1-1-2012

Evolving Architecture

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EVOLVING ARCHITECTURE

by

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Bachelor of Architectural Science, Ryerson University, 2010

A thesis

presented to Ryerson University

in partial fulfillment of the

requirements for the degree of

Master of Architecture

in the Program of

Architecture

Toronto, Ontario, Canada, 2012

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Abstract:

The way one uses and operates within a space will continue to change over time as needs and desires evolve. However, the successfulness of a space is often dependent on several programmatic elements that enable an intended use. Thus, when looking at changes in needs and desires, time is a factor that can impact a building's program and function. Subsequently, architecture as a notion cannot afford to be static. Therefore, it is evident that there is a need for an evolving architecture with programmatic elements which can be continually altered as required. Through this, a buildings ability to evolve will then allow it to facilitate any inevitable change over extended periods; ensuring that architecture is not stationary in time. With an evolving architecture being the thesis position, this project argues for an architectural form that can constantly be transformed to accommodate a function and its changing programmatic needs.

Acknowledgements:

First and foremost I would like to express great gratitude to my thesis supervisor Dr. June Komisar who not only offered me great encouragement and support to aid me in the completion of this thesis project, but was always patient, allowing me the room to work in my own way. I would also like to thank my faculty advisor Dr. Albert Smith for his valuable insight and guidance over the past two years. One could simply not wish for two better or friendlier advisors.

I wish to extend my gratitude to my fellow colleagues at Ryerson University for their advice, and feedback over the years. Without them, this undertaking would not have been so memorable.

I wish to acknowledge my colleagues at Turner Fleischer Architects Inc. for their support in my undertaking of this degree. In particular I wish to acknowledge Peter Turner, who has always been a mentor and friend to me.

I would not have been able to peruse this degree for it not for my parents, Ali and Faizeh Mehdi. They have always been key pillars in my life; supporting me throughout my academic and professional endeavours. Thank you to my parents for their endless love and support.

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1. Introduction:

Through education and professional practice, architects and designers are trained to create architecture. However, one question that is still in need of exploration is what happens to a structure after the building is complete? Once a building has outlived its intended use, is it to simply be demolished in order for the process to begin again? Or rather is there an alternative option in which a building can in essence, be transformed to constantly meet the new requirements of the existing and future uses. This option would allow a building to be a constantly evolving system instead of a completed project. This notion of a transforming or evolving architecture is what this project aims to explore.

The successful functionality of a space is often dependent on its ability to accommodate several programmatic elements; each of which has implications on the form and arrangement that the space takes. That said, the way one functions and operates within a space may change through time. As a result of this change, the addition, rearrangement, or elimination of programmatic elements may be necessary in order for a building to best serve the needs of the users. While in some cases these desired changes may be small in nature and thus, easily accommodated, in other cases larger interventions which cannot be easily accommodated are necessary.

Thus, change of need over time requires the inclusion of time as a factor that can impact a building's long term functionality. If buildings could be transformed or redesigned at the user's discretion to fulfill emerging demands, they could then be continually customized over time to meet the new needs of a program. This would enable buildings to better serve both the function and the users. Consequently, there would be a reduced need to simply demolish old buildings as they could be constantly altered.

These notions form the motivations of what an evolving architecture seeks to explore. Through a study of background information that explores the role of the architect in understanding user needs, the context will be provided in order for the position of an evolving architecture, and the rationale that supports, to be presented. Following this a literature review will be conducted which will examine the works of scholars who have conducted research that is applicable to this project. As a result of this literature review, ways and methods of designing for change will be investigated. These methods will then be discussed in greater detail through the course of the precedent review. Lastly, the embodiment of this research will then be put forward in the form of a design project.

2. Background Information:

The birth of Modern Architecture was a consequence of the recognition of a historical discontinuity.[1] While the initial barrier to modernism was the desire of continuity with the tradition, the realization that the way to the future was not through the past severed this link.[2] As a result, Modern Architecture was free of the constraints of tradition and became the dominant movement of the 1900's. In the years following the Second World War, a "period of unprecedented urban reconstruction and economic expansion"[3] was under way. A revolution was occurring within the realm of architects and architecture in the form of Modernism. Through the works of notable architects such as Frank Lloyd Wright, Mies van der Rohe, and Le Corbusier, modernism gained popularity "and continued to dominate the scene well into the 1960s."[4]

