. While Maslow's theory provides a hierarchy with which to organize needs based on a functional program, it does not reveal the interrelatedness of the theory's needs. Max-Neef's needs framework on the other hand, shows just how much overlap there is between his axiological needs categories, which are essentially what Maslow's theory describes, and the way in which these needs can be satisfied. The disadvantage of his matrix is its lack of hierarchy, which makes it difficult to focus on the specific needs of a complex functional program. In order for the human activity system to frame an architectural problem, it has to show the interrelatedness of the needs, and provide a hierarchy with which to organize those needs. By restructuring the hierarchy to create a hybrid of the two systems, the various categories of needs can be visibly related, and potential emergent correlations can be identified, through which they can be systemically addressed and satisfied (see Fig 2.3).



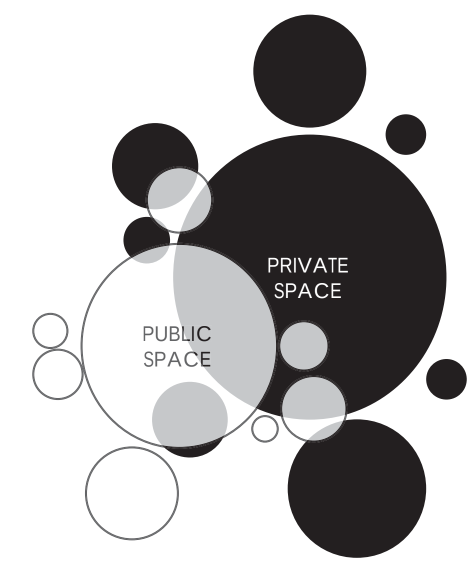
| FIG 2.3 | **Hybrid Needs Framework**
A hybrid of the two needs theory systems as a functional hierarchical needs Venn diagram to aid in understanding the relationship between needs and better frame the design problem through these relationships.

The hybridized system of the needs theories being used, to organize the needs within the thesis is based on the contexts proposed by Max-Neef, which have also been used to group Maslow's needs pyramid. At first glance, the prominence of the context in framing specific needs is evident, and illustrates how specific design objectives can become the emphasis of a design exercise, around which other needs can be related and addressed relative to primary needs. It provides visible insight into where the needs/satisfiers shown in Max-Neef's matrix can fall within the various contexts, and allows designers to control how they relate to each other and how ultimately they can be synergistically addressed. This allows for the needs/satisfiers to be organized in a way that defines the role of different spaces, public or private, and their contributions to satisfying both primary social needs and other secondary needs. This is particularly useful for the development of the thesis, as it creates an easily manipulated framework in which to define the activity system that the artifact system can be designed to support.

Artifact System: Spatial Configurations

The utilitarian emphasis of functionalism, focuses on the efficiency of the designated function or programmatic assignment of a space in order for a designer to shape the space. This overly simplified design process was driven by the efficiency with which the desired program was carried out. This, in most cases, resulted in spaces that did little to address the complexity of the spatial experience governing human motivation and behavior. In *Functionalism Revisited*, Lang and Moleski discuss how experience and perception influence and motivate human behavior. Our accumulated individual experiences, or narratives, as Sussman and Hollander refer to them, shape the way in which we perceive daily experiences and dictate how we feel and respond to these experiences. This allows us to cognitively process and determine what opportunities or affordances are available within a given space, and to modify activities and behaviour to enable a person to create a more favorable situation (Lang & Moleski, 2010, pp. 41, 43). Experience and perception are subjective. However, all theories of human needs indicate that there are commonalities that all humans desire, such as social connections, which can be incorporated into design. Furthermore, environmental psychology informs how space and its articulation can contribute to an experience supporting various types of human activity.

What is critical to the design of the artifact system, is looking at spaces as elements within systems. While a space may be considered as autonomous and function independently, as would be the case in a modernist building, the approach being developed here, proposes that space is best understood in relation to the spaces to which it is related in the whole artifact system, which in this case is a building. In similar fashion the relationship between public or private spatial systems is understood holistically in the context of the thesis (see Fig 2.4). Miller and Benhamou define the artifact at the level of a social group or organization as a building. The artifact is intended to support or facilitate human activity associated with it, and as Ferguson's inorganic definition would describe it, is ordered by the rational manipulation of its elements, which in the context of a building is manipulation of space.

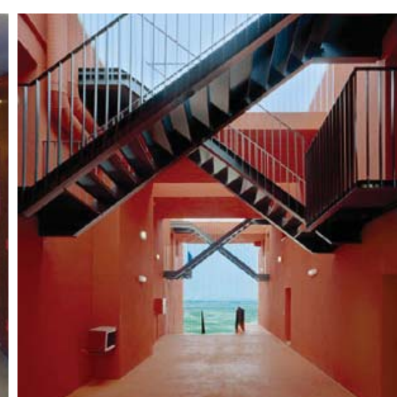


| FIG 2.4 | **Artifact Spatial Relationships**
Conceptual diagram illustrating the type of dynamic complexity relationship between the public and private spatial system of the designed artifact where the nature of the relationship is such that one system is integrated with and supports the activities of the other.

Within this organization or system of space, it is extremely important to ensure that the overall configuration is perceived and can be understood as a holistic entity, an argument supported by Bill Hillier, who interprets space as the machine for living (Hillier, 1996). This perspective can be supported by the way in which the experiential qualities of space, through perception, are accumulated to create an overall conception of the experiential qualities of a space. To put this into the context of public and private systems in a building, a corridor can again be employed to demonstrate how one space acts as an element, as opposed to an autonomous system. In the previous example, a corridor in a functionalist building was viewed as a device for moving people within the building, and its efficiency judged based on its ability to do so effectively while optimizing on space. If a systems thinking approach were employed in the design of the corridor, it would be just one element in the system of public spaces in the building, and treated in a way where its function supports and is supported by other spaces in the system.

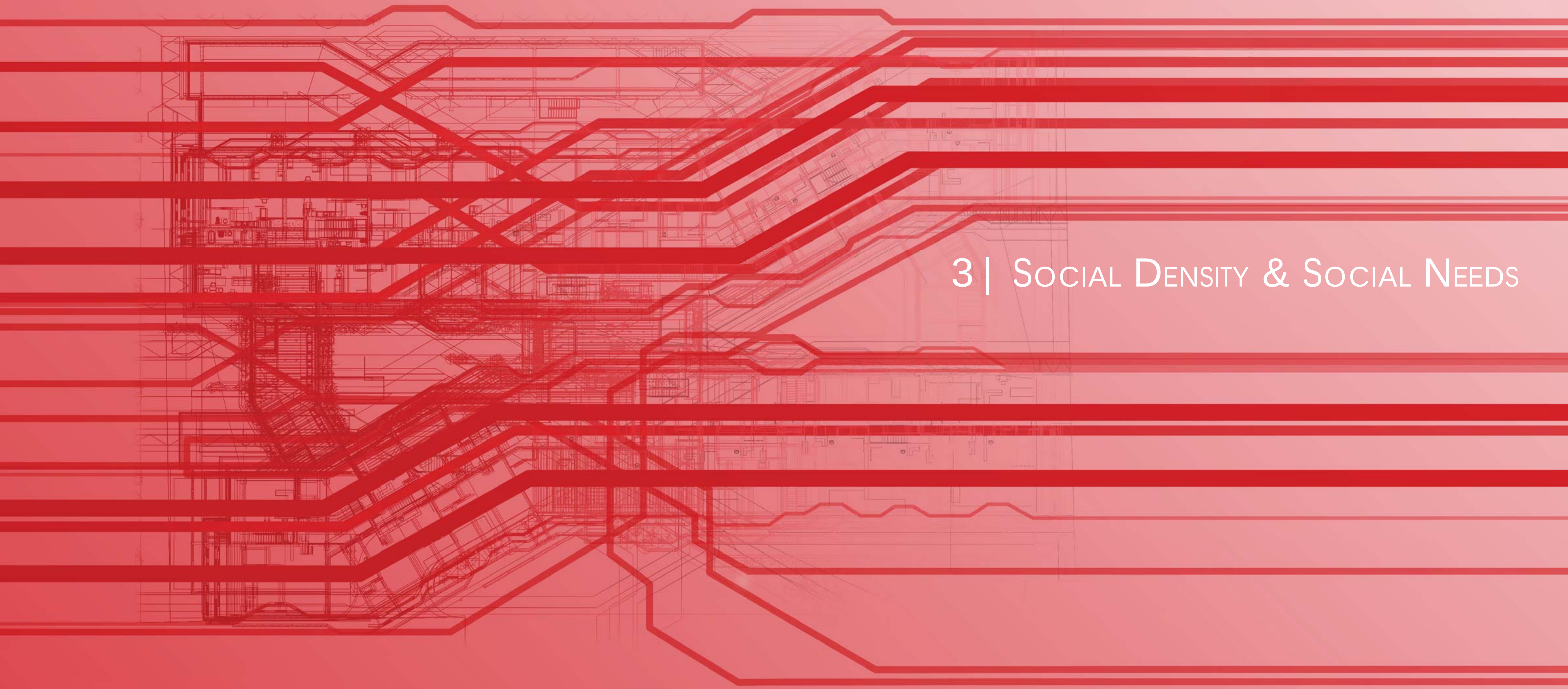
The difference in the illustration above, may be better understood by comparing Unité d' Habitation and Mirador (see Fig.'s 2.5 & 2.6). The corridor system in Unité is designed as a means of moving people through the building and nothing more, while the public spaces consist of exterior spaces at ground level and the retail spaces located on the seventh and eight floors (Forster, 2006, pp. 74, 75). All are public spaces but there is no relationship between the spaces. Furthermore, the experiential functionality is similarly discrete, and does enable the spaces to complement each other. As such, the corridors although public, can only play a minor role in the social life of the building. In contrast, Mirador's corridors are organized into a diverse collection of interconnected spaces that are intended to contribute to social life within the building, essentially functioning as a system. As such, the corridors are designed in a way that is more conducive to public life, i.e., open to the exterior, providing natural light and ventilation, large enough to accommodate comfortable social interaction between neighbours, and varied enough to provide a diversity of spaces among the corridors. In addition to this system of interrelated corridors, are public spaces that are located within and around these corridors within the building, all of which contribute to an overall, varied experience of social spaces within the building. Ultimately, the public space is designed to function holistically, creating a synergy among the spaces that could not be achieved if functional efficiency was addressed on an individual space basis.

| FIG 2.5 | **Corridor in Unité d'habitation.** (Near image)
| FIG 2.6 | **Corridor in Mirador** (Far image)



In Sussman and Hollander in their *Cognitive Architecture,* place a greater significance on the social and the environmental influence of design on the quality of spatial experience, while aspects of the self are understood in relation to the social context, and meaning is derived from collective identity. What is most compelling about the approach they present, is the intent to satisfy human need based on human nature and patterns. Such an intent speaks to a better understanding of complexity and use of patterns, endorsed by Bachman and Salingaros respectively.

Regardless of the difference in perspective, the framework of human nature can still be applied to the three categories. Ultimately, to address human nature, it is imperative that design is sensitive to the complex system of needs which motivate human activity. A systems approach focuses on the interrelatedness of human activity and motivation, which informs the designer how space can be better designed to support, not just a function, but also other needs that are systemically related to function. By understanding the way that needs are designed to be satisfied in relation to human patterns, the artifact that is designed is more likely to be sensitive to the complexity of the activity needs/system.



3 | Social Density & Social Needs

wExploiting Density for Social Needs

A defining characteristic of cities is their density. A specific result of their population density there is the corresponding diversity of interests that exist within a concentrated area, a diversity that does not generally exist outside of cities. This diversity can greatly enhance the quality of social life within the city. The same can also be said at a smaller scale, in a high density building. In theory, an ideal city is planned so that its basic societal needs are dispersed, to create an equal distribution of resources across its territory. The distribution of the public spaces, as defined in the previous chapter, within the context of the thesis project, will be organized in a similar way to ensure an even distribution of and access to social spaces at the building scale. The activity artifact system relationship will be explored, and the social needs, as defined by the activity system, adequately supported by the artifact, the building, through an equal distribution of public spaces.

In the context of this thesis, the activity system is defined by any action intended to satisfy human needs, as understood through the hybridized hierarchy discussed in the previous chapter. The hierarchy of needs in turn governs the logic that drives spatial organization of the artifact system which at the scale of the group is a building. In this connection the thesis project will explore housing at the urban level, while the focal element or aspect of human needs being explored will be the social needs. The result is a spatial system that focus on the relationship between public and private areas of the building.

How humans qualify their experiences depends on an understanding of how perception and cognition of phenomenon occur, and how they influence not only our behaviour but also the physical and mental wellbeing of every individual. Much effort has been expended to describe how we sense and what we sense: scientific qualification and understanding is based on a process of simplifying phenomena in order to comprehend and define them. However, this cannot easily be done because of the complexity in which we sense and perceive external information. To fully understand how perception works, it is insufficient to rely exclusively on the empirical evidence which science can provide. Part of perception stems from consciousness and from experiential memories, which allow us to interpret and understand what we gather through various sensorial stimuli. Phenomenological theory suggests that we develop an understanding of the world through accumulated experiences, which are created through these sensorial stimuli as we begin to become aware of the self and the outer world. Humans perceive and interpret phenomena, through which they later understand similar phenomena, because they apply their initial knowledge of the former to that of the latter. They learn and understand through experience. This process is applied to their senses, perception and understanding of the world (Merleau-Ponty & Landes, 2014).

As humans develop, their various experiences create memories and associations which shape their perception and understanding of their surroundings. They begin to categorize or "schematize" concepts which are applied to new information that is perceived. This is also part of the social conditioning process (Norberg-Schulz, 1968). Something else that contributes to their understanding of the world as they develop is the relationships shared with others. They begin to inform each other and their understanding of the world. Cultural and social experiences thereby play a role in perceiving and understanding the world. The understanding of others as a separate consciousness with shared perceptual fields affects how one perceives and acts with others. Perception is a process of learning and accumulating experience that beings at childhood. This process occurs within social settings, meaning that what is learned is not isolated from individual experience, but is influenced by collective social consciousness as well. From a phenomenological perspective, social relationships with others are inseparable from how one perceives and understands the world. Social relationships become part of individual identities, as one begins to understands the world and self-identity through the eyes of others.

In addition to the significance of a perceptual understanding of the world through others, different micro-cultures of various social collectives play important roles in the overall wellbeing of the individual. Part of an individual's experience takes place within the social realm. People share space with others and establish common meaning for that space. In a house or community for example, meaning is individual, but it is also shared with other members of the group. This idea can be extended to the larger community and the various social networks that make up parts of individual identities (Bloomer & Moore, 1977). The space that is shared with others reinforces existing relationships, which are essential for psychological wellbeing. Based on these arguments the social nature of humans may be deemed an essential consideration for the design of a high-density urban environment.

Relating the Unit, to the Building, to the City

What is most critical in the systems approach in an urban context, is the relationship between public and private spaces, particularly housing than other typologies. Human needs theories acknowledge that people need places for social interaction. Conversely there is also a need for private space as well, which necessitates balance between the two spatial systems. For this reason, some negotiation between how people are grouped, scaled, and distributed into social units, and the proximities within spatial configurations, is necessary. These considerations become significant, affecting the overall form and defining a building as an autonomous spatial system, existing as a microsystem within the larger city scale. As these internal relationships are drafted in the design process, they too begin to define emergent functional relationships between architectural positives and negatives, elements and spaces, respectively, which define the boundaries between public and private spaces and systems. For example, from a different perspective, one might question the level or extent of privacy necessary in these socio-spatial relationships. The atypical spatial dynamic could effectively evolve social ties within a built space.

As a smaller system or subsystem within the city, and one which is to be integrated with and contribute to its immediate context, a building can benefit from a similar framework, based on a city's organizational structure. Just as the city has a fair distribution of special functions and common functions, a building can be organized where specialized functions are strategically distributed and interconnected through the internal pedestrian system comprised of the building's public spaces – that is, it's shared or communal spaces – which are connected to the private spaces or units. Similarly, private spaces can be arranged within the building in such a way as to create a hierarchy of social relationships, thus affording individuals the opportunity to create closer personal ties based on proximity, instead of finding themselves lost in an endless grouping of units.

Analyzing through a Systems Lens

The following case studies look at how the relationship between private and public spaces are addressed as a complex system, centered around the specific design intent in light of which the design was based.

| FIG 3.1 | **Center Village**
Central courtyard space

CENTER VILLAGE: Winnipeg, 5468796 Architecture

Density, Scale and Proximity

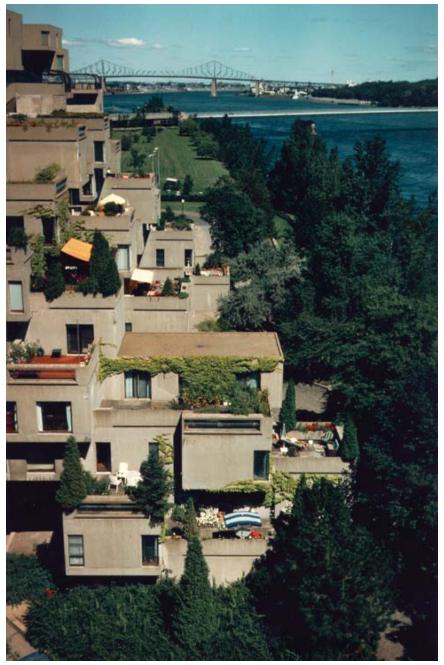
This project in its approach to private and shared space, challenged the typical proportions associated with these two spatial types. Intended for underprivileged families, the scheme was designed to promote social relations among its residents by minimizing the area occupied by the unique unit types. This allowed more area to be allocated for public space and shared among the residents. Also, the space was accessible to the wider public, thereby promoting connectivity to the immediate context. The site, originally zoned for six single-family units, was given a much larger allotment for the shared space, and increased the density to 25 units. From a systems perspective, the scheme questioned the spatial needs of private spaces in relation to public spaces. Based on a different view of this relationship and the needs of the residents, it reprioritized the balance within the two systems of space. Also, due to increased density and the changing proportions, it became important to use the public space as a buffer to ensure ample privacy within the high density neighbourhood. Again, because of the altered space proportion, and the proximity and placement of the windows and entrances, there was sufficient space around the units to ensure that the communal space provided ample distance between units. Despite what could be considered a restrictive urban boundary, the shift in spatial priority between the systems created an environment which could promote social relations while maintaining scale sensitivity appropriate to the density. This fostered comfort, as spaces were not cramped and residents did not feel pressured within either spatial system.

8 HOUSE: Copenhagen, BIG

| FIG 3.2 | **8 House**
View of units overlooking courtyard and grazing and beyond.

Circulation + Movement

The 8 House program was required to integrate a mixture of commercial and residential space into a newly developing commuter area in Copenhagen, adjacent to existing farmlands. The design objectives essentially required a building that would create an active urban realm for commerce, social interaction and connection with both the surrounding new development and the farmland adjacent to the site. The form conceived by the architect extended an active and walkable street into the third dimension. In so doing, the architect was able to achieve a ramping Mobius strip, allowing continuous pedestrian traffic along both residential and commercial frontages. The design layered the program horizontally to separate private and public realms. This allowed privacy for the residences while maintaining a continuum of pedestrian traffic through both realms. The scheme also addressed how social interaction occurs at a more intimate scale. The threshold where the residential units meet the ramp consists of a small landing with individual planters at each unit. As simple as this was, it allowed a gradient between the privacy of the unit and inclusivity of what is essentially a public street. The buffer provides a zone which can negotiate the nature of social interaction between the resident and the guest or passerby. The social pockets around the ramp, including the main courtyards, provide ad-



| FIG 3.3 | **Habitat 67**
View of units overlooking the adjacent St. Lawrence River.

| FIG 3.4 | **Markethal**
View at entrance to market space

ditional settings for social interaction, creating a variety of spaces with differing degrees of social comfort that are highly visible and are along a highly active pedestrian street.

HABITAT 67: Montreal, Moshe Safdie

View + Variation

Habitat was designed to privilege each unit with uninterrupted views of nature and to create a sense of individuality among residents through what appears to be units that are varied and unique. The formal approach of organizing the units on a single loaded corridor oriented at forty-five degrees to the units themselves and units that are modular but rotate based on their location in the scheme, created a modular system that was able to achieve the intended design goals. What this also created was a unique proximal relationship between the units, which effectively allowed units to have a certain degree of visual access to the balconies and open spaces of other units. By organizing the units in this way, the design allowed for a sense of individuality among the units while simultaneously helping to create an atmosphere that is conducive to familiarity among residents in neighbouring units and thus an environmental potential for social interaction. If the scheme were analysed in terms of a systems perspective, it would demonstrate the relationship between the public and private systems, which had allowed for privacy yet still maintained allowances for social interaction among residents. The corridor system, relative to the orientation of the private system, the units, created a dynamic collection of varied spatial conditions. Essentially by the synergistic relationship between the two systems, the public system benefitted the private one, creating unique visual experience of the site and scheme through the proximity and spatial relationships between units.