Through this same time period American philosopher Paul Weiss was gaining popularity for his works in metaphysics and writings on the aesthetic of Modernism[5]. In his 1961 text of *Nine Basic Arts,* Weiss discussed his views on the responsibility of an architect and in particular his belief on the importance of an architect's unrestricted creativity. Paul Weiss believed schools of architecture should encourage students "to experiment with the building of all sorts of space, in all sorts of ways, with all sorts of material. They should have periods in which they do not care that their work may not interest a client or that no one may ever build it or that it may not fit in with prevailing styles."[6] So important was the role of an architect's creativity in Weiss' view that he believed it should not be restricted by "judges, critics, clients, and problems relating to engineering, city planning and scales."[7]

While this rationale may have been beneficial as "such thinking has led to the creation of countless striking aesthetic objects,"[8] the issue is "(the) often undeniable beauty (of the architecture) resists inhabitation and contributes little to the creation of a successful built environment."[9] Therefore, "if we demand that architecture provide both physical and spiritual shelter, the creation of such aesthetic objects fails to meet the architect's special responsibility."[10] It is this special responsibility that this thesis project works to address. While projects such as Pruitt-Igoe in St. Louis were initially viewed as architectural marvels having "won an award from the American Institute of Architects when it was designed"[11], the designers failed to fully take into account the realm of an architect's responsibility and the need for architecture to provide both physical and spiritual shelter. Although Pruitt-Igoe's failure as a development cannot be blamed solely on architecture, bad design does bear the weight of

responsibility to some degree as “architects were insensitive to the needs of the lower class population.”[12] This inability of architects to fully understood user needs is further explained through a quote by George Kassabaum, one of Pruitt-Igoe’s designers who stated “you had middle class whites like myself designing for an entirely different group.”[13] Although, it must be stated that the counter argument to this claim in recent years, in accordance with the *Pruitt-Igoe Myth* by Katherine Bristo, is that architectural design was but one of several factors in the demise of the project.[14] Regardless, the responsibility of an architect has remained constant over the years and in the case of Modern Architecture, Pruitt-Igoe and architecture today, a failure to fully understand and design in accordance to a user’s needs has occurred.

When speaking at a TED Talk in 2011, David Chipperfield delivered a lecture entitled “Why Does Everyone Hate Modern Architecture?” Through this talk Chipperfield discusses a disconnect he believes is evident between architects and the public. He argues that a lack of “healthy dialog” is not only to blame for unsuccessful works of modern architecture, but also for many buildings today. As a result, as Chipperfield states, architects are now telling us how the cities might look whereas in the past a harmonic quality between the individual and architecture was evident. In Chipperfield’s view, this harmony is what architecture should attain. While architecture is now something that is happening to us, architecture should strive to be born out of collaboration and dialog between the architect, users, clients and developers. This is precisely what this thesis project works towards. Through collaboration and healthy dialog, the user’s needs and desires must be understood in order for a successful space to be designed.

This thesis argues that spaces need to be designed from the outset to be flexible so users may customize them as needed. Collaboration and dialog, as Chipperfield proposes, may only prove to be beneficial for a limited period of time as they do not take into account the long term implications that change of need or use has on the demands of a space; as a user’s inevitable change in needs and desires over time greatly affects the successful functionality of a space. This belief is best represented in the text of *Time Based Architecture* that states “society is changing at such a speed that buildings are faced with new demands which they should be in a position to meet.”[15] Since architecture is not a timeless medium,[16] “a new approach, therefore, is to design buildings that are able to cope with such changes, in other words buildings that respond to the time factor.”[17] Therefore, if architecture is the resultant of program and function of a space for a given point in time, a change in the program of a space, or the way in which users function within it, should result in a change in architecture. Thus, architecture should not remain

constant over extended periods of time. With that being said, if architecture as a notion should not be stationary or static in time, why are buildings designed to be static in time?

This notion of inevitable change over time requires the inclusion of time as a factor that can impact a space's long term functionality. Thus, in order to ensure the continual and successful functionality of a space, a plan to facilitate changes through the course of time must be made. With this rationale as the foundation some design questions emerge. What can be done at this time to facilitate the continual and inevitable change of program within a space over coming decades? What if there was a system of architecture which could be transformed so that spaces were never made redundant and could, at any moment, be adjusted based on the needs of the user? These questions form the underlying principles for exploration within this thesis project.

2.1 Thesis Position - Evolving Architecture:

If spaces could be transformed or redesigned at the user's discretion to fulfill current demands, they could then be continually customized over time to meet the emerging needs of future programs. This would then enable buildings to better serve both the function and the users of a space over extended periods of time. In turn there would be a reduced need to simply demolish old buildings as they could be constantly altered in accordance with current demands. This alternative will also prove to be more sustainable as it will capitalize on the benefits of embodied energy; while providing financial incentives as there would be a reduced need to relocate.

This is what an evolving architecture proposes; an architecture that can constantly be transformed to accommodate functions and their inevitably changing programmatic needs. While evolving architecture is similar to that of adaptable and mutable architecture, the term evolving architecture is used as this implies an evolutionary process that is associated with time. Furthermore, while this notion may seem similar to that of adaptive reuse, it is not. Adaptive reuse refers to a structure which is later used to serve a purpose other than what was initially intended. Such is the case for example, of industrial buildings converted into residential lofts. Thus, adaptive reuse differs from this project, as this project is intended to be adjustable from the outset such that it can better serve the needs of its current and future users rather than take on a new purpose all together. Furthermore, a building of evolving architecture can change numerous times instead of being a single, purpose built transformation. Through evolving architecture and other notions of time based architecture, "form follows function is giving way to concepts like polyvalence, changeability, flexibility, disassembly, and semi-permanence."[18]

3. Literature Review:

This concept of designing for change has been the subject of several scholarly works over the years. In addition, several projects have been developed with this concept of change over time as the central component of the design direction. In the following paragraphs literature and projects will be discussed in order to establish the context of this thesis project; as well as to further instil the theoretical underpinnings of this thesis project.

One well documented example of a development that attempts to deal with this issue of time and its implications on architecture is *The Grow Home* by Avi Friedman. Through the texts of *The Grow Home,* Avi Friedman puts forward the notion that designing for growth and adaptability allows users to modify living spaces in accordance to evolving needs.[19] In addition, the ability to change and adapt in the case of a home not only allows for financial incentives, as the need to relocate to acquire this change is no longer as necessary, but also allows for greater individuality. Greater individuality is achieved as alterations can be made specifically in response to an individual's life cycle changes. The floor plan can be modified to create space for a newborn child or young children; after, spaces can once again be reconfigured to make way for areas to be used by adolescents or young adults. Similarly, towards the end of this cycle and upon the departure of children from the home the plan can once again be revised to recover any vacated space.[20] Thus, within Avi Friedman's Grow Home, the user can constantly configure the space to best suit their individual needs at a particular time.

While Avi Friedman's notions of designing for change applies to his proposal of The Grow Home, the same rationale can be applied to other projects that employ a strategy of change or alteration based on user needs over time. Furthermore, while the Grow Home deals with alterations brought on by life-cycle changes within a residential building, other catalysts of change may be evident in projects of a variety of different uses. One such example of another catalyst of change is technology. In *The Future Metropolis* by Lloyd Rodwin, the author provides some historical context of what practitioners and theorists thought would come of cities based on emerging technology of their time, 50 years ago. While all the author's predictions of future cities have not come to fruition yet, by gaining a better understanding of the anticipated and actual impacts of technology upon space through the last 50 years, the influence that future technologies might have on cities and spaces may be better understood.

When discussing the role of communications technologies and their affects on the shaping of the city, Rodwin states “the larger purpose of present research in communications is to design systems capable of transmitting information with greater degrees of reliability, fidelity, capacity, economy and distance. Short of transmitting the actual person, the next most faithful representation is his picture.”[21] Based on this advancement of technology in areas of communication, the author believes that the virtual representation of a person would be a satisfactory replacement for the actual person. Thus, he depicts a scenario in which an individual is no longer required to physically relocate in order to have personal encounters. Rather he sees the impacts of this similar to those of the telephone in which people who were usually required to remain mobile could now be fixed. Furthermore, he believes that buildings and infrastructure may no longer be required such as schools and supermarkets. This has enormous implications for architecture.

Fifty years later we do have these technological advancements and more; however, the impacts of such technologies on space is debatable. While currently buildings and infrastructure are still required, we can see that some of these anticipated impacts are in fact coming to fruition through online applications for shopping and education. Furthermore, in cases such as video conferencing, subjects that would normally be required to travel to various destinations for meetings are now able to remain stationary. By understanding how technology has altered the need for, and arrangement of spaces today compared to that of 50 years ago, one can see that the technology of today may in fact dramatically alter the need for, and arrangement of spaces tomorrow. Thus, technology can and may act as a catalyst of change rendering current arrangements of space, programs and functions unsuccessful or obsolete. In the same manner that this emergence of technology has altered how people use a space and what a space is used for, other factors may also emerge which too will alter how individuals use a space. If function, to a degree, is to define the physical characteristics of a space, then a change in function or use should consequently result in a change of form. However, little is currently done to facilitate this change of form within architecture over time.