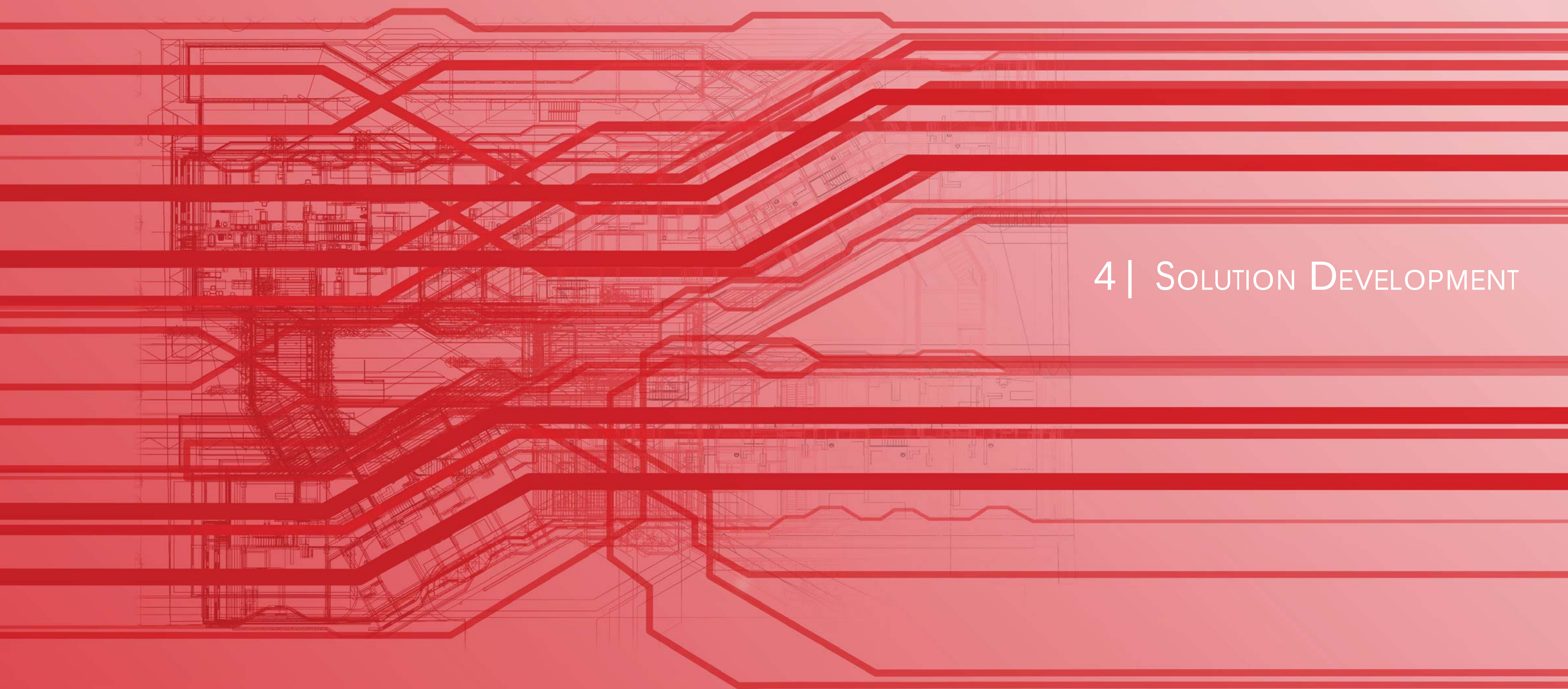
MARKETHAL: Rotterdam, MVRDV

Residential, Commercial & City Integration

While the building massing and constituent elements, the residences and the market, are fairly simply put together, overall this project is a clear example of how the two programs are synergistically combined into a mutualistic relationship resulting in a project where the whole is greater and more beneficial than the individual parts would be. Looking at the residential component, the individual units' interior circulation and organization is not vastly dissimilar from what would be expected of a slab block. What makes the social condition unique is the relationship on the interior, between the units and the market. Not only do the units create an enclosure over the market, but by organizing the units to extend across the entire block, the units are privy to a direct visual connection to the facing units and the activity of the market below. The effect for the residents, is creation of a unique experience of a part of the city and city life, which has the potential to create a unique sense of place translatable into personal and social ties to the market and home. For the market patrons and city pedestrians, the scale it presents on the ground floor in particular takes advantage of the height of the residential canopy protecting it from the elements. The glass façades also cap the views of the city on either side of what is a portal, framing and connecting the city beyond. The massing essentially allows the market to appear as a mere sheltered space within the city, not disconnected from its context. What the project achieves is a clear separation of public realm and private spaces through the articulation of the form. At the same time the formal and programmatic relationship creates a unique experience of space for both spatial systems. The systems also relate to each other, whereas individual systems analysed on their own, could be considered typical to other residential or market typologies.

Design Intent of the Artifact: Organization and Articulation

By analyzing housing in this framework, one can better understand how the balance between these two systems can result in a more humanistic architecture. In each case the analysis defines the activity system based on needs expressed through the individual design intent of each project. In all cases the activity is supported by the way in which the spatial systems are organized which is, defined by the physical articulation of the architectural elements. The precedents thus serve as good examples of how various architectural devices are capable of creating an architectural artifact that addresses human activity, which is itself defined as a product of human needs.



4 | Solution Development

Form and Social Integration

As previously stated, population density comes with many advantages, particularly social density and diversity. However, the higher the density, the greater the challenge is to design the built form in a way that can accommodate a liveable environment that remains sensitive to the human condition. In higher density urban environments, the challenge necessarily becomes a balancing act between the horizontal and vertical dimension. The relationship between these spatial dimensions has direct implications for the physical qualities of urban form and, consequently, for its overall spatial experience. Rudolph Arnheim discusses the nature of the relationship between the horizontal and vertical axes, and how it affects spatial experience. He discusses the primacy of the vertical axis and the fact that we experience movement in space through the horizontal axis. As a result of the way in which human beings orient themselves from gravity, primacy is given to the vertical axis, as it is the only consistent source of orientation. Due to this, the effect of horizontal and vertical perception is quite significant to how we feel, in habit, understand and experience space (Arnheim, 1977). The issue he discusses that is most pertinent to the thesis, is the impact on social integration and sense of hierarchy inherent in form that emphasises one orientation over the other. Using Frank Lloyd Wright's houses as examples he remarks on how, "The horizontal style of living promotes interaction, free mobility from place to place, and ease of progress, whereas vertically-oriented living stresses hierarchy, isolation, ambition, and competition," (Arnheim, 1977, pp. 38, 39). This principle can be applied at different scales to larger buildings and urban environments. This can be readily perceived in public corridors and streets, where horizontality encourages freedom of movement and openness, while vertical elements and boundaries create variety, hierarchy and define and give meaning to the horizontal plane. In well-designed spaces, the combination of the vertical and horizontal elements define areas that are scaled appropriately for socialization. However, it is also well understood that there are limitations of the vertical and horizontal dimensions which must be adhered to which support to social interaction. Christopher Alexander among others discuss how, in the context of a street, one becomes detached from the social life of the ground plane beyond four stories, while the shadows cast from higher buildings detract from the warmth of the street level (Alexander, 1977, pp. 15-18).

As demonstrated by case studies examined in the previous chapter, many different architectural devices govern the relationship between private and public spatial systems. As briefly discussed above, the relationship between vertical and horizontal dimensions is a critical factor that affects the spatial potential for social integration within a built work. For the purposes of this thesis, the exploration of form will focus on how horizontality and verticality affect how the spatial organization (architectural negative) and the articulation of elements (architectural positives) can define the relationship between the public and private spatial system of the design project. While the spatial configuration is unquestionably important, space is inhabited but it is not what is actually seen and interacted with. For this reason, the articulation of the elements is what actually defines space and what allows one to perceive space. Furthermore, it is the elements that define spatial boundaries and hierarchies and ultimately give unity and coherence to a built work

Systems Approach to Spaces and Elements

The main shortcoming presented in functionalist design is an oversimplification of what is defined as functionality and the independence of spaces which fail to address the interconnected nature of human need and experience (activity system). The solution outlined here, seeks to approach the design process through a systems thinking methodology, whereby individual spaces are understood as a series of interrelated spatial conditions, designed and formed with an intent to mold each other towards a holistic experience. These spaces are expected to promote social integration throughout the building (artifact) system which can then be scaled as required to incorporate the building system in a similar way as the subsystem of a city.

Strategies derived from engaging design based on relationships between public and private systems is aimed at a holistic functionality as opposed to an independent, spatial functionality. As with human needs systems, these spatial systems are interactive and should be satisfied based on how the systems relate and influence each other. In order to create a building that functions holistically, an environment in which social integration is promoted must also be manifest. The design process, which will address the systemic relationship of spaces, will first be engaged through the design of the spatial organization and elemental articulation. Consistent with Hillier's argument for 'space as the machine' spatial configurations are critical.

> *"Very few of the purposes for which we build buildings and environments are not 'people configurations' in this sense. We should therefore in principle expect that the relation between people and space, if there is one, will be found at the level of the configuration of space rather*

than the individual space," (Hillier, 1996, p. 30).

In the context of the thesis, his discussion supports an emphasis on spatial relationships as a means of creating a design that can support social integration. By configuring space in a way where individual spaces function in a mutualistic system, the building as a whole system, the artifact, is designed in coherence with human sensitivity to form and space and supports human needs, the activity.

Strategies and Tactics

The strategies and tactics that will govern this process will therefore focus, first, on the spatial configurations and, second, on how they are articulated in order to ensure that spaces are functional individually and can act as a cohesive whole. The strategies are intended to ensure that spaces are designed in a way which will allow them to contribute to the overall experience of the building and create mutualistic relationships will other spaces. Design strategies for addressing relationships between spatial requirements of public spaces versus private spaces will be governed by the following strategies and their corresponding tactics:

|1| INTENTION PRIORITIZING: In many multi-residential compositions, units are given priority over social amenity spaces in terms of the views, building location and access to light. Further, they are typically positioned where they become isolated destinations within the building, preventing potential for random engagement with the spaces. While reasons for giving priority of these elements to units are understandable, they do not negate the fact that social spaces require similar treatment to be successfully utilized. There must also be meaningful contribution to the social atmosphere and, ultimately, community cohesion of the place. The social infrastructure and the individual units were organized in a way that would not diminish common spatial requirements of the units. Equilibrium was also established among social spaces, and the design encouraged usage of social spaces while still maintaining the quality of more private spaces and units. By balancing the priority weights of spaces, the overall building will better address both social needs and individual needs.

I. Balancing Resource Access: organizing the massing of the public and private systems so that the form allows access of to Light and Views to both systems

II. Pedestrian Exposure: allowing the activity within the building (its pedestrian life), to animate all areas in the building. The circulation will be exposed to all areas and concentrated to create an augmented perception of life within the public areas.

III. Spatial Definition: create a gradient of spaces sized and articulated to create a diversity of social scales within the building. These elements of the public system (shared spaces) will be designed to be sensitive to the number of people occupying the space and the privacy required by adjacent private system (units).

IV. Spatial Ambiguity: Defining spaces in a way that their extents are clear but use perceive the boundary elements are perceived and not material, thereby allowing flexibility of activity and pedestrian movement.

|2| PATTERN CONGRUENCE: Human are designed to satisfy needs in ways that are natural to their physical and psychological condition. Sensitivity to how satisfaction occurs in normative circumstances and how satisfiers can exist together is important in order to design within the tested laws of the human condition and not outside of it. Space and the built environment play a fundamental role in mediating social relations and as such the way that space is articulated should be sensitive to how people behave and are affected by space and spatial qualities. By understanding the rules of the existing socio-spatial patterns, a synthesis that is conducive to how both individual and social needs have evolved to be achieved.

I. Socio-Spatial Logic: balancing horizontal vs Vertical elements to encourage social interaction while create variety through a hierarchy of spatial conditions. Organize spatial proximity and scales in a way that supports interaction but respects privacy.

II. Social Organization: cluster private spaces in quantities that supports meaningful social relations and create diversity within groups by mixing unit types within clusters.

III. Environment Behavior Setting: address the spatial quality through visual variation using natural elements and variation in material.

|3| SPATIAL RECIPROCITY: Various social and individual needs are potentially mutually beneficial to each other. By addressing these needs, based on how they potentially can be related to each other in a system, a design solution can be reached which strategically addresses multiple issues in a way that is potentially simpler and more efficient.

I. Visual Engagement: using variation in architectural form of facades and spaces to create visual compositions that can stimulate and engage occupants of other spaces and provide another means to animate views from multiple vantage points.

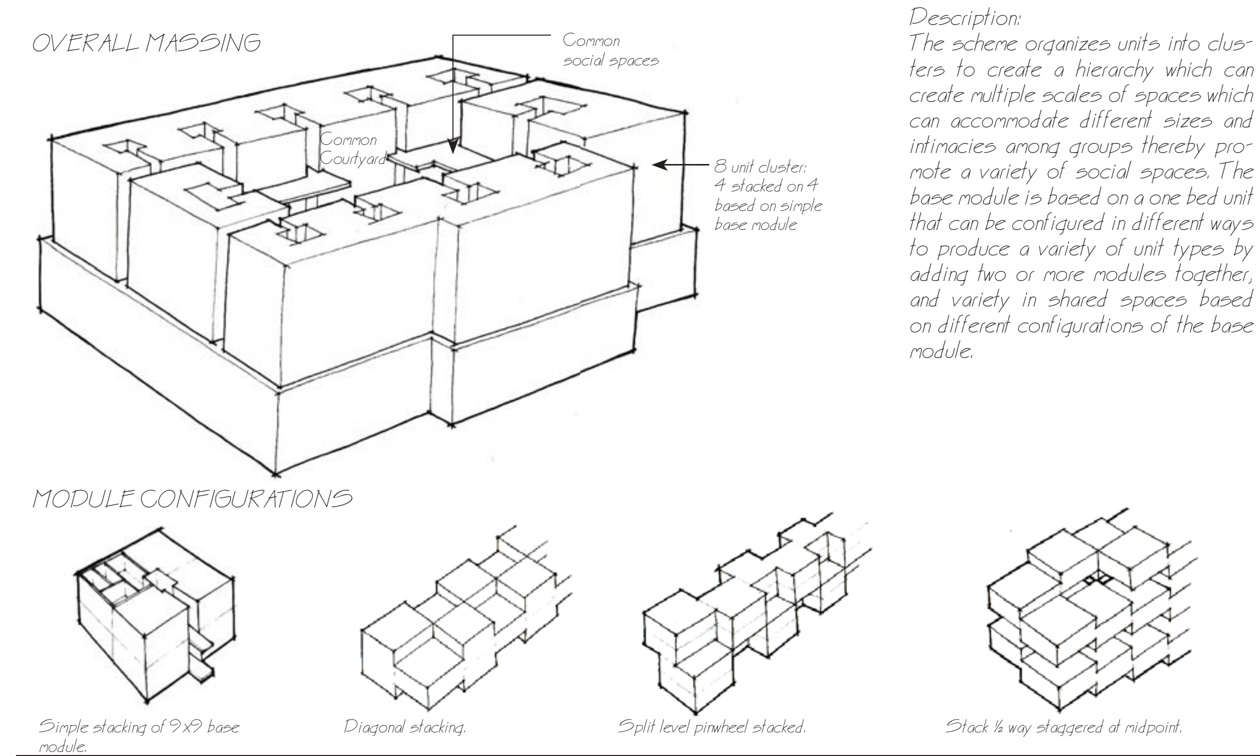
II. Spatial Comfort: include articulate different elements throughout the building that can aid in climate control to and buffers and visual barriers to provide privacy.

|4| COMPLIMENTARY POTENTIALS: various needs and satisfiers are similar or are inherently related. By exploiting these potentially agreeable elements, a synergistic whole can be created that satisfies both elements in a way that increases the quality of what would have been two individual and separate solutions.

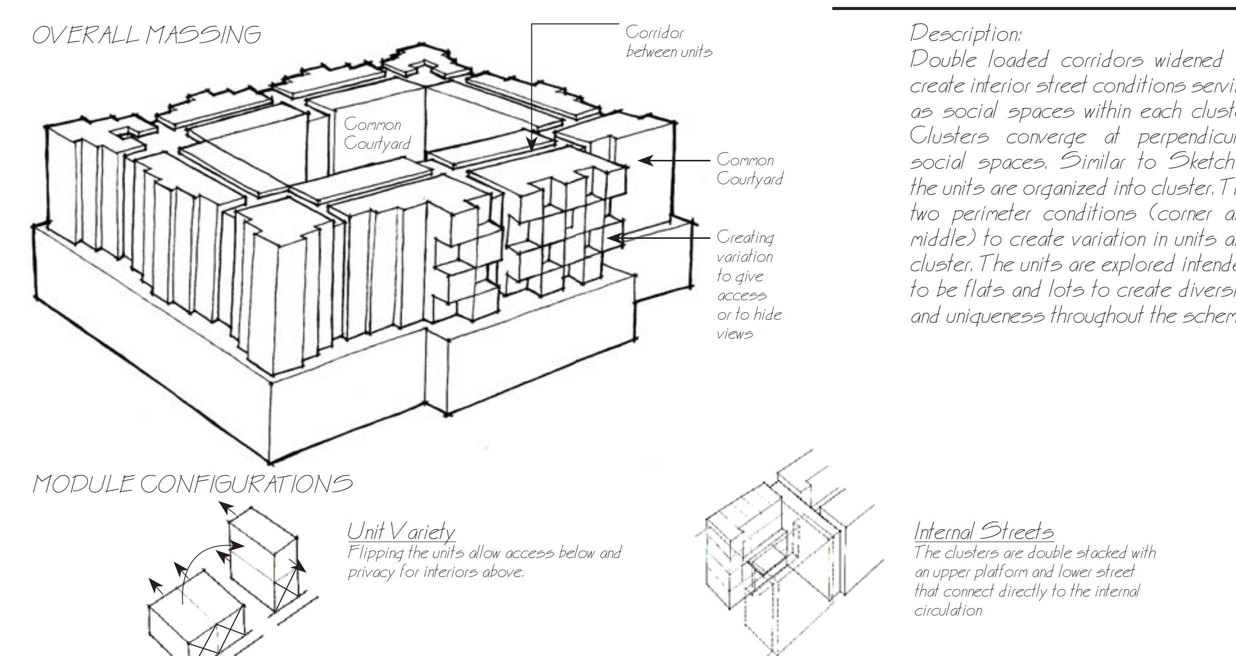
I. Identities: allow for flexibility of use and elements within shared spaces to encourage spatial uniqueness and shared ownership thereby creating positive spatial associations and foster social identities through these shared spaces.

Initial Synthesis and Investigations

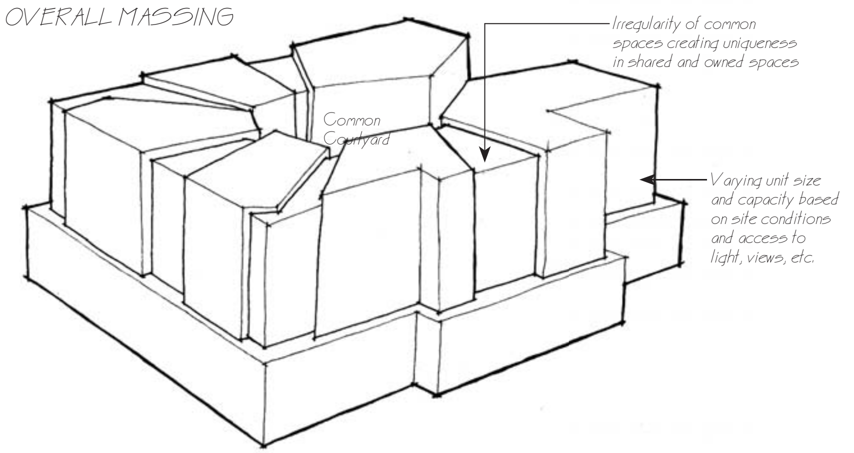
Initial investigations looked at several spatial configurations at two scales: an intimate human scale that addressed smaller social groupings, and a larger scale of the whole complex into which the smaller scaled groups would be combined (see Fig's 4.1-4.4). These initial investigations were all within a 4-6 storey height limit to maintain social distance between the top and street levels as well as to control availability of light. The resulting interior conditions took on the appearance of a small-scale streetscape, which became the primary repeatable element, scaled to human-sensitive proportions, responding to more intimate social scales (see Fig's 4.5-4.7). The overall structures were organized as groups of these smaller units which, were then located around a larger common courtyard area.



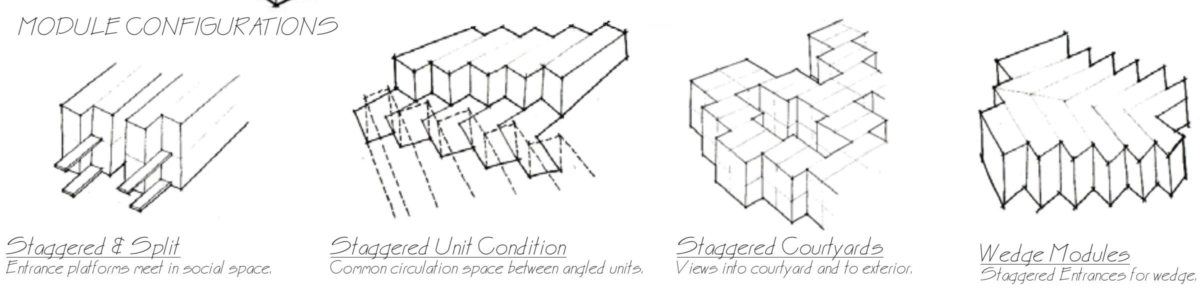
| FIG 4.1 | **Design Sketch 1**



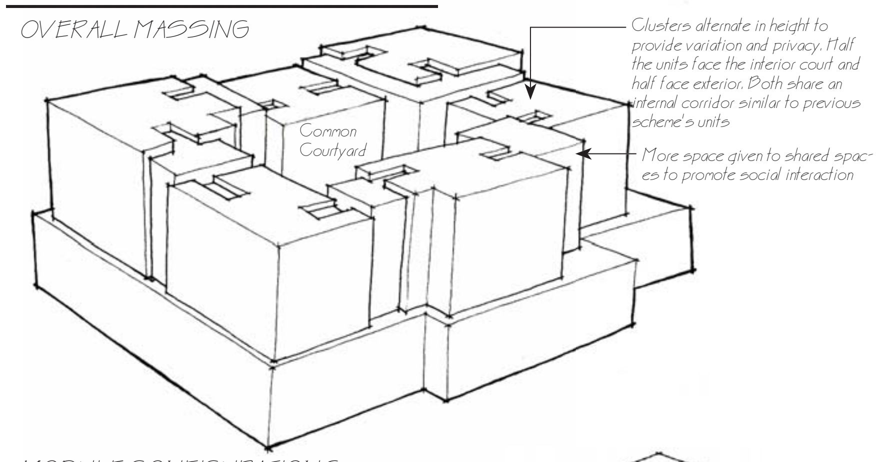
| FIG 4.2 | **Design Sketch 2**



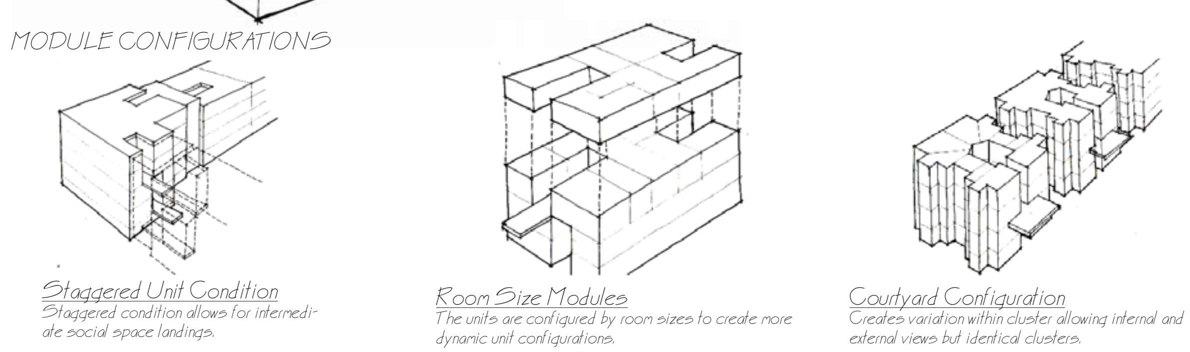
Description:
The irregularity form explores collective and unit variation among the units and shares spaces moreso than the previous strategies. The form explores how regularity of the overall spatial organization and social structure can be achieved with an irregular for to while allowing all units and spaces equal access to light view and interaction. The orientations also begin to address how privacy can be achieved in restrictive spaces.



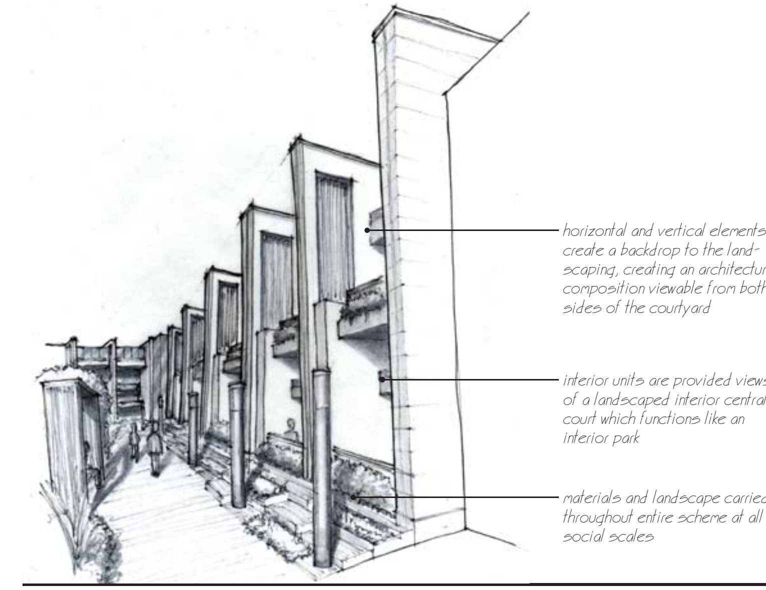
| FIG 4.3 | **Design Sketch 3**



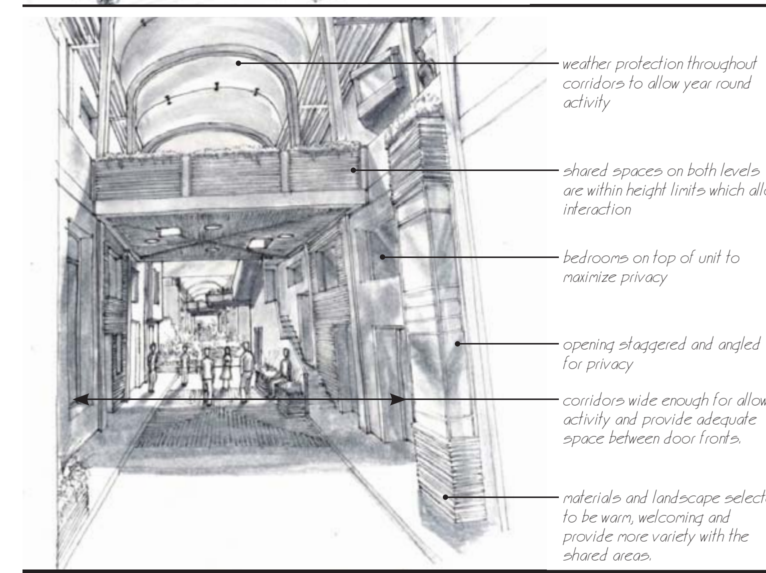
Description:
Common areas connecting courtyard clusters for exiting and provide intermediate social spaces. The shared spaces connect to the clusters by staggering the configuration in plan and section to create variety and unique conditions within the entire scheme. The interior cluster conditions are comprised of multistory units to increase heights to create privacy while remaining within a height limit that allows connectivity through from top to bottom of the scheme.



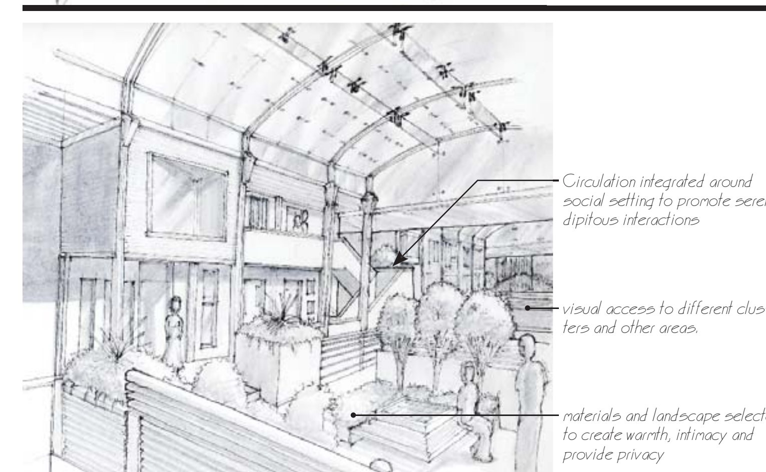
| FIG 4.4 | **Design Sketch 4**



| FIG 4.5 | **Design Sketch 4 Main Courtyard**
Main central courtyard shared by entire building addressing social interaction at the building scale.



| FIG 4.6 | **Design Sketch 4 Shared Corridor**
Interior corridors providing access to units within clusters and creating a casual level social interaction.



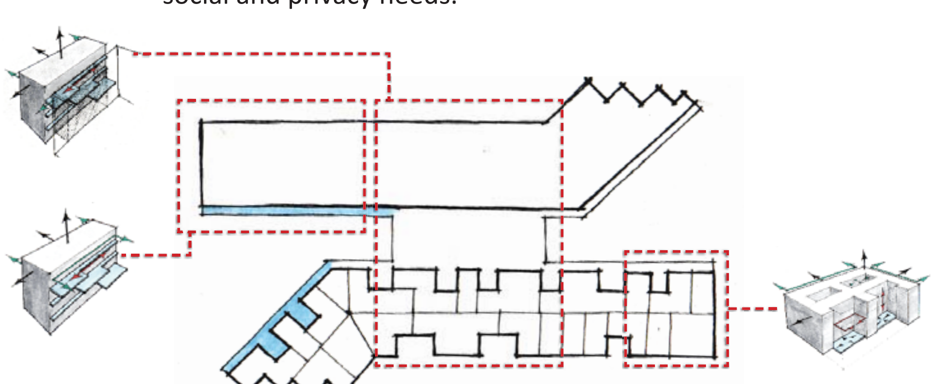
| FIG 4.7 | **Design Sketch 4 Social Space**
Social spaces within clusters to provide different scaled spaces to accommodate different group sizes and areas within clusters. These spaces create more intimate spaces for social interaction.

Limits of Form (Intention Prioritizing)

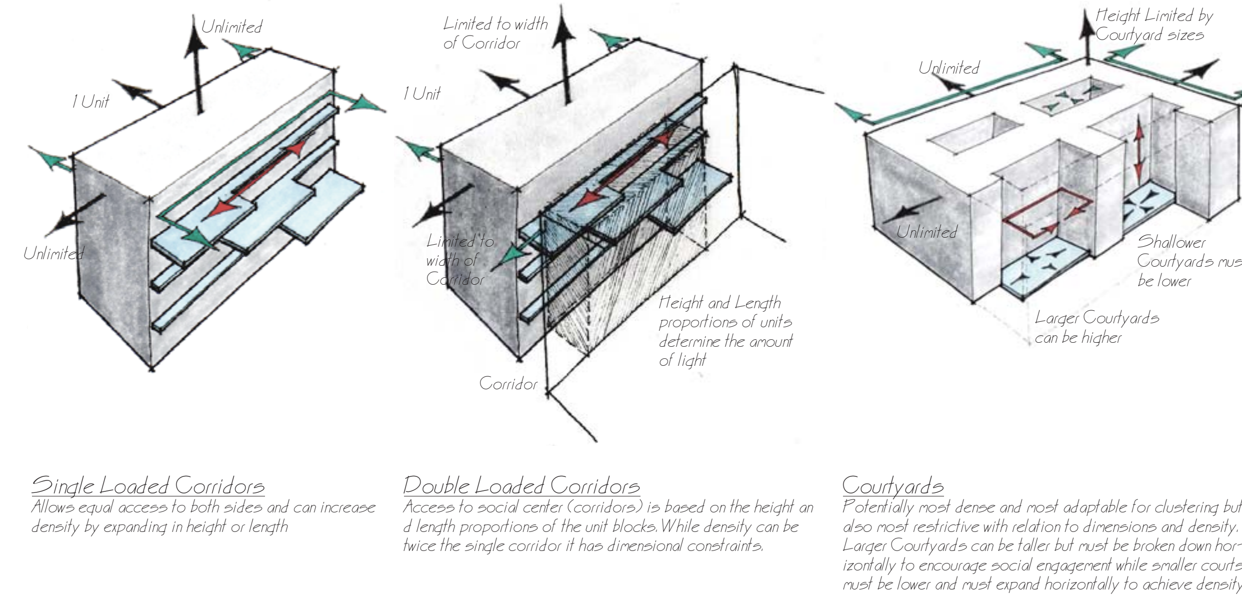
One of the interesting realizations of this initial attempt to create a more social environment was the fact that the resulting spaces took on characteristics of what is generally known to produce good social spaces in the public realm. The public realm is intended to satisfy a multiplicity of social needs that can be addressed to some degree in the private realm. The reason this might not happen, lies with the argument that this thesis makes, namely that the spaces being designed do not address human needs systemically. In this case, the relationship between public and private spaces was designed to allow more flexibility between the two, mediated at the social group scale, to create a more social environment, capable of satisfying social and privacy needs. By understanding the nature of these human needs and how they are satisfied in space the resulting design becomes more systemic and responds to human needs.

Subsequent investigations were focused on a better understanding of how form can be manipulated in different ways, particularly to increase density while maintaining the intimate social nature of the spaces (see Fig. 4.9-4.10). As the form increased in scale, it became readily apparent that necessities such as light and view had to be negotiated among spaces. By examining what are very basic spatial configurations of residential buildings a better understanding of the limits of their various spatial forms was reached and incorporated into a form which balanced these variables into one form (see Fig. 4.8). In light of this, if public spaces were to satisfy needs in tandem with private spaces, it would mean that more priority would be given to those public spaces in terms of their design and resources such as light and view. This provided further cause to question the nature of the private and public divide, and how it could be negotiated to address both social and privacy needs.

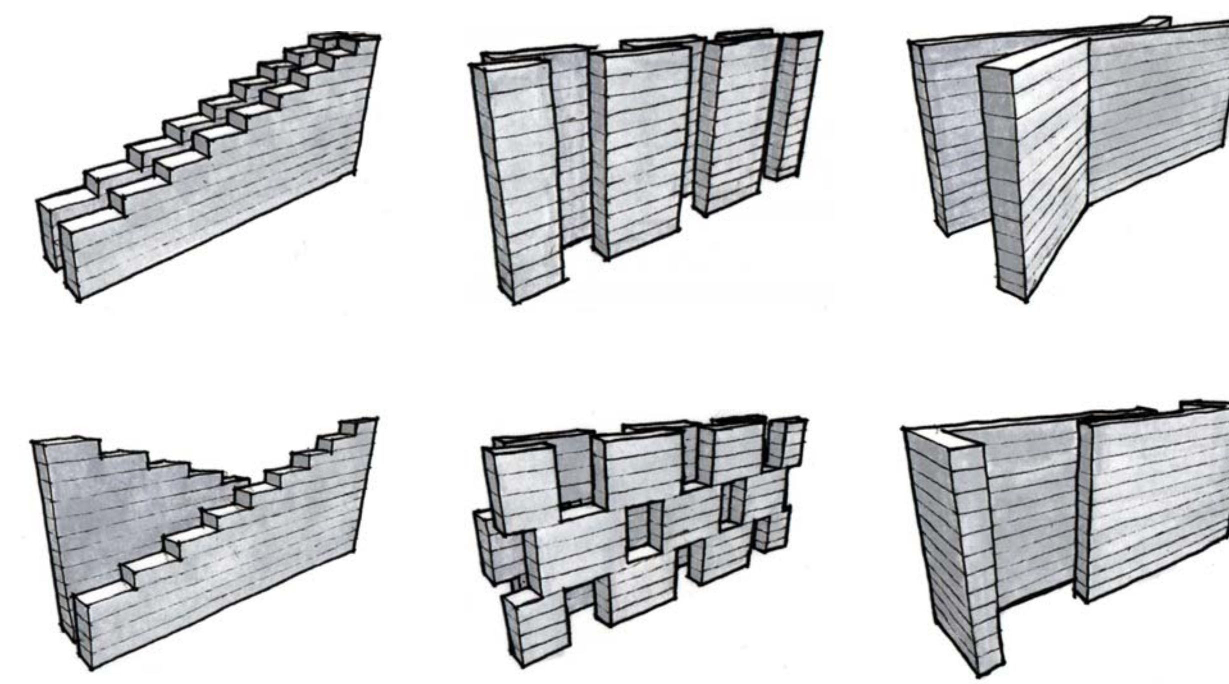
Visual access connecting units and corridors horizontally and to the floors and social spaces immediately above and below. Maximum width across void is within visual proximity for facial recognition and appropriate for social spaces.



| FIG 4.8 | **Formal Exploration**
Configuration and massing synthesis.



| FIG 4.9 | **Unit & Circulation Configuration**
Dimensional limits of residential arche-

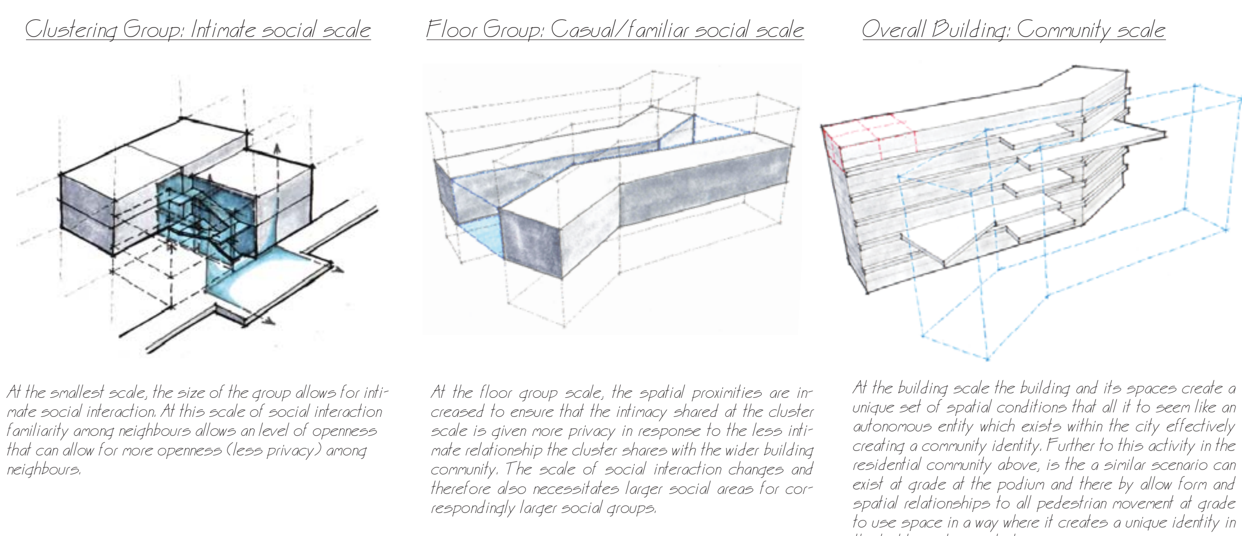


| FIG 4.10 | **Massing Studies**
Massing studies for light and views.

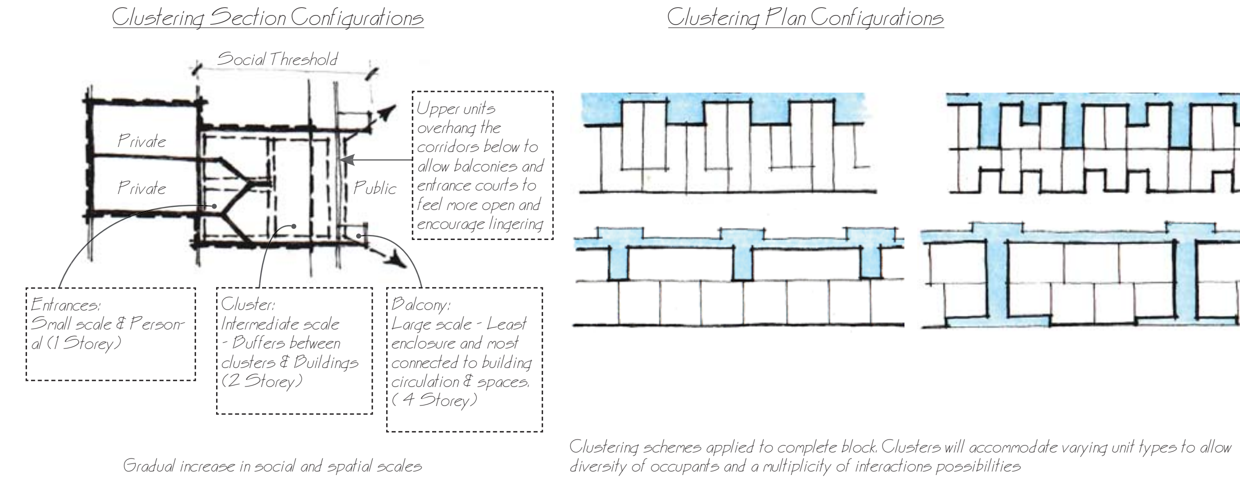
Designing For Humans (Pattern Congruence)

While designing for increasing public and private spatial systems, it was necessary to ensure that the scale of the spaces was conducive to a comfortable social environment where meaningful relationships could be fostered. For this reason, it was crucial to break down the larger space into smaller spaces that were appropriate. Various configurations were used which balanced private with public spaces. The end result was a base cluster built around a small court which was large enough to act as an intimate common space serving as a shared social threshold (see Fig.'s 4.12-4.13).

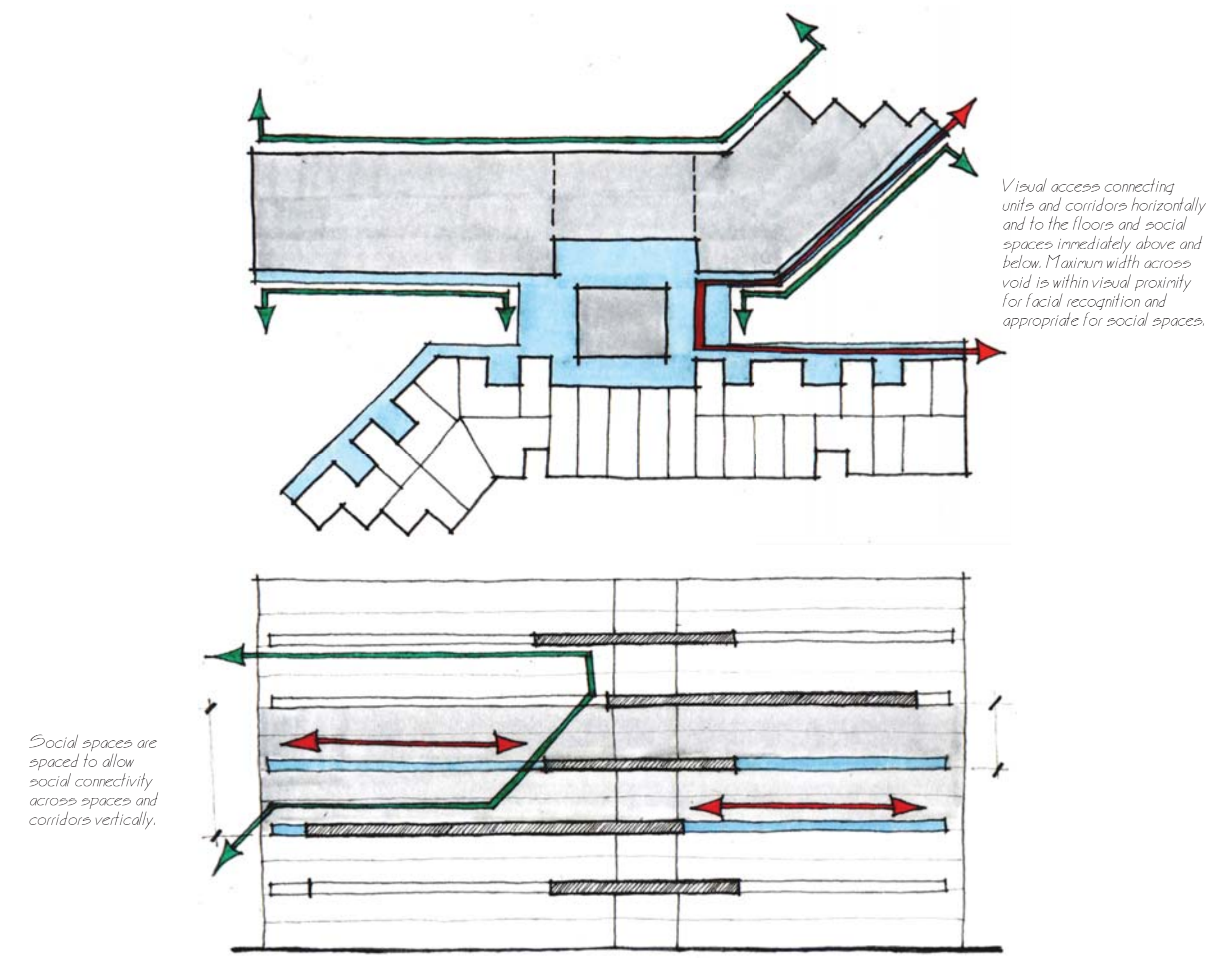
While this first level of social zones was intended to foster comfortable social interaction within an intimately scaled space, other levels are necessary for a similar social atmosphere throughout the entire building (see Fig. 4.11). At this scale, the private-public relationship effectively mimics a community environment where other socially related needs such as safety, security, and a sense of belonging can be addressed by creating a familiarity among clusters. Here the level moves from the cluster of units to floors of clusters, which are grouped in fours and are surrounded by social bridges. Furthermore, at the overall building scale, the building begins to act as an autonomous community environment that fosters social integration through consistency in its social environment throughout. This environment and will be mimicked at the podium level to allow the grade condition to foster similar social identity with the building's urban context.



| FIG 4.11 | **Social Hierarchies**
Balancing social and privacy needs through scale.



| FIG 4.12 | **Cluster Configurations**
Variation in unit sizes and organization



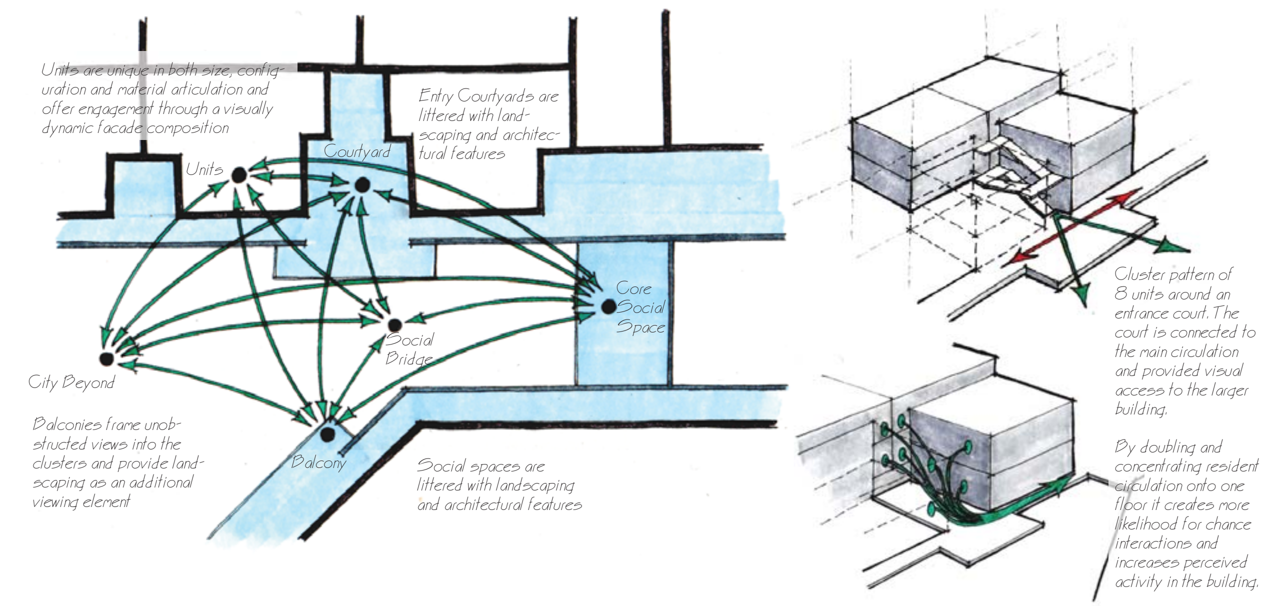
| FIG 4.13 | **Cluster Size & Height Limits**
Balancing Cluster size with resources.

System Symbiosis (Reciprocity and Complementary Design)

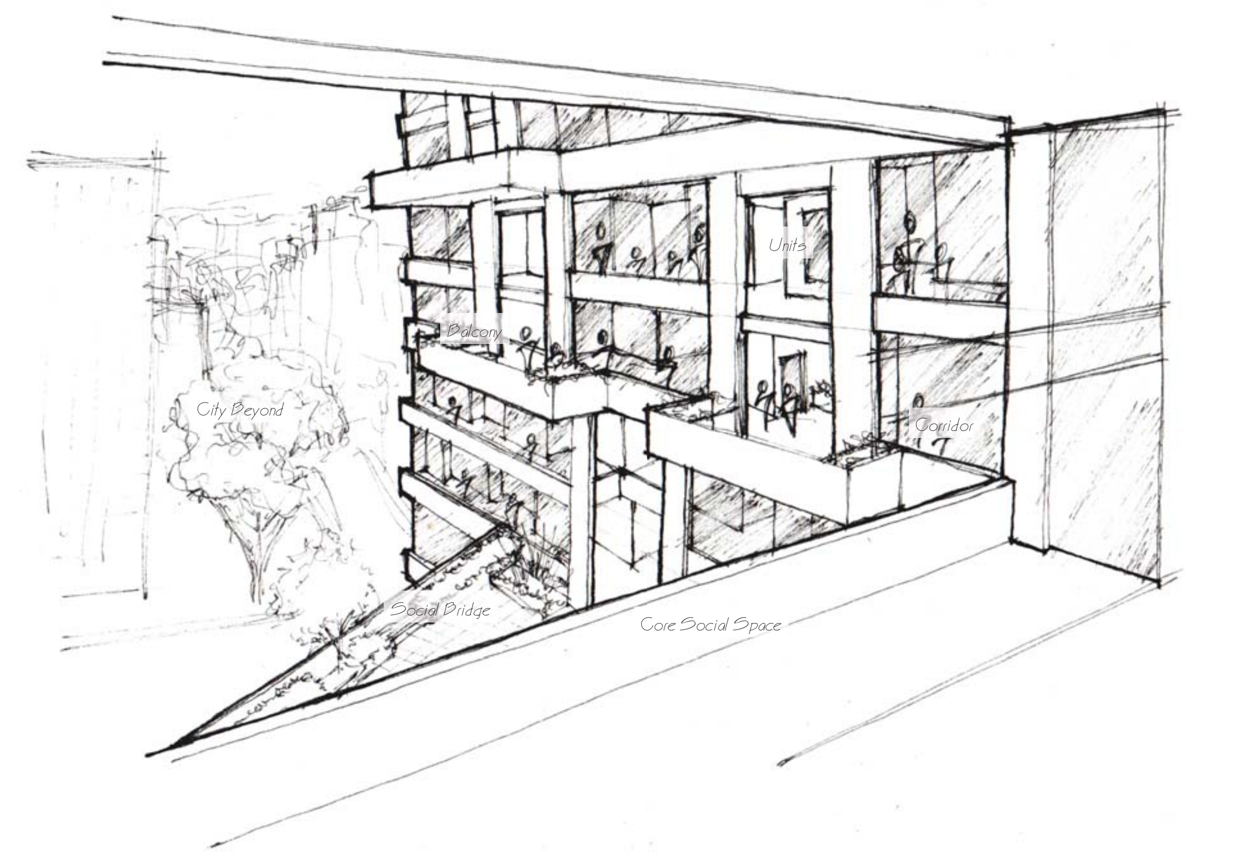
In all natural systems relationships can be found between elements that are mutualistic. Through the lens of the human needs activity system and the context of the design project, the social life of the community is just as important to each individual as it is to the whole. This mutual need of the individual and the collective presents an opportunity to leverage the need into a spatial solution that benefits both the individual and collective. The solution that was explored, employed the circulation system as a means of, not merely connecting and moving people through the spaces, but allowing the system to play a much more integral and active part in the building's community life. By opening the form to allow the circulation to become an element animated with the life of the community, in a fashion similar to a street, it would become a place to watch and be watched. By changing the function of the corridors from a path connecting A's to B's, into a place where the life of the building is exhibited, the way in which it was articulated in like manner had to change in order to accommodate its new function. This change was capitalized on by adding balconies, which extended from the cluster spaces, both enlarging the spaces and encouraging movement in and out of the intimate spaces, further allowing social interaction across clusters (see Fig. 4.14).

This physical and visual connectivity effectively became a catalyst for redefining the functional roles of other spaces within the building. The central core also provided another high-traffic space for casual encounters, which could further animate the building (see Fig. 4.15). This process of rethinking the functional definitions of public spaces by reconsidering how needs can systemically be satisfied through spatial relationships was explored in other areas of the building. The idea was explored in the relationship between the shared spaces of the residences above, and the public domain below. Just as the life of the building became an asset to its community by exploiting visual connections, life in the street initiated a mutualistic relationship between the ground plane and the private shared spaces above.

The changing dynamics of the spatial functions required a unique way of defining spaces. The spaces were intended to bleed into each other (see Fig.'s 4.16-4.18). They were designed with elements that defined implied spatial boundaries where possible to encourage movement, to be socially inviting and not to be perceived as barriers (see Fig.'s 4.16-4.17). Where privacy was necessary, the elements were in contrast, articulated with ma-

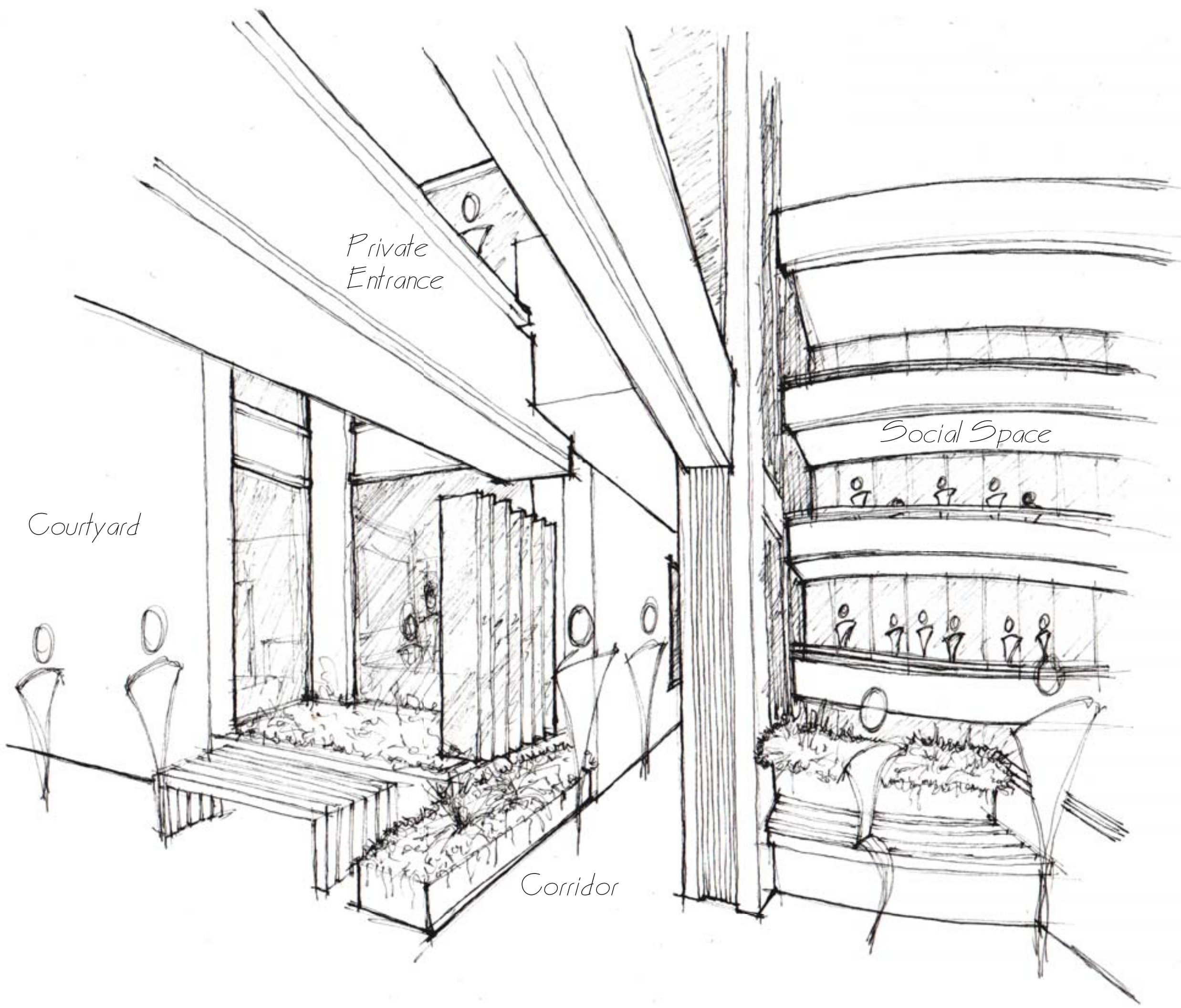


| FIG 4.14 | **Animating the Building**
Exposing the life of the building to itself.

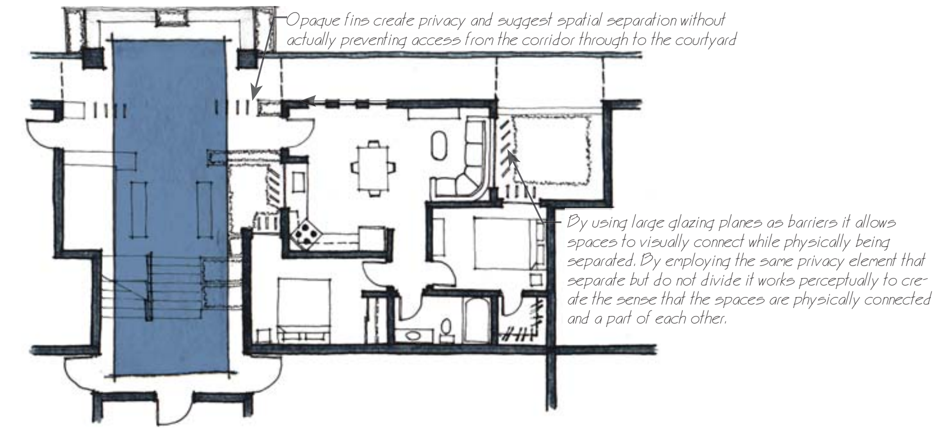


| FIG 4.15 | **Viewing the Life of the Building**
View of city and building from core space

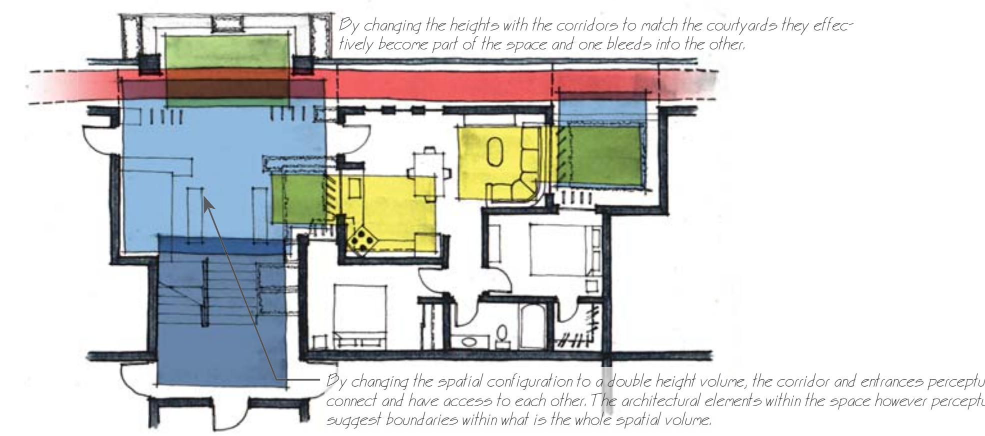
terials that clearly emphasized the physical boundary between shared and private. In so doing, the architectural elements became clear indicators of private and public spaces in the building. By clearly identifying spatial ownership, and carefully managing the amount of public space around private spaces, the design encourages social interaction in the public spaces appropriate to the level of privacy needed around the private spaces. The most evident example is between the clusters and the main corridors. Here the materials which define the relationship between public and private spaces limit social congregation around the more private areas of the units, while allowing interaction in the areas that are designed to facilitate it while not preventing access from



| FIG 4.16 | **Blurring Spatial Boundaries**
Private luster and public courtyard



| FIG 4.17 | **Perceived Boundaries**
Articulating elements to imply boundaries



| FIG 4.18 | **Fluidity Between Spaces**
Allowing spaces to bleed into each other

either space.

It is a fact that humans need the society of others. However, solutions presented in most tall buildings to address this need, typically manifest in social activities at grade or social spaces – amenity spaces – scattered throughout a building. These are insufficient to create a sense of community within its walls. By understanding the complex nature of human needs and how they are best satisfied systemically, the way in which the architectural problem and ultimately the solution is engaged changes, as in the case of the design project. By investigating the relationship between needs, social versus privacy needs for example, we change the way we address these needs. This creates a different functional definition of how we attempt to satisfy these needs based on that understanding. In the case of the project, a more plausible way of creating a socially favorable environment is developed where social needs are balanced with privacy needs.

5 | Solution Application

Density in Context

As evidenced through the case study analysis and preliminary design research, the human environment relationship engaged through the framework of the human activity and artifact system is a viable way of ensuring a design that is both functional and sensitive to human needs. To demonstrate the validity of the practical application of this assertion, the thesis project will use the proposed systems framework to develop a residential scheme focused on social integration. Within an urban environment and in accordance with the idea of systems scaling, the design project will manifest as an autonomous system of public and private spaces at the building scale. Further, it will extend into the urban fabric at the city scale, where it becomes an element within its immediate context. Given the urban context, the project will reflect through its spatial organization the primacy of social needs, and be articulated in a way that reflects the interrelatedness of the human needs system as it relates to its social objectives.

To test the strategies of the thesis, the design project will be sited in Toronto. The high-density housing stock most prevalent in Toronto, particularly in the urban core, is the tower podium configuration, an evolution of Corbusier's Radiant City model, which results in programmatic compartmentalization. While the model was intended to open the ground plane and to allow a more active pedestrian life, the combination of programmatic stratification and prominence of vehicular traffic has left much to be desired of the pedestrian plane. Despite all its promise, this has been a problem with the housing stock of Toronto that has evolved from the post-war slab blocks to the contemporary point towers that dominate the urban core. In as much as it is understood that qualities such as human-scaled spaces and variety make for good social spaces, the quality of social environments is based on more than the quantity and quality of individual spaces. As argued in this thesis, quality in the complex of a real world environment results from how the spaces function as a unit. As such, through the lens of systems theory, it becomes apparent that a residential building, composed of a collection of social spaces, built around private units, is not sufficient to foster a social environment across either the building or its urban environment. Essentially in both the slab-block configuration and the point tower, there are public spaces and private spaces, but the two types offer no real relationship capable of fostering a social environment. What further worsens potential for social engagement is the fact that in point towers in particular, while the overall density is increased by height, the social density per floor is greatly minimized. This further exacerbates social isolation within tall buildings, which occurs due to lack of social integration, which exists and increases the more distant one is from the social life of the street (Alexander, 1977).

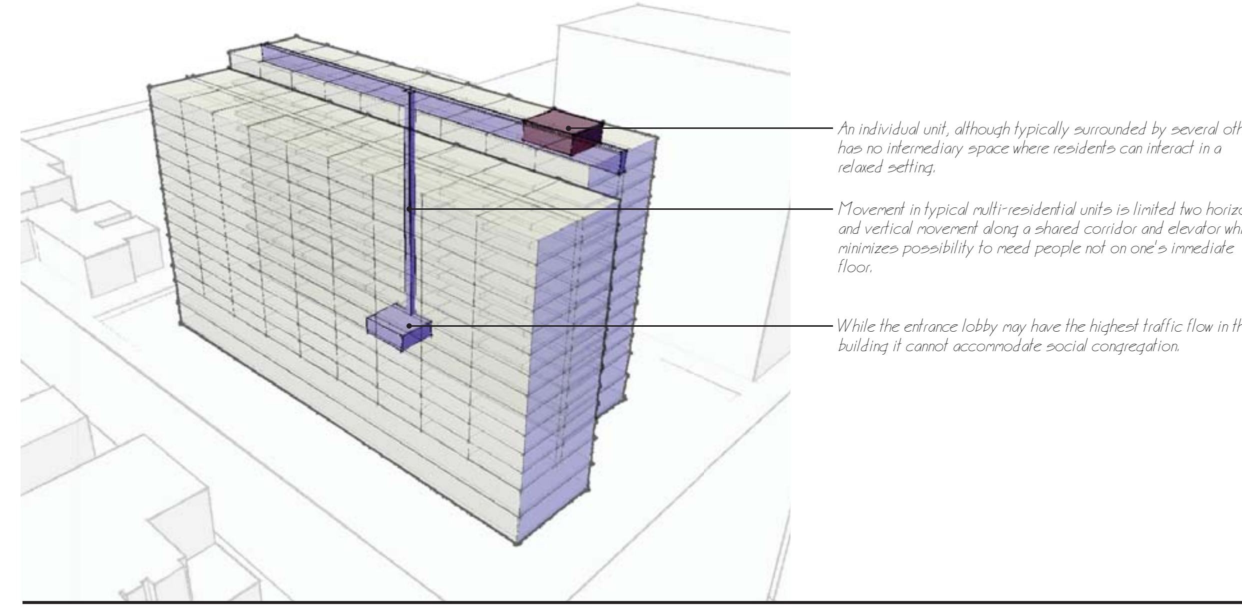
The physical form of high-density housing in Toronto does very little to contribute to the social life of its occupants. Despite the advantage of freeing the ground plane and increasing density, the point tower does nothing more than allow people to live in one spot. While some towers can serve as landmarks or icons, the density that exists and continues to appear as a product of this typology is unsustainable. What is being promoted as an alternative to the point tower is the construction of midrise development along the larger avenues throughout the city (Gillis, 2013). In keeping with the idea of designing the building to be an element within the larger system of its immediate urban context, the design will abide by the proposed development recommendations for midrise housing. By complying the project will adopt the rules that govern the relationship among the other elements of the urban-scaled artifact system. This compliance is possible because the rules that govern the midrise recommendations are consistent with the strategies that address human-sensitive design, specifically the **Pattern Congruence** strategy. Essentially the midrise development is aimed at creating more human-sensitive environments (Gillis, 2013), which is the ultimate goal of the Pattern Congruence strategy and by extension this thesis, therefore the rules that govern the behavior of the spatial systems of the building are not in conflict with those at the city scale. For this reason, the midrise developments along avenues are appropriate for the site selection of the thesis project. The specific site chosen is at the intersection of Bathurst Street and Adelaide Street West (see Fig. 5.2). The site sits on the boundary between commercial midrises where the Fashion, Entertainment and Financial Districts are located, and a large area of low-rise residential units. It is well connected by transit with existing pedestrian laneways, connecting in and around the immediate vicinity. Proximity to the residential and commercial elements will provide an opportunity to allow the public elements of the design to be integrated into the urban fabric and be amenable to the scaling of the public and private systems from the building to the city.

Formal Evolution

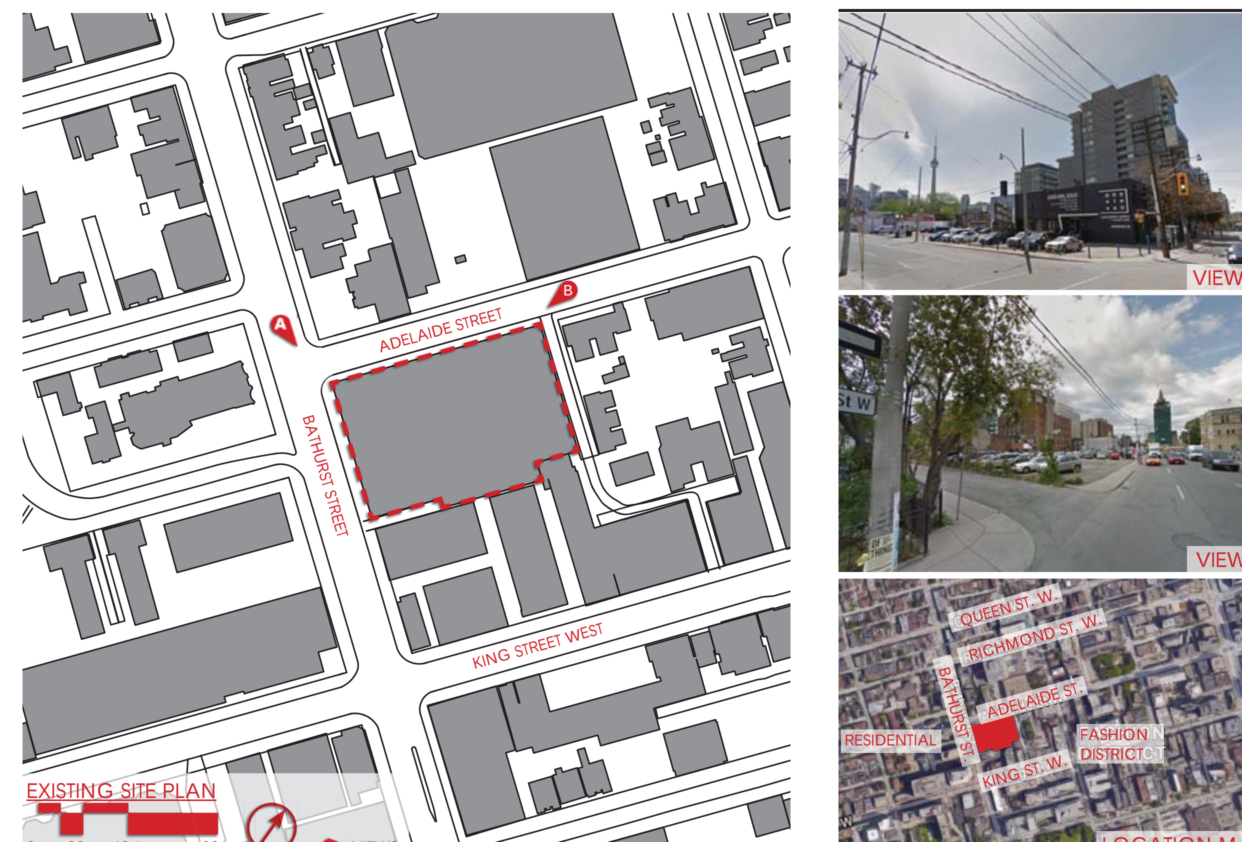
The ideas discussed in this research were employed in the design to create a socially integrated high density housing prototype. The design focused on the three main scales that are intended to build gradient of social settings within the project: the intimate or cluster scale, the floor group scale and the building scale, which also addresses how the building in turn meets the urban site. The strategies and tactics developed in the research were further refined based on various texts which address the design of human-sensitive spaces. These include primarily, Rudolph Arnheim's *The Dynamics of Architectural Form*, Christopher Alexander's *A Pattern Language*, Jan Gehl's *Cities for People* and William Whyte's *The Social Life of Small Urban Spaces.* The Activity system, as established in the research, suggests a change in the functional description of public and private spaces. The design project therefore will achieve a more social environment through manipulation of both private and public space as two separate but mutualistic spatial systems.

Existing Type – the Slab Block

A typical slab block configuration was selected as a base for several reasons revealed in the preliminary research (see Fig. 5.1). First, the double-loaded corridor system provides a favourable ratio between circulation space, the primary spatial element in the public space system, and the private space system. The basic formal configuration can be easily manipulated to change the proportional relationship between systems as needed. The second reason is that the double-loaded corridor system can be indefinitely extended and effectively is only limited by the site or the impact the scale of the massing may have on the surrounding area. The double-loaded corridor system can also be easily configured in multiple ways to best suit the site or broken into smaller components for formal variation or articulation. Finally, the form is defined by its length, which is dissimilar from a point tower configuration. For example, it creates more opportunities for horizontal circulation. Based on Arnheim's writings, horizontality, and by extension horizontal movement, creates spaces which are more conducive to social integration. While this is an advantage, there must be some sensitivity as to how it meets the grade condition to ensure that the mass remains permeable. These favorable conditions should also allow the main mass to connect to the base and not become a massive barrier across the site relative to the street. By virtue of this configuration, the form should be more readily amenable to a high density of social interaction across individual floors.



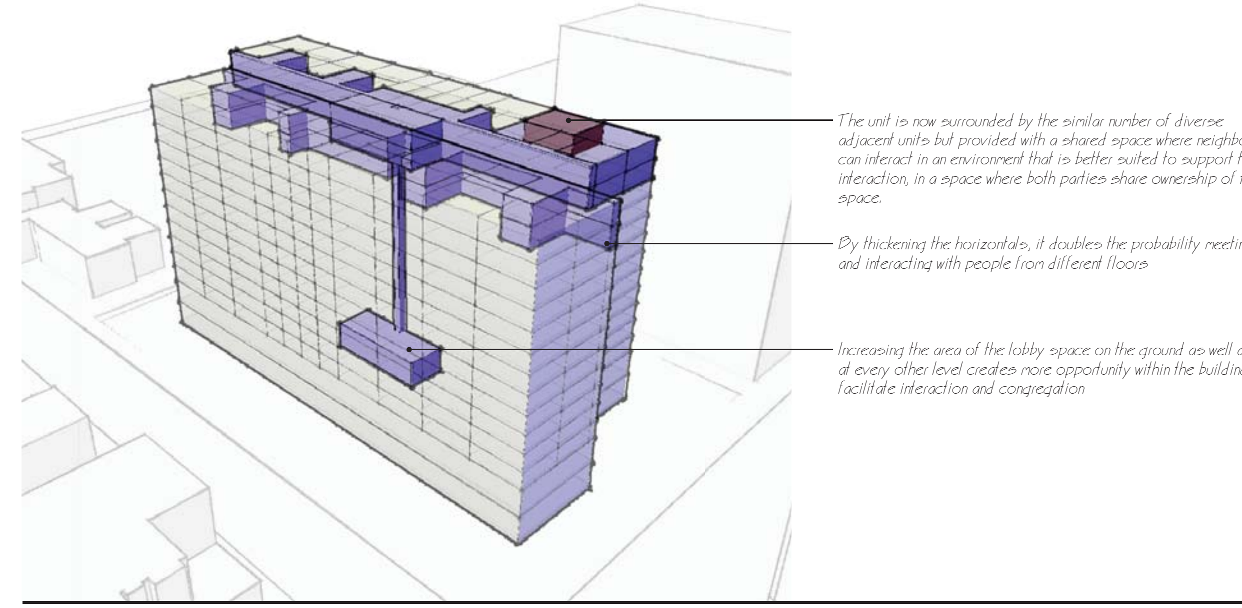
| FIG 5.1 | **Massing Diagram 1**
Exploiting density.



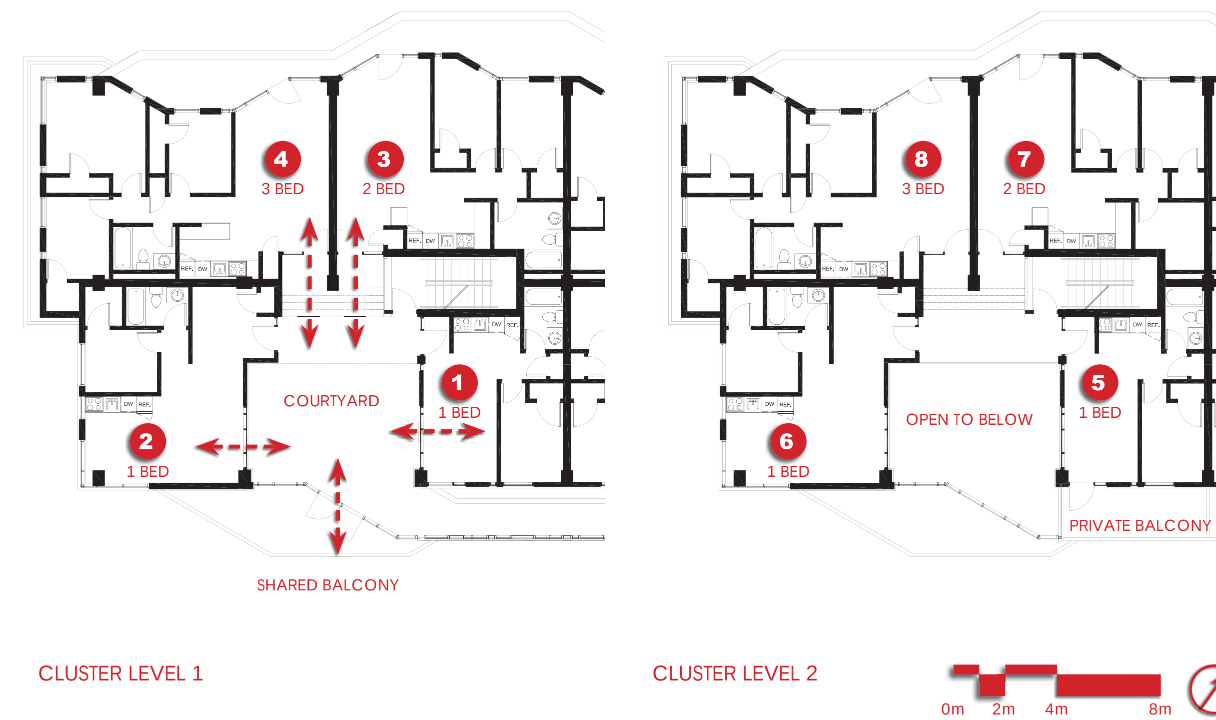
| FIG 5.2 | **Proposed Site**
Bathurst Street & Adelaide Street.

Public/Private System Hierarchies & Groupings

The second stage takes the massing and configures the base's hierarchical relationships between the public and private systems (see Fig. 5.3). The horizontality encourages movement and social integration, while the level of intimacy and hierarchy is established by the vertical articulation of space into clusters as this is more likely to promote intimacy and closer social ties (see Fig. 5.4). The floors are divided in two stages that are defined by the corridors of the public system. The floors are divided into groups of four levels as a first step. By organizing the floors into groups of fours the vertical height within the group is kept within a limit that permits social interaction. To better define the group and reinforce the physical connection across the group, a social link (the social bridges) is incorporated into the public system (see Fig. 5.6). Within this height restriction of the group the social link can effectively serve a similar function to the street and create a common public space servicing that group. The second level consists of the hierarchy of the private system, the units, and the relationships the groups share with the public system. The units are clustered in groups of eight to twelve, organized around a common courtyard appropriately scaled to balance privacy with adequate space for social interaction among group members. The courtyard acts as a threshold condition between residents, thereby creating a space to interact without having to invade one's personal space. Each cluster occupies two floors and is connected to the main public space system via corridors on the lower floor. While the clusters create the first level of social intimacy within the building, they are still connected to the wider community by the corridors. This creates a social gradient connecting residents in various degrees, thereby taking advantage of the larger horizontal scale for which the base was selected. Finally, by concentrating the movement along the corridors on two of the four floors within each group, it increases the chances for interaction outside of the first level of intimacy within the public system. The third level of intimacy would be defined by encounters incident at the common links and lobby areas. By creating the gradient between the level of intimacy between the public and private systems, each system informs how the spaces of the other are proportioned. This also ensures that balance is maintained in the relationship regardless of the scale the overall form expands to, similar to a street in the city.



| FIG 5.3 | **Massing Diagram 2**
Social hierarchies: clusters & floors.



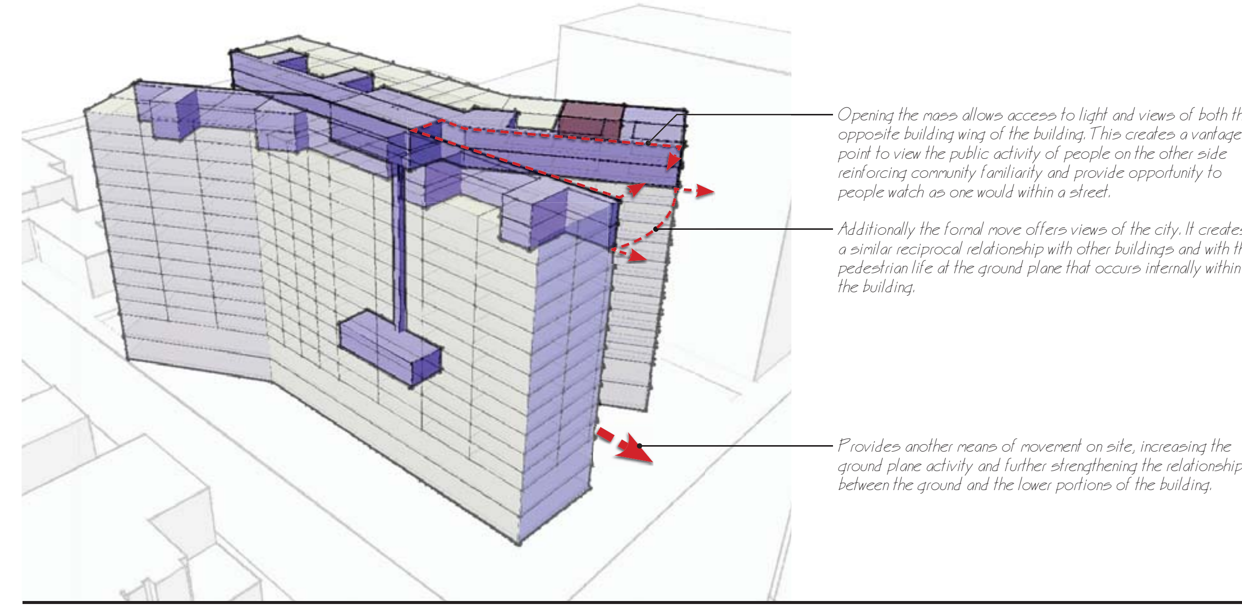
| FIG 5.4 | **Cluster Plans**
8 unit cluster showing unit types.

System Prioritizing

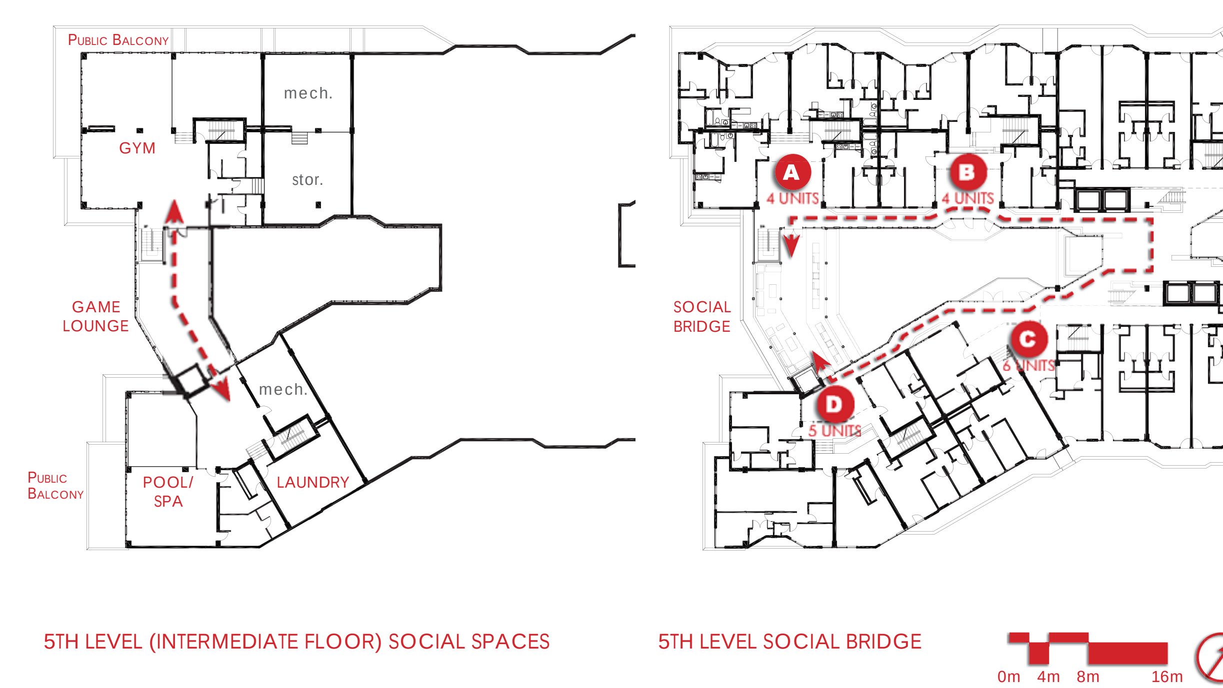
At the previous stage, the relationship between public and private systems created internal conditions between the corridor, courtyards and units. The change in relationship necessitates that the form be modified to allow equity of resources, light, views, and so forth, to all units and between the public and private systems – the idea being, that if the public system is to be a shared asset of the private system, the spatial elements of which the system is composed should become places that contribute to the overall positive experience and social interaction of the whole building. By splaying the ends of the masses, it opens up the cores and the interior conditions to light, ventilation and views of the city (see Fig. 5.5). The opposing mass, which is located at a distance that allows visibility across the building, does not create privacy issues across the floor. Again, the split across the massing at similar floor groups creates another opportunity to observe the life of the building in the same way one that might from a house in a street condition.

Further, the social bridges provide opportunities to localize complementary amenities that have potential to increase chance happenings within the building (see Fig. 5.6). One such mutualistic pairing is that of a laundry room, typically housed in a basement and a recreation room. Although, as the former is not a typical social catalyst, by providing a space in close proximity in an environment such as the landscaped bridge space above, or an activity room below, it would create a different dynamic than would a typical basement laundry facility. Essentially again by rethinking how public spaces work as a unified system, opportunities such as these groups allow for more chance encounters in a greater diversity of social environments.

Additionally, a positive outcome of opening the masses is the opportunity it creates for the mass to be penetrated at ground level. This initiated the process of articulating how the overall mass began to address the street condition and connected its local area.



| FIG 5.5 | **Massing Diagram 3**
Shaping the form to suit light & view needs.



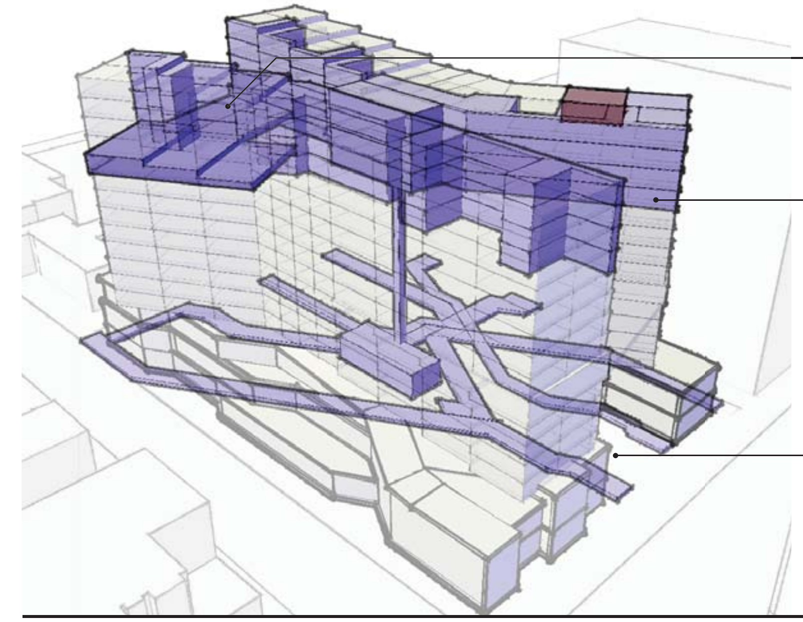
| FIG 5.6 | **Social Bridge & Social Floors**
Strategic programing for interaction.

Connecting to the City

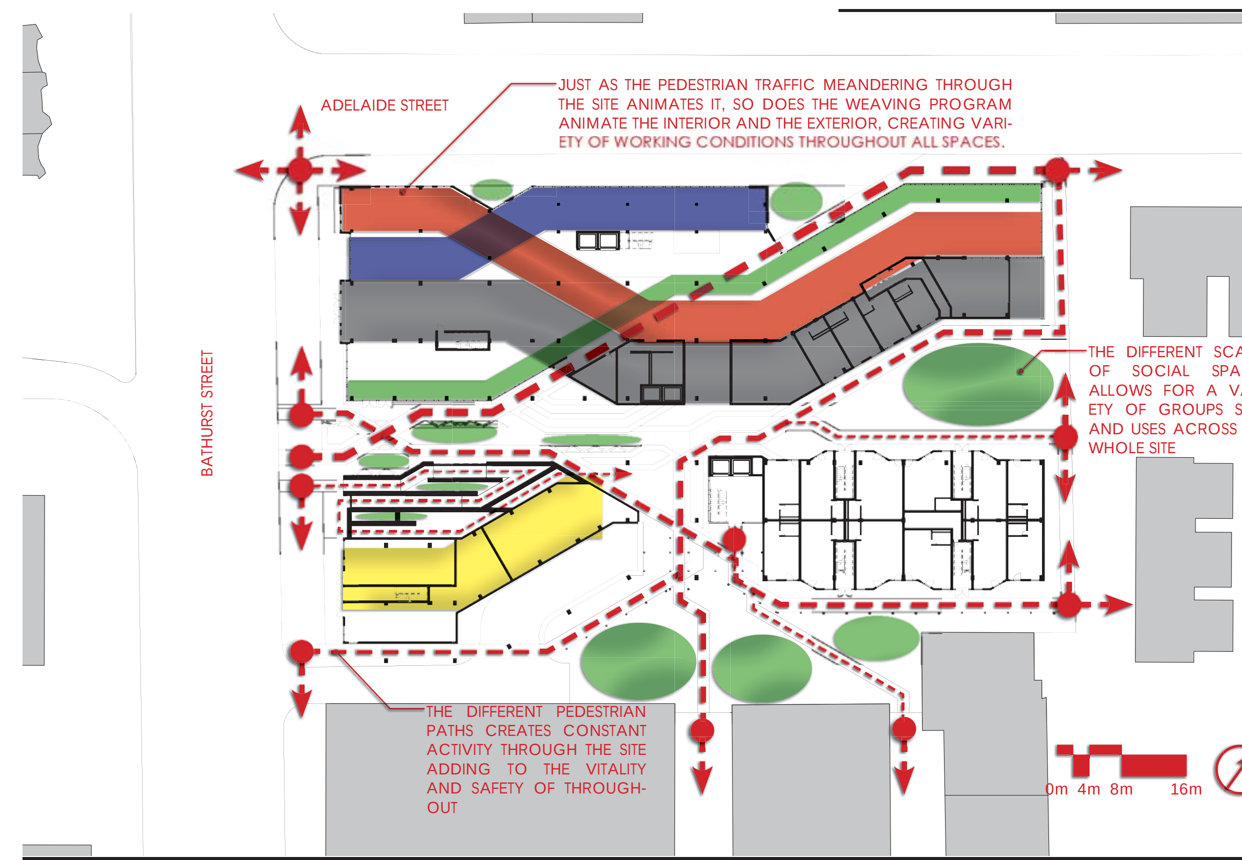
The private and public systems were developed together, which gave shape to the overall form in stages. This initially involved massaging the two systems and two massings (see Fig. 5.7). The programmatic elements of the podium are similarly organized to create a mutualistic relationship between its individual elements. The interior circulation and the various programmatic elements are visually and physically connected to each other. They overlap creating various internal conditions for a diverse set of working conditions that would be ideal for a co-working facility as well as for other small offices. In the same way that the residential units are organized to create a gradient of social conditions that benefit interaction among the residents, the podium creates gradient conditions across its different commercial spaces, allowing different interactions along strips of program. Further, the exterior pathways meander through the site, thereby allowing a variety of connections across the site. The space between these site paths creates pockets for gardens and seating across the site, much like the corridor system above, and animates the public system at grade (see Fig. 5.8).

Massing and Formal Articulation

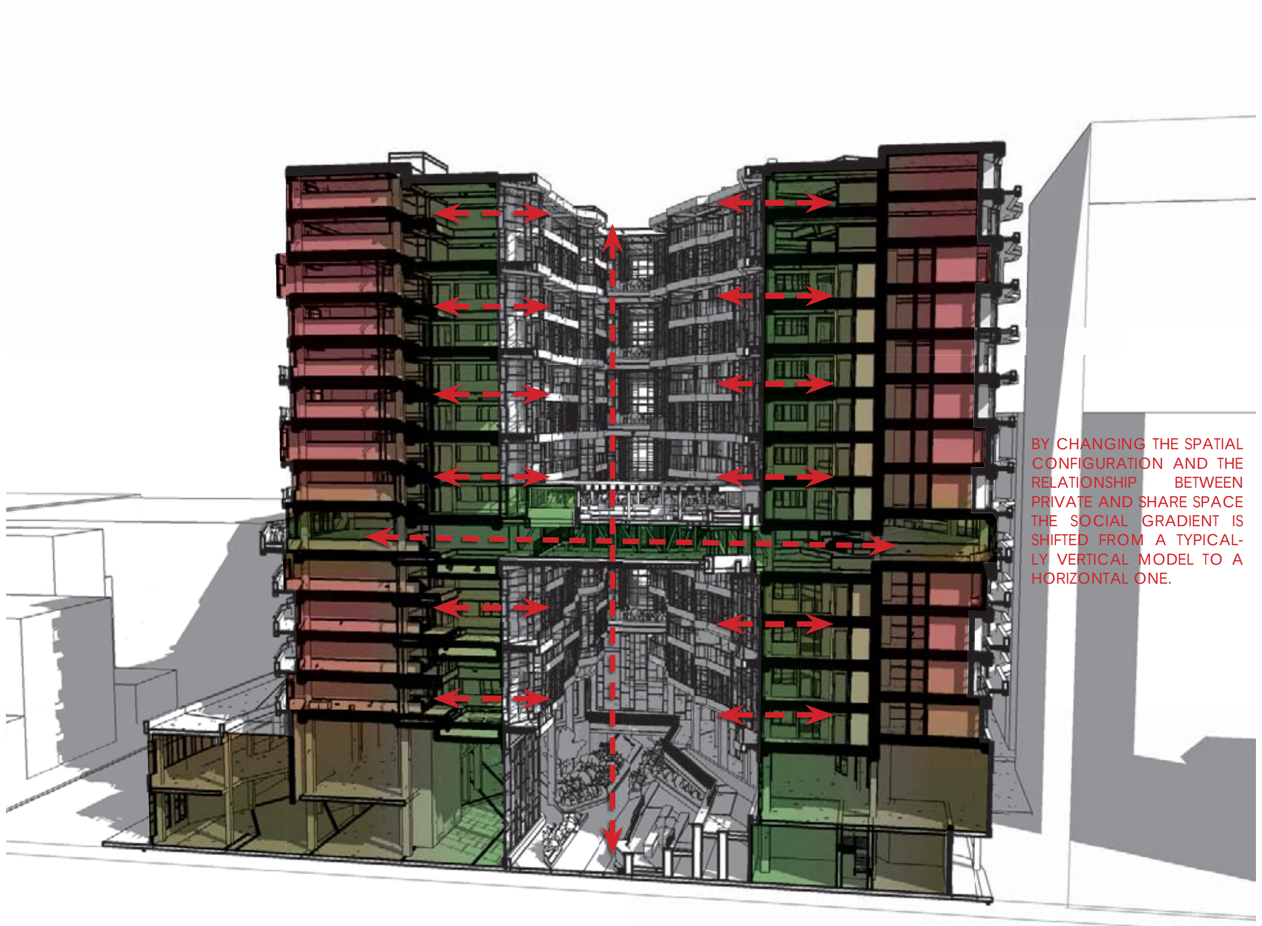
Finally, the massing is refined to reflect the articulation of the spaces and groupings. In so doing the mass is broken up and scaled to provide variation, as opposed to remaining as a solid mass above the podium. In as much as the mass is limited in height it is still important to articulate the mass in order to contribute to the street edge. The lower floors of the residential units are given larger balconies to allow residents close in proximity to street level to participate in activating the ground level. The balconies are angled and staggered to mimic the form of the main massing and the podium elements. On the interior, the courtyards, give way to balcony extensions that penetrate the corridor walls and create another means of interaction across the overall scheme. Another layer of intimacy between the courtyard and the overall massing animates the building core, thereby exhibiting the life of the building to the residents, the street and the courtyard below.



| FIG 5.7 | **Massing Diagram 4**
Articulating the ground plane.

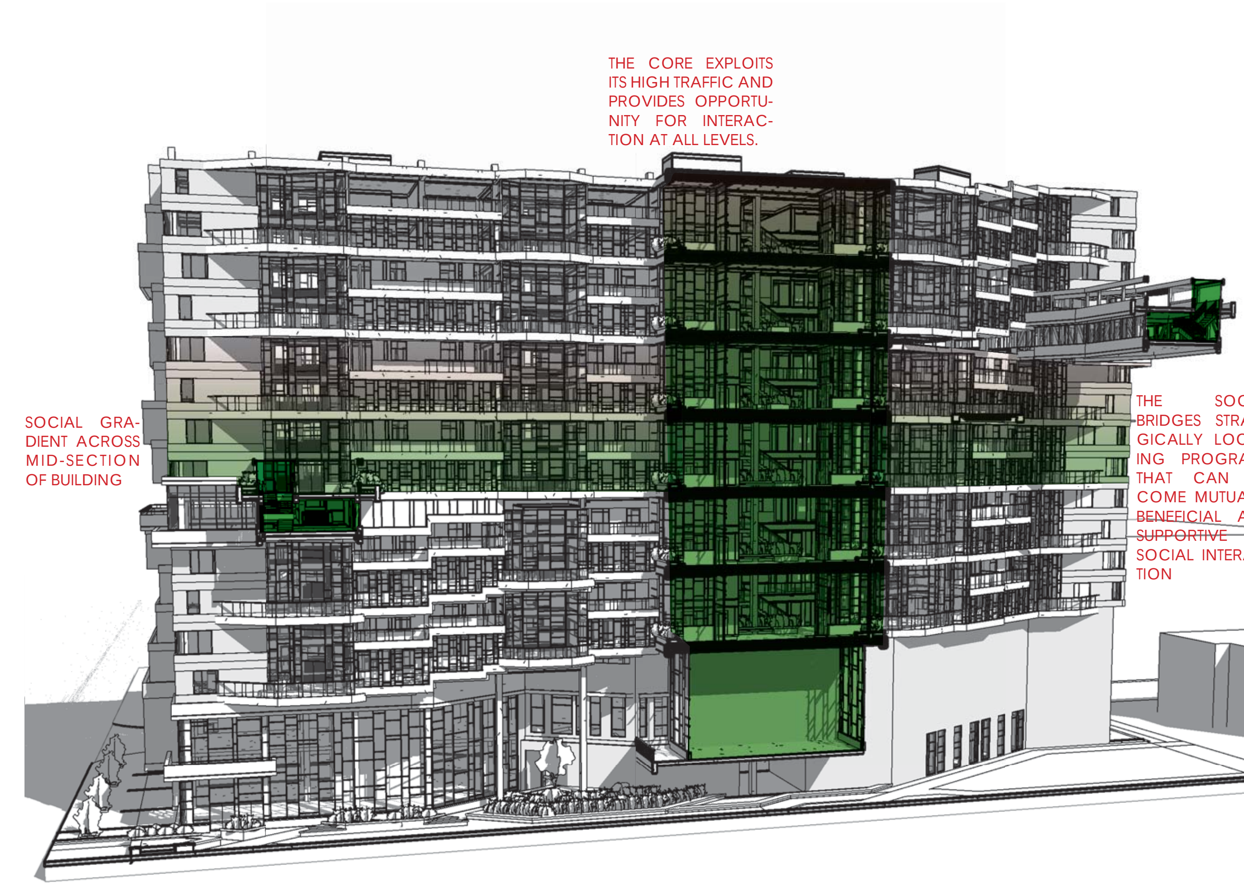


| FIG 5.8 | **Site Plan**
Pedestrian & Program distribution



| FIG 5.9 | **Transverse Section** showing social gradients across building.

In a typical high rise apartment, social interaction is very limited among residents. It is minimal across floors and sporadic in designated social areas at best. While housing is generally intended to fulfil certain basic needs, such as shelter, warmth, security, and so forth, the functional definition of housing can still fall short of addressing human needs holistically. This ultimately results in an environment which, despite meeting basic needs, may still have a negative impact on quality of life. Humans need social engagement but unless space works systemically to promote a social environment, the space cannot counteract against social isolation within large buildings. What the design project demonstrates is that a better understanding of how different needs exist and work within a holistic framework, in what theory defines as the activity system, can facilitate a more accurate functional definition of the artifact, which will better respond to human needs. A better understanding of the relationship between the activity and the artifact systems, in this case, resulted in a design where the social gradient effectively shifted from the single, normal, vertical direction, where social isolation is typical, to a model where the gradient exists in two directions (see Fig.'s 5.9-5.10). In this model, social interaction is much less likely to occur, not only because of the axial shift, but because the shift allowed the spaces to be configured in a way that presented opportunities for implementation of other known successful patterns within the design.



| FIG 5.10 | **Longitudinal Section** Showing social gradients directly connected to mid building 4 floor group bound by the social bridges.

6 | Solution Testing

Sensitivity to Scales

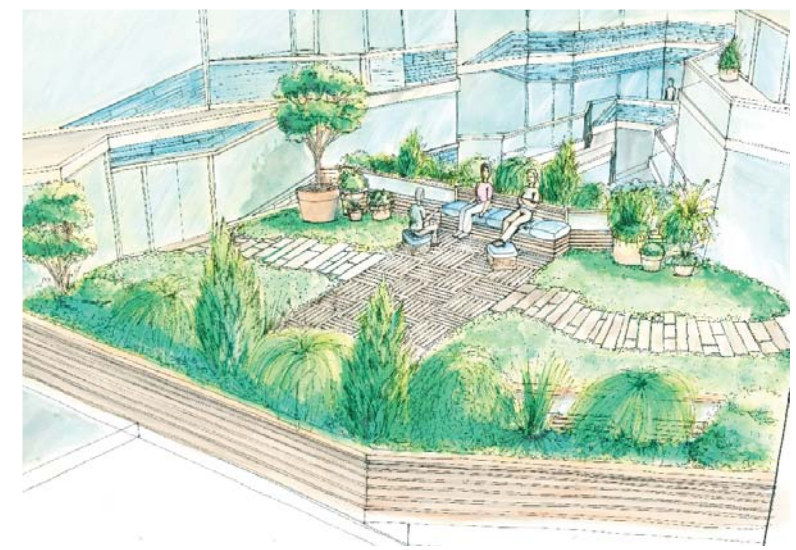
Throughout the various stages of design exploration, what was most prominent was orchestration of the architectural spaces and elements at the different focus scales which mediated the relationship between public and private areas to satisfy both social and privacy needs. Although the processes that prompted the scaling were primarily concerned with the configuration, sizes and proximities of the spaces, the actual spatial quality is equally affected by materiality and articulation of the architectural elements. The elements which defined each space were chosen to be sensitive to the human scale and arranged so that their organization could be an appropriate response at the different social scales being addressed.

The overall massing was the result of allowing the two main masses to exhibit themselves both to each other and to the city beyond. However, the sizes of the masses necessitated their reduction to a scale appropriate to human proportions. The social hierarchy that divided the building into three groups of four floors was the first step in the process of reducing the mass. Secondly, by varying the different floors, the overall massing appeared more articulated and closer to human proportions than it was as an undefined extrusion. Additionally, the podium and the social bridges and spaces on the fifth and ninth floors, introduced another means to divide the building and provide more variation to the form, further animating the façades, from inside and outside of the site. By subdividing the mass in this manner, each mass became an architectural composition viewable from all spaces within the social hierarchy and from the city itself.

While massing reduced the overwhelming size of the form, the materials further broke down elements to a level of detail appropriate for human proportion. They were chosen to create a warm ambiance and appropriate level of visual stimulation that could promote social interaction. As such, specific colours and materials were chosen. This pallet was applied throughout the building, allowing social areas to feel warm and welcoming, and to be easily identifiable throughout the building. Additionally, while there were various fixed elements incorporated into the structure, most furniture was proposed as moveable, allowing users a greater sense freedom, addressing needs of ownership and the need to belong while satisfying social interaction.

Ultimately, the massing subdivision and the articulation of the spatial elements were potentially the most important aspects of translating theoretical ideas into physical reality. At each scale, the massing, form and materiality contributed significantly to spatial quality, to promote social interaction and retain privacy.

| FIG 6.1 | **Cluster Concept**



| FIG 6.2 | **Social Bridge Concept**

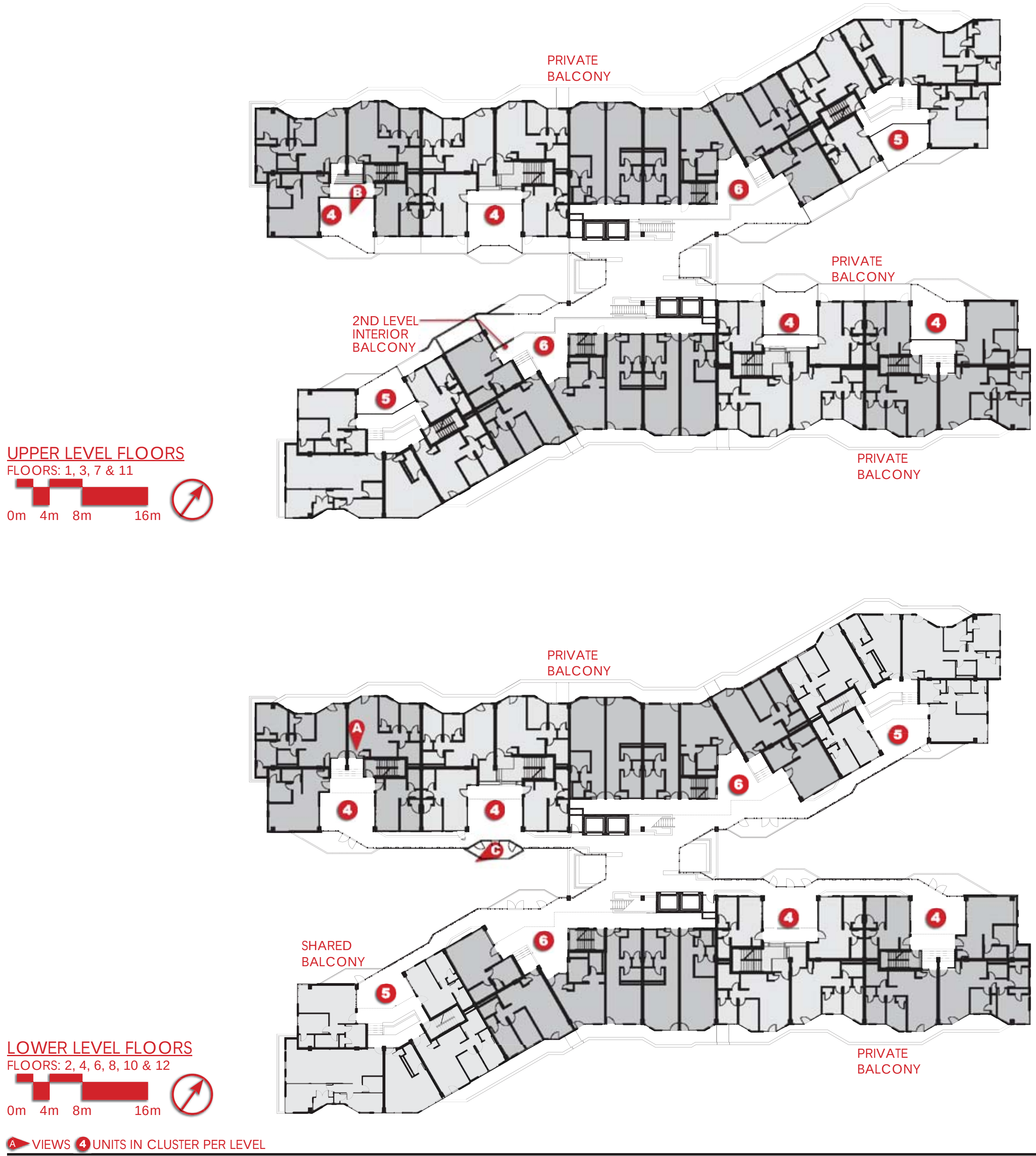
| FIG 6.3 | **Courtyard at Grade Concept**

| FIG 6.4 | **Cluster Interior**
(opposite Page - refer to view A FIG 6.5)

Cluster Scale

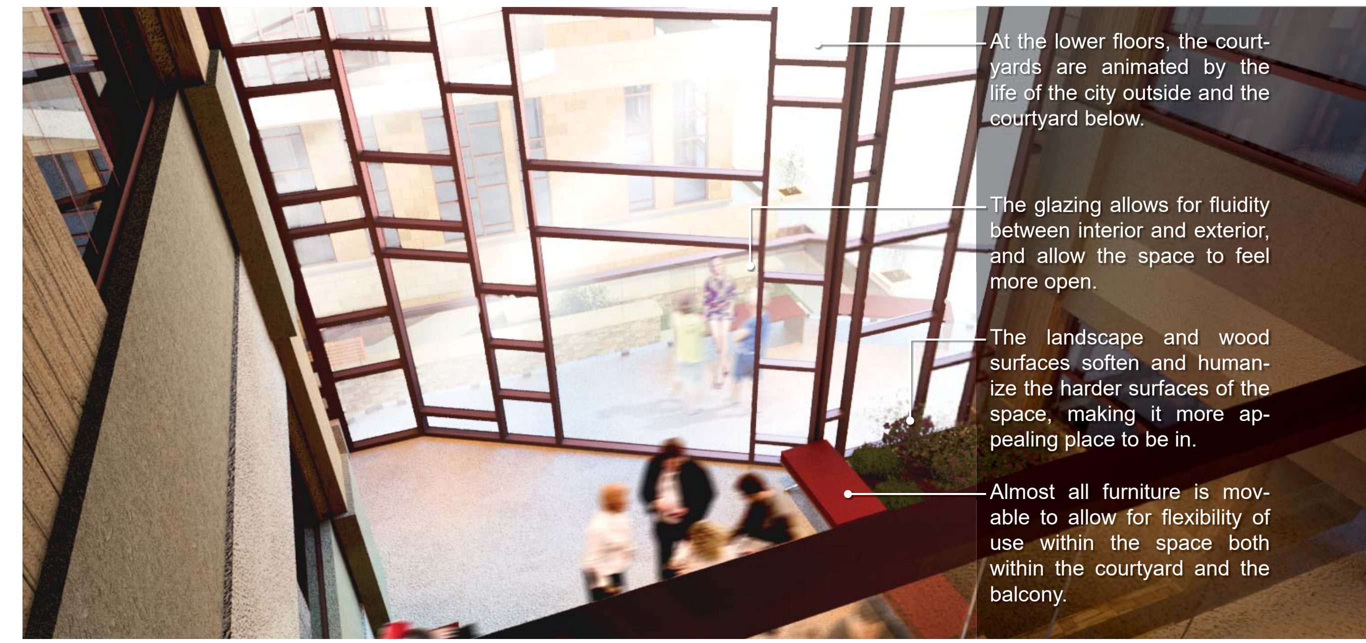
The cluster was the most intimate scale within the building and needed, more than anywhere else, to exude a warmth which could be associated with a welcoming social atmosphere that would encourage the residents in its units to perceive the shared space as an extension to their own private spaces. The elements perceived as the coldest and most alienating, the concrete structure, were softened using warm colours. Additionally, these hard surfaces were softened using wooded elements and plant materials that also contributed to a level of visual stimulation necessary to allow the users to be engaged with the environment. Use of glass allowed for a visual connectivity from within the units to the cluster, and from the cluster to the building. Its absence would have inhibited social integration and fluidity between spaces. The choice of glass in these areas is the most significant influence on social nature. The rationale is that, while its use may infringe on privacy, glazing can be protected as required by the residents as need, allowing them to control how they interact with their neighbours. Using an opaque material places the choice in the hands of the designer, which greatly limits potential for social interaction. Similar to moveable furniture the layout offers as much flexibility as possible to allow residents to negotiate among themselves how the space is used. Ultimately the choice of materials created an engaging environment which was welcoming to it residents. It was designed to be a place that affords and is conducive to different types of activity, can feed of the life of the adjacent spaces and reciprocates its own liveliness to other spaces.

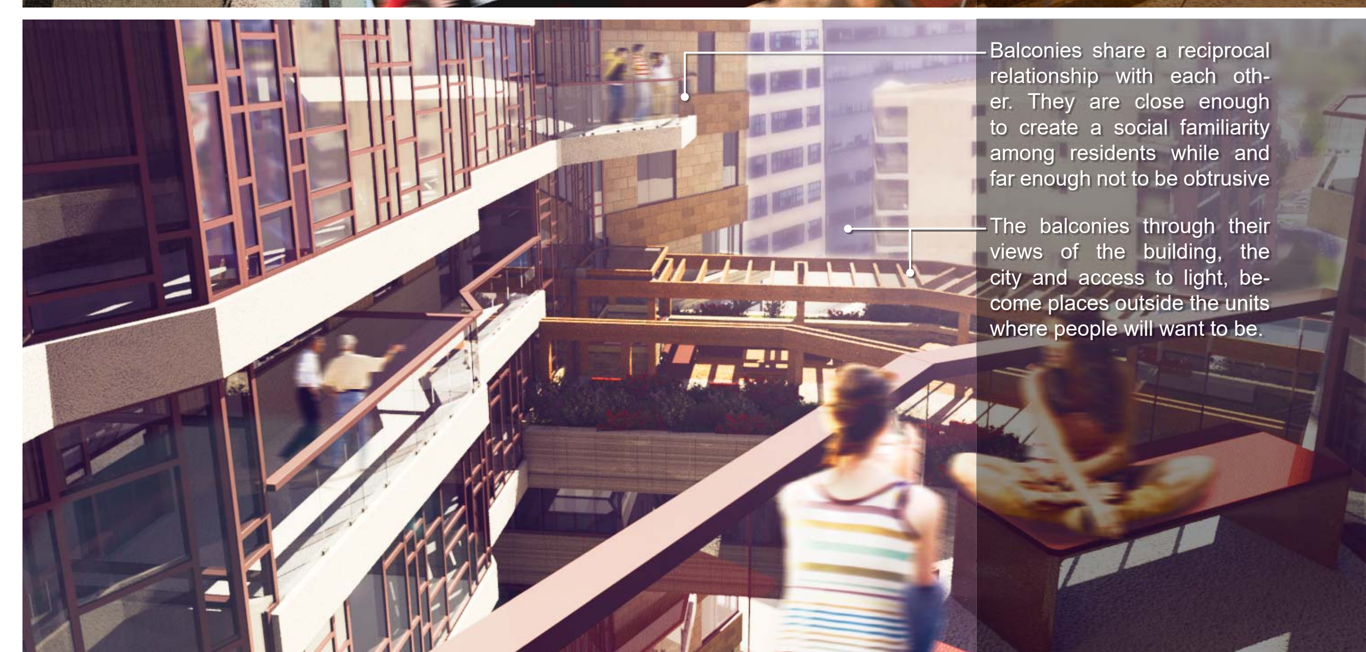
| FIG 6.5 | **Typical Residential Floor Clusters**



| FIG 6.6 | **Typical Upper & Lower Levels**

| FIG 6.7 | **Unit Interior**
(page 76 top - refer to view A FIG 6.6)
| FIG 6.8 | **Cluster Interior Balcony**
(page 76 middle - refer to view B FIG 6.6)
| FIG 6.9 | **Cluster Exterior Balcony**
(page 76 bottom - refer to view C FIG 6.6)

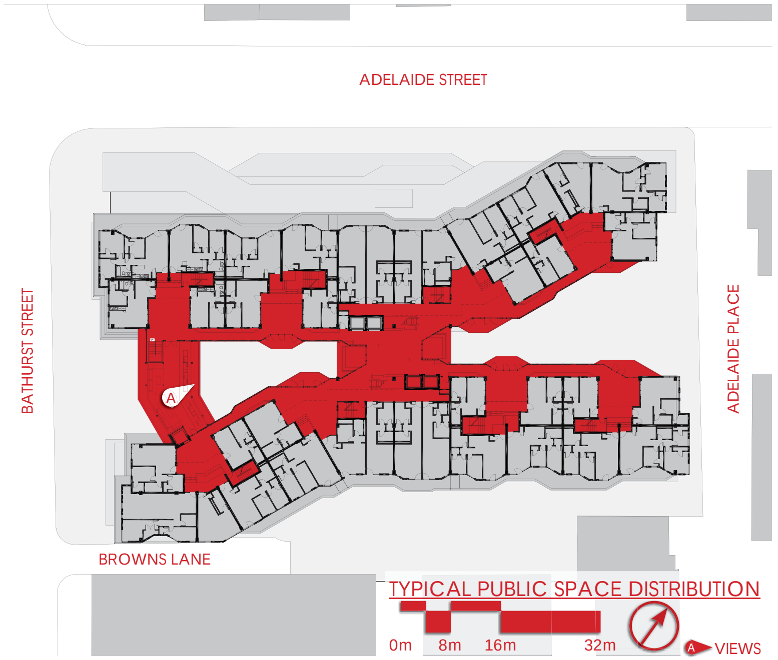




Floor Group Scale

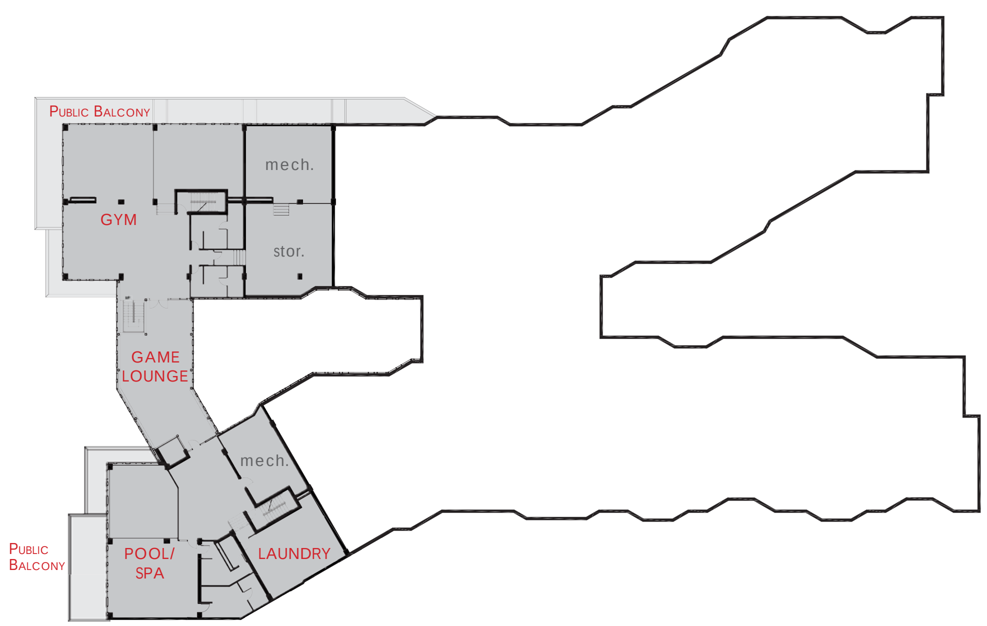
At the floor group scale, the choice of materiality, free furniture and landscaping is very similar to the cluster scale, in order to humanize the main structure and create a consistency in the atmosphere and language of social spaces throughout the building. The use of glass here is more impactful than any other scale. While the proximity between masses provides sufficient privacy between masses, use of glass allows public spaces to feel open and to permit people to see and know who the members of their immediate and wider community are. At this scale it is also necessary to subdivide the various massings to ensure that all elements remain sensitive to human proportions. The design was based on the premise that horizontality encourages social integration. However even the horizontal bands of solids and voids had to be subdivided to ensure visual variety. For this reason, hierarchy among the horizontal planes was created using verticals in a pattern that created the necessary variety while maintaining a horizontal expression. The floor group scale is arguably the most critical scale. While the cluster addresses needs of ownership and individuality, and allows for intimate relationships, the group scale reinforces a greater sense of belonging among the immediate floors through casual interaction with the immediate community. Ultimately, this serves as a bridge between most intimate and most public spaces.

| FIG 6.10 | **Social Bridge Looking into Core**
(opposite Page - refer to view A FIG 6.11)



| FIG 6.11 | **Plan of Public Areas of Floors**

SOCIAL BRIDGE FLOORS
FLOORS: 5 & 9
0m 4m 8m 16m



INTERMEDIATE FLOORS
FLOORS: 5B & 9B
0m 4m 8m 16m

A VIEWS

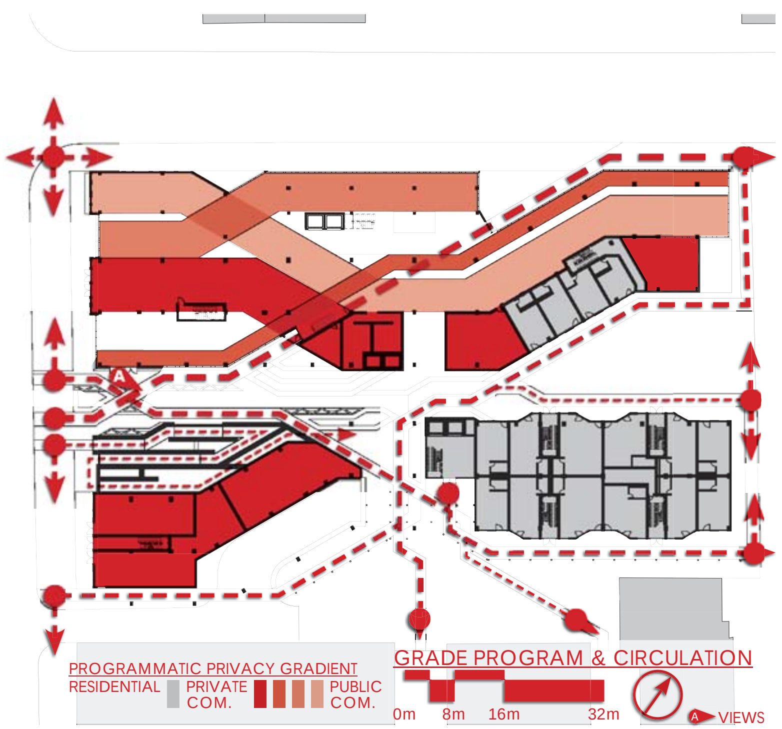
| FIG 6.12 | **Social Bridge Floors**

| FIG 6.13 | **Typical Corridor**
(page 80 top - refer to view A FIG 6.12)
| FIG 6.14 | **Typical Floor Core**
(page 80 middle - refer to view B FIG 6.12)
| FIG 6.15 | **View Across Social Bridge**
(page 80 bottom - refer to view C FIG 6.12)

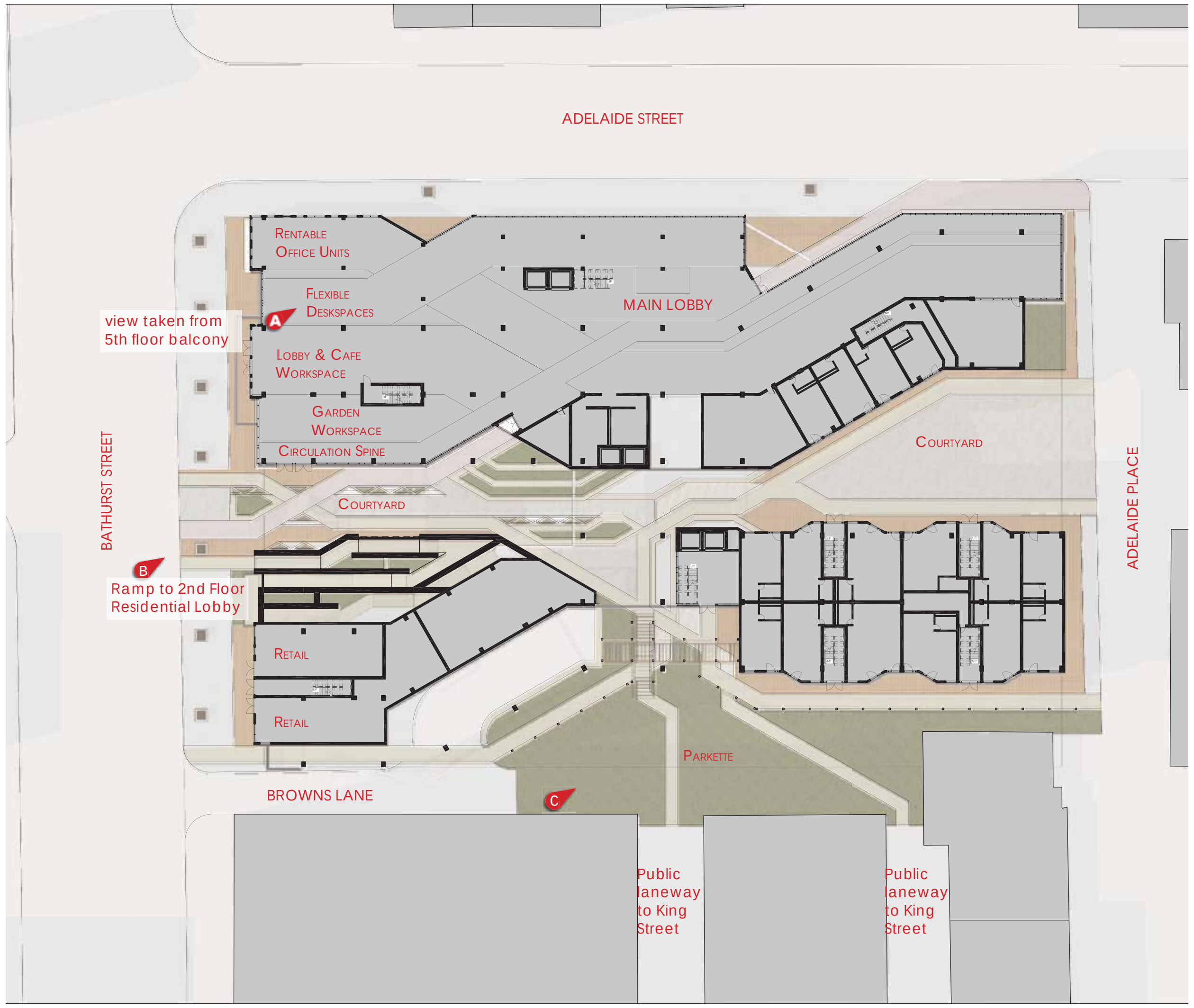
Building Scale

The building as a whole entity becomes an object in the city. As opposed to the other two scales, the building scale is able to address social needs. However, the idea of the building as a place is established in the minds of residents through the cluster and floor divisions. What the building as a place, can provide to further identify is more variety to the resident and to the city, reinforcing its value to both communities. This is achieved through the ground plane and the podium condition. Similar to the process of dividing the building mass, the ground plane is divided to create different sizes of spaces that can accommodate different group sizes and different activities. Also mimicking the process above, the spaces are articulated with similar landscaping and materials, which soften the hard edges and make the spaces more suitable to social interaction. The areas are divided by pedestrian paths through the site which allow these groups spaces to be constantly activated in social engagement through the flow of people moving through a local pedestrian laneway network. At this scale, the building allows itself to become an integral place within its wider context, creating social opportunity within the city through materiality, scale, openness and exposure, in a similar way to the private residential network described above.

| FIG 6.16 | **Courtyard at Grade**
(opposite Page - refer to view A FIG 6.17)



| FIG 6.17 | **Ground Floor Program**



GROUND FLOORS
FLOORS: 5B & 9B
0m 4m 8m 16m
VIEWS

| FIG 6.18 | **Site Plan**

| FIG 6.19 | **5th Floor Social Space Balcony**
(page 84 top - refer to view A FIG 6.18)
| FIG 6.20 | **Street View into Courtyard**
(page 84 middle - refer to view B FIG 6.18)
| FIG 6.21 | **South Yard & Pedestrian Paths**
(page 84 bottom - refer to view C FIG 6.18)

Just as the interior conditions allows for opposing balconies to benefit from each other, the exterior balconies and facades create a similar reciprocal relationship by staggering their heights, variation in band thicknesses and undulating the perimeters.

The massing creates a grand welcoming gesture however it has to be articulated at a human scale to successfully entice pedestrians movement. The various elements and formal strategies respond to this need for both the residential top and public realm below.

The ground plane pathways to define unique pockets of space that connect the residences, the workspaces and the city. Human scaled elements and natural materials are used here to ensure the spatial quality can foster social interaction and exploit the pedestrian density.

The site not only allows for pedestrian movement by connecting to local laneways but it also defines spaces which can become a part of the local urban landscape by creating spaces unique within the immediate locale that can improve the quality of life of both the building and its wider community.

While the overall form is divided to reduce the overpowering size of the building, it has to be further reduced to allow the spaces it creates in both internally in the residences and externally in and around the site to support a social interaction in the public realm. For this reason, the various balconies, windows and the floor planes were the architectural tools employed to create achieve this requirement. In addition these elements explored different arrangements to create a greater sense of variation to prevent a monotonous and unstimulating experience from any point in or around the building.

| FIG 6.22 | **View at Bathurst and Adelaide**

Attention to the scale of space has contributed more to the design than any other tactic. However, spatial perception can also be greatly influenced by the materiality, texture and colour, the elements that give form to abstract ideas of scale and space. Essentially, spatial dimensions, while important to behavior, are only one part of an equation that determines whether a space can support social integration. Although virtual, the renderings demonstrate the type of spatial qualities that the thesis asserts are capable of encouraging social integration within a building of certain scale. They show the importance of how the scales of the different spaces and the relative proximities of one space to another can allow a space that may normally be considered completely private, to be opened to in a way that privacy is still kept but also encourages social integration within a small group.

CONCLUSION

We exist in world that is complex and in order to define most phenomena it is necessary for us to reduce them to comprehensible entities that can be processed by the human mind. While this process is necessary to understand them, it also removes context and simplifies the relationships, that are necessary to fully understand their existence. A full knowledge can only be had when what is known about them is contextualized. The fact is that while we simplify in order to understand something, reality is interconnected, and is always affected and cannot be divorced from context. Systems theory seeks to address complexity by understanding, not just the phenomena in isolation, but how they exist and are affected by other existences. In theory by applying systems theory to the design process, the design solution proposed in this thesis is more closely based on reality and more accurately addresses problems of social needs. What has been asserted and demonstrated is that, for any solution to be robust enough to accommodate the complexity of reality, it is necessary for it to be understood in context, through a systemic process.

In this thesis, it has been established that the production of a work of architecture is a means to satisfy a set of human needs. Individual needs on their own are complex and it is difficult to understand how they are related and work in a system. This is compounded further when addressing multiple needs such as social needs, compliments of which have been addressed in this thesis. It is necessary to simplify them in order to understand how they exist and relate to each other in order to find a solution that can address them appropriately. Architectural paradigms that have relied on deductive means of satisfying needs have produced real solutions that fall short of theoretical promises, despite the laudable intentions which spawned the ideas. However, research shows that, to address the complexity of human social need it is necessary to understand how one need is affected by the other, that is to say, the systemic relationship among them.

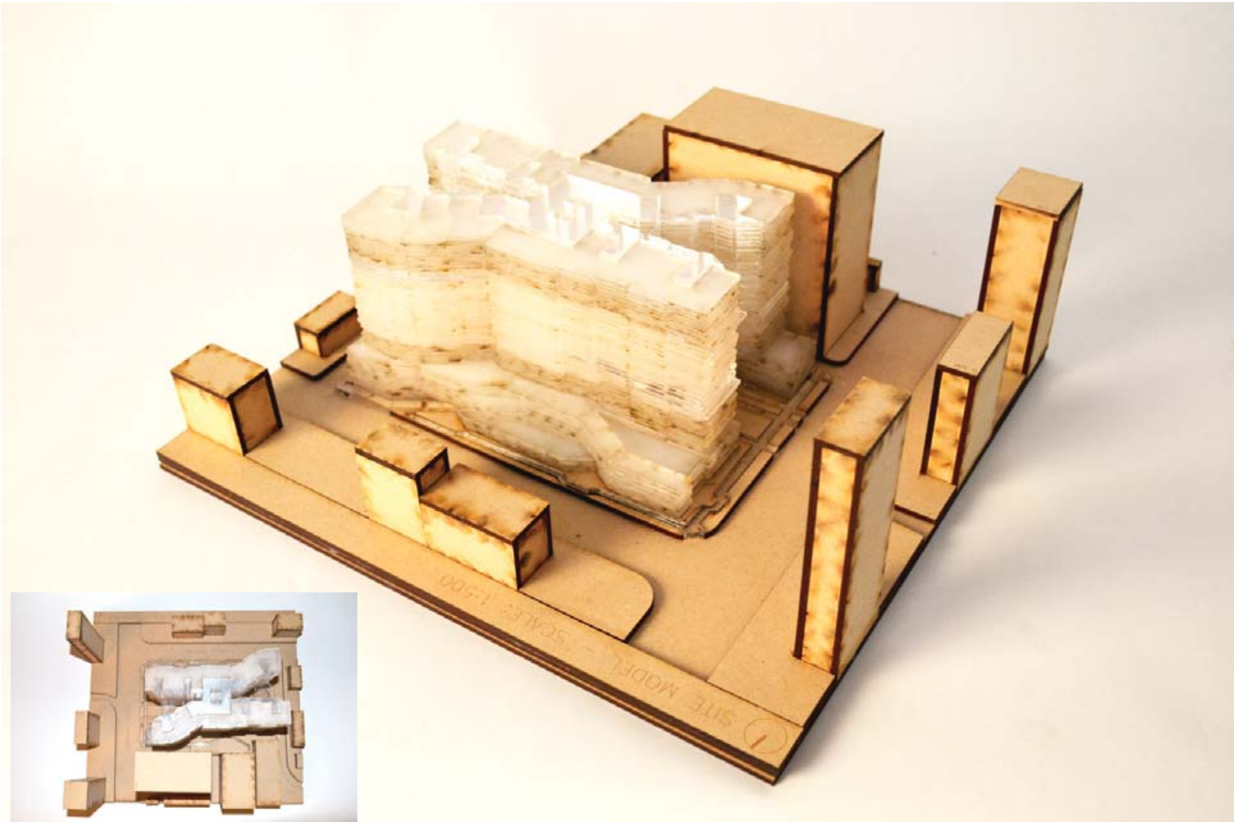
Application of systems theory gives an advantage to the design process, in that it better mimics the nature of how humans are programmed to satisfy their needs than does a model of design based solely on an oversimplified deductive approach one. Although the complexity of the solution is closer to reality, it must not be designed in a way that is deterministic. Ultimately, human needs are subjective, and each individual addresses them in his or her own way. Such needs can also vary with time, meaning there is no one solution that can become a blanket solution for every scenario.

Consequently, as the design process becomes more sensitive to how humans systemically satisfy needs, the design begins to resonate more with human activity, which can be defined in the context of the thesis as their social behavior. This is because as both theories of need here explored suggest, actions are typically motivated to address multiple needs, and are seldom focused on addressing one specific need in isolation from others. With regard to the specific focus of the design, namely addressing social needs, the building effectively creates through its hierarchy of spaces, a configuration akin to a small community. Here, in contrast to a typical high density building, social needs are typically met through the openness of what is essentially a street condition. While there are issues with privacy, due to limited area sizes, what must be understood is that, as was the original intent of the design, social and privacy needs are addressed as a collection, and not as separate needs. In a typical building, privacy would clearly be a major issue, but because the spaces are divided in a way that limits traffic into the more private space, generally only those neighbours with whom one is familiar would occupy these spaces, thus allowing social ties to make privacy less of an issue – and where it is an issue, to be solved by simple means, controlled by the residents themselves. The resulting spatial relationship, designed through an understanding of the relationship between different needs, better limits the potential for social isolation in all areas of the building. While strategic planning of social spaces within the building compliments and supports social activity, it is also important to ensure that these smaller intimate spaces are equally distributed through the building, to allow all residents easy access to social interaction.

Ultimately, it is the people who make the place, so even though one addresses the systemic nature of social needs, reality necessitates that any design, no matter how thorough, is still subject to many more complex variables. Despite the success of patterns and solution, they cannot be successfully repeated if they are not sensitive to differences in context, which include the aims that a design is intended to serve. As a design study, the resulting thesis project is based on successful patterns, which were contextualized through the lens of social needs. Simply stated, the process sought to understand how human social needs work and how they can be addressed through patterns and subsequently shaped into an architectural form. While the thesis in itself does not claim to propose new ideas, it does demonstrate how existing ideas can frame an architectural problem in a way that increases the probability of success in creating spaces that more intuitively satisfy human social needs.

| FIG 0.1 | **Balcony at Core**
(opposite Page)

APPENDIX | A: PHYSICAL MODELS



SITE MODEL

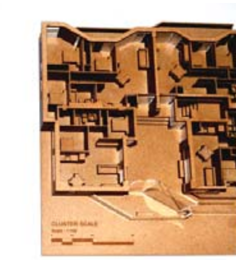
CLUSTER SCALE MODEL

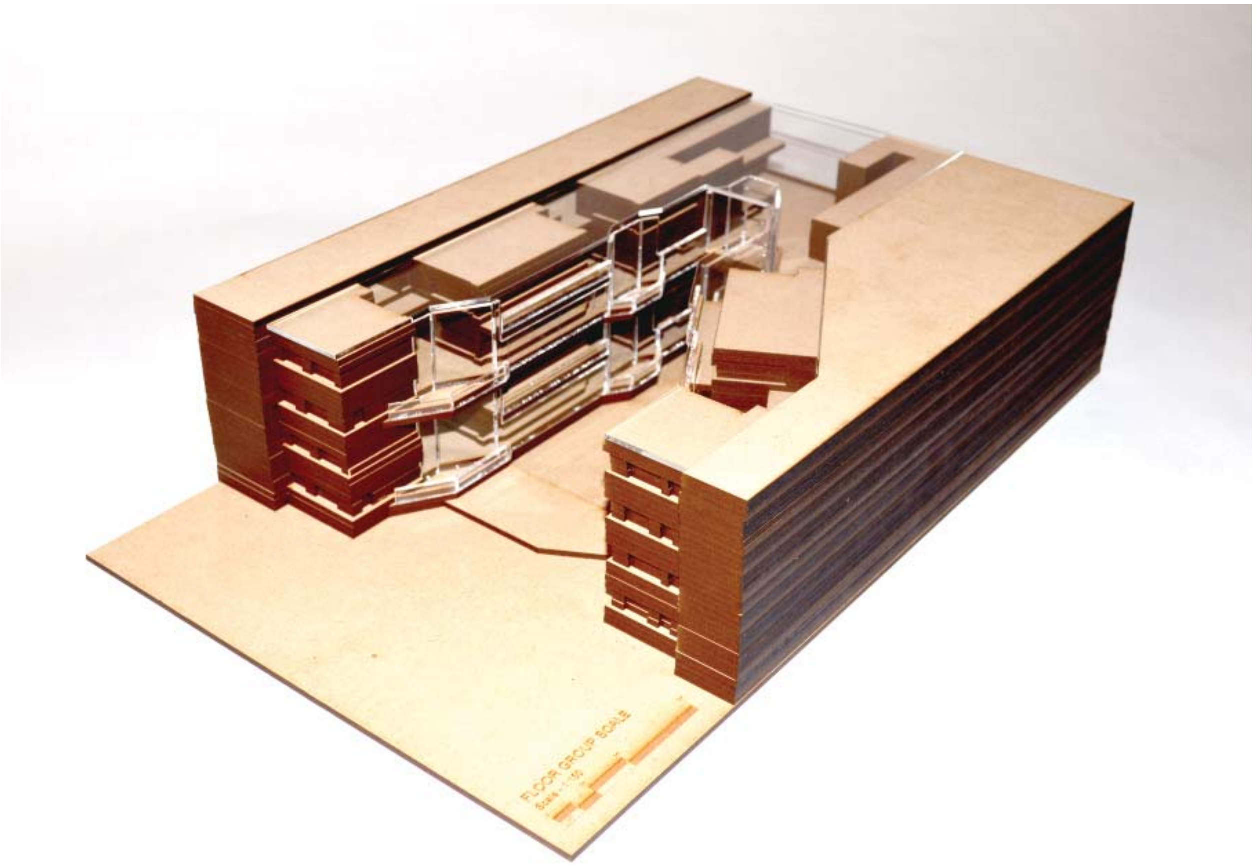
FLOOR GROUP SCALE MODEL

BUILDING SCALE MODEL

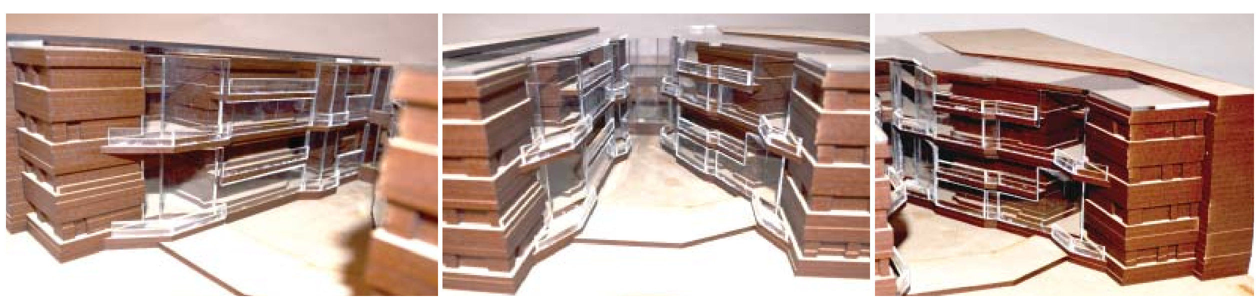
GAME
LOUNGE

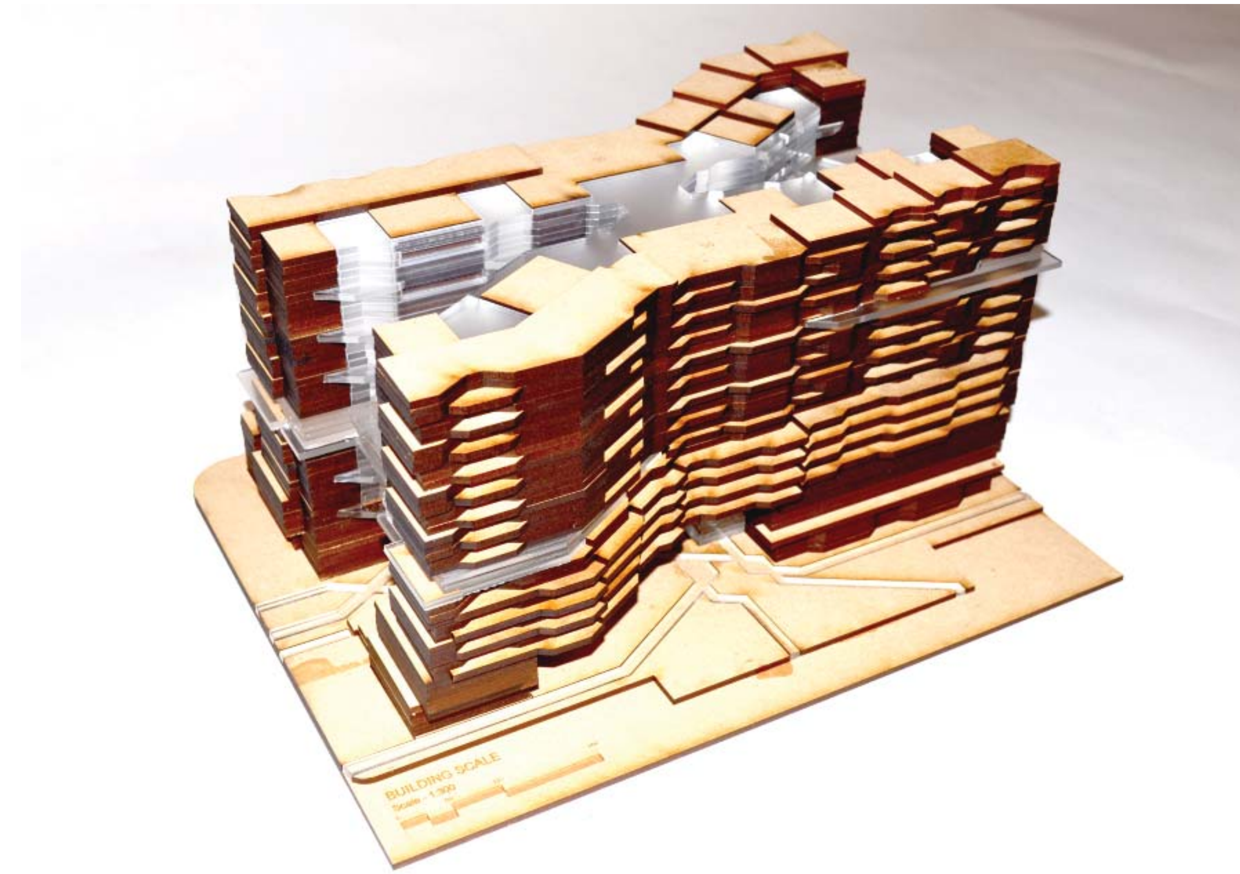
CLUSTER SCALE MODEL
SCALE: 1:100



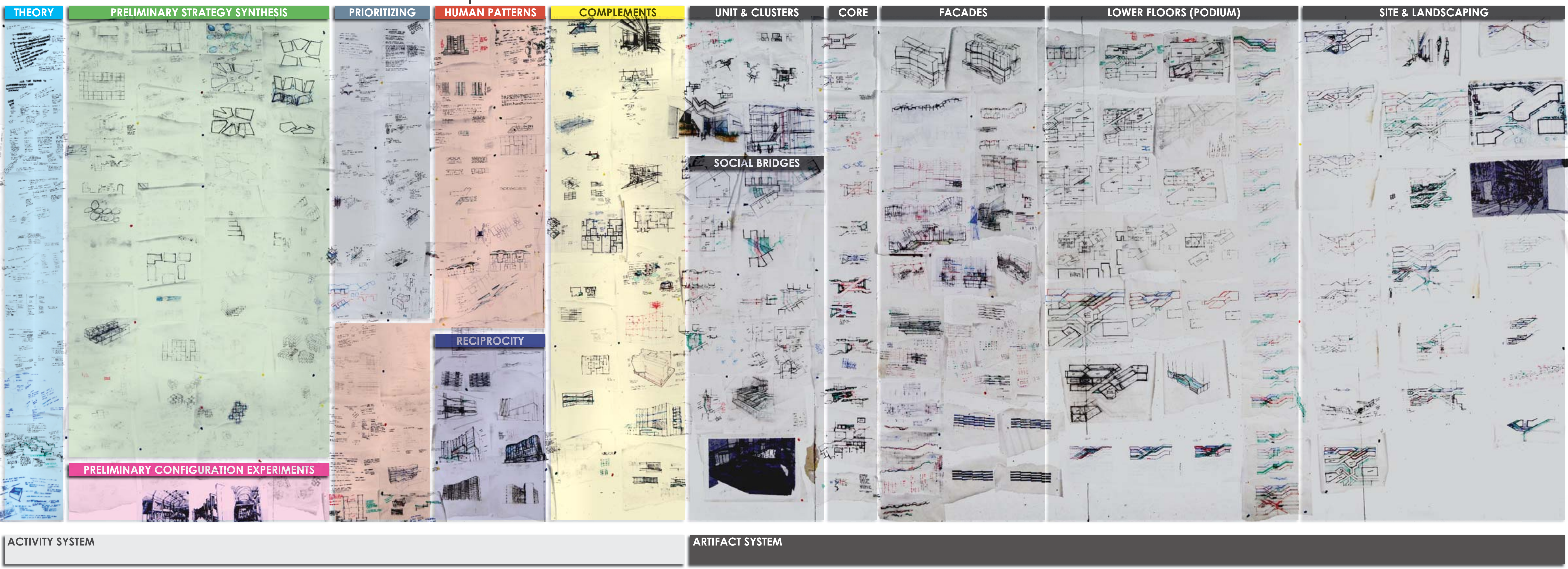


FLOOR GROUP SCALE MODEL
SCALE: 1:100



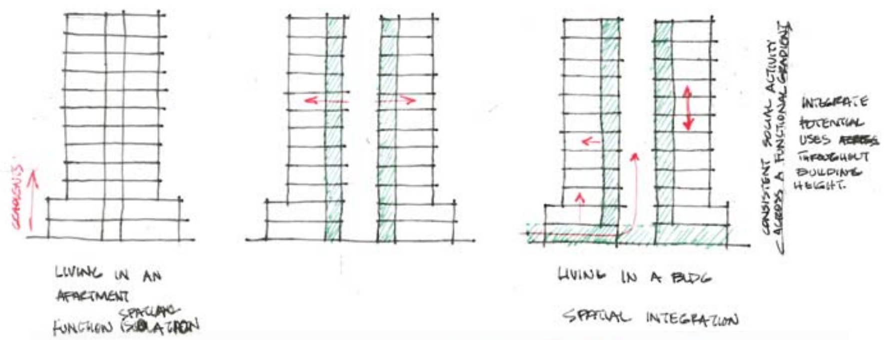


BUILDING SCALE MODEL
SCALE: 1:100

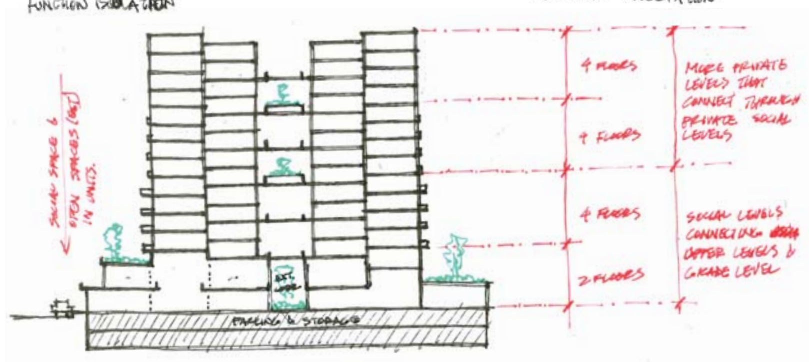


The Design Process

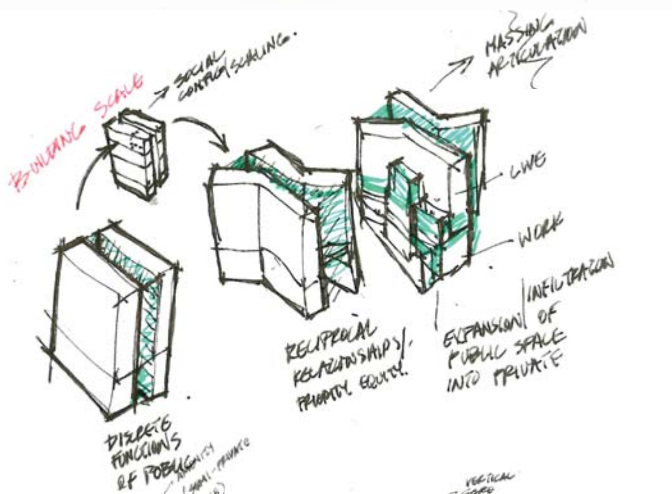
Every design decision whether or not stated within the work was the result of many iterations which pushed and refined each idea. Near the end of the thesis process the sketches were assembled onto a wall which was eventually organized to tell the story of the story of the past year of work. This "Wall of Complexity" proved very insightful in helping clarify and give order to the seemingly chaotic spread of paper attached to the wall. The following pages shows a few sketches that capture several key points in the development of the design project.



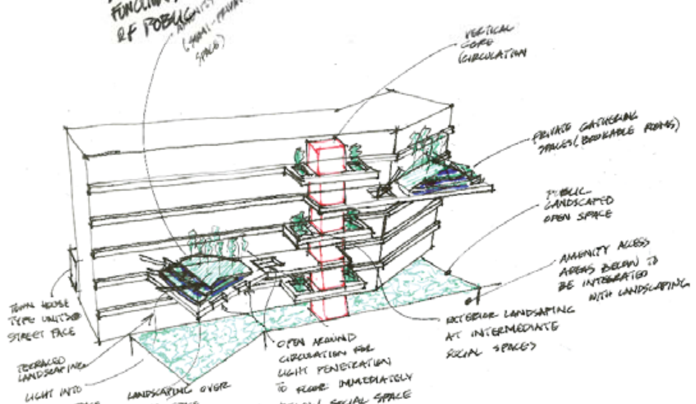
Identifying typology problems and theorizing solutions



Proposing strategies to address problems

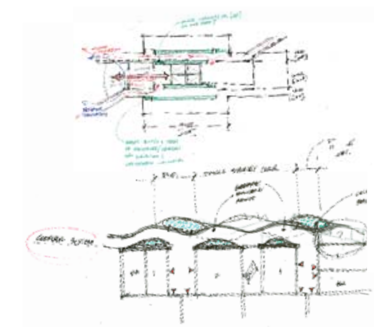
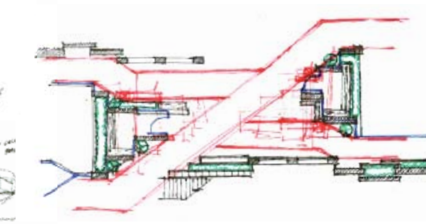


Looking at formal implications of solutions

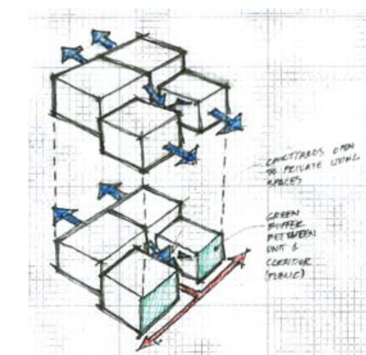


Creating a framework with which to design a workable building solution

Concept Development

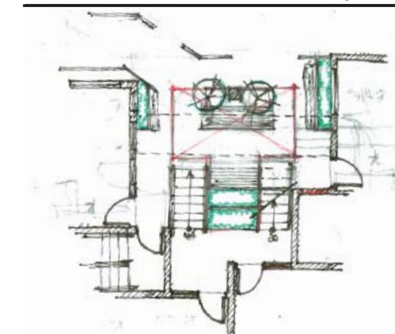




Corridors & Circulation Development



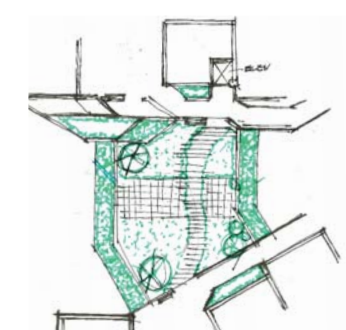
formulating cluster configurations

developing unit layouts for social engagement

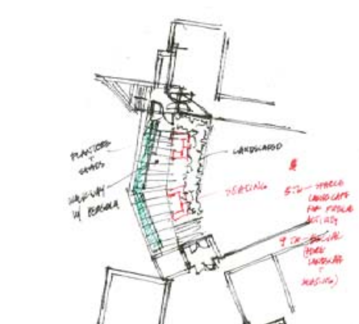


detailing materials and unit entrances around clusters

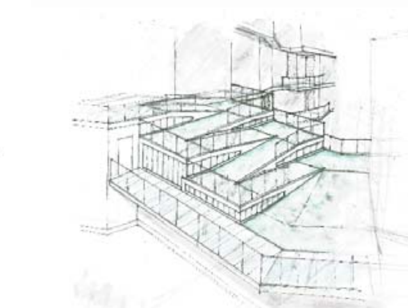
Cluster Development



exploring ways to create common social spaces

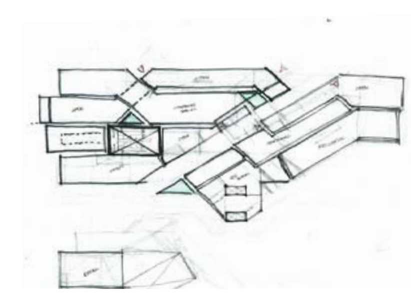


creating different spatial conditions within spaces

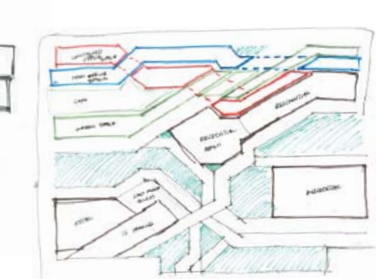


exploring different ways of moving and using social spaces

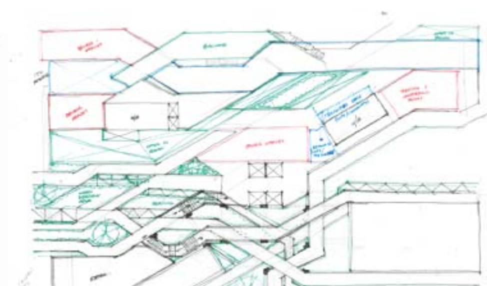
Floor Group Development



exploring how a dynamic plan can encourage social integration



extending the movement and social integration patterns through the site



articulating and bringing the site and program down to human scale

Building (Podium + Grade) Development

Wall of Complexity

LIST OF FIGURES

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