According to Theodore Prudon in *Preservation of Modern Architecture*, the most common way of maintaining an existing building once the threat of abandonment and subsequent demolition has been made evident, is to transprogram the space by inserting new programmatic elements into the old envelope. This is also described by the concept of adaptive reuse and often requires extensive renovations; thus is not always feasible. Furthermore, adaptive reuse, or the

transprogramming of space as Theodore Prudon describes, refers to a scenario in which a structure that is no longer used for its intended purpose can be adapted to serve a different purpose altogether. While adaptive reuse is a viable option for a total change in use, it is in a sense a last resort to preserve a building as it can no longer serve its existing function. Thus, adaptive reuse is not an appropriate strategy of accommodating change when the goal is to transform a building to better serve its existing user. In contrast, Avi Friedman's notion of designing for change allows for the addition or removal of building components as the need arises. Through this process an existing user can constantly configure the space in accordance to their evolving needs.

3.1 Hybrid Space:

As has been discussed, through factors and catalysts of change such as technology, economic stability, financial status, etc. a total change in the programmatic use of a space may be necessary or desirable over time. An example of such a situation would be the gradual conversion of spaces within a commercial building into residential areas. This incremental transformation of programmatic elements within a building would, in this case, convert a single occupancy building into what is now commonly referred to as a mixed use or hybrid building.

A mixed use or hybrid building is essentially a container that houses several programmatic elements of varying uses.[22] As is stated through the text of *This is Hybrid* by a+t, "the history of hybrids begins at the end of the 19th century, when the dense city started to accept the overlapping of functions as inevitable."[23] Thus, hybrid buildings emerged in essence out of necessity, as cities grew too dense to maintain the segregation of programs. Hence, programmatic elements began to overlap and be housed within the same container, therefore creating the mixed use or hybrid building. This depiction of hybrid buildings as container for various programs is further instilled through the excerpt "hybrids are characterised by a mix of uses in the same project. It integrates different programmes which also have different developers, different management and, obviously, different users. This is to say that a hybrid can be as diverse as a city in users, use times, and programme."[24]

Whereas *This is Hybrid* provides the rationale for the emergence of hybrid spaces out of necessity, another view is the increase of hybrid or mixed use buildings as a result of the blurring of physical boundaries through virtual means. This notion of blurring boundaries and emergence of mixed use buildings is further reinforced by *The Spaces of Organization and the*

Organization of Spaces by Karen Dale and Gibson Burrell. Through this text, the role of space in the shaping of our everyday lives is studied with a focus on how these spaces relate to each other in the wider social world which they aid in forming. As a result of growing technology a notion put forward by the authors is the existence of an "electronic envelope"[25] which has resulted in individuals being able to travel and operate in the same manner regardless of their physical location through electronic means. Consequently, the authors state that there is essentially an "extension"[26] of the physical boundaries of a place.

An outcome of this electronic envelope is a changing set of relations between an individual and space and according to the authors has resulted in a mixed or hybrid space. In essence, spaces are now able to simultaneously communicate and thus, function in ways contrary to what they were initially intended. An individual can be both at work while at home, while at the same time communicating with another space altogether. To add to this point, the authors use the modern day mixed use building as an example of a built form which has resulted from the dissolving of boundaries of a space. "Modern forms of life have led to the blurring of these boundaries. This is seen literally through the construction of new 'mixed use' spaces and buildings... Here work, play, sport, consumption and accommodation are deliberately combined with greater or lesser success."[27] This typology is used in this example as it represents a single building which is now combining different uses and in doing so, blurs the physical boundaries of space.

Therefore the hybrid or mixed use building is not only a building that contains a variety of programs within it, but rather is also a space that transcends normal levels of interaction between different places and people within those spaces through virtual means. While hybrid buildings blur the physical boundaries of one programmatic element to another, recent technologies at the same time blur the metaphoric or virtual boundaries of the space. Thus, spaces are now able to function in ways beyond their initially designed purpose.

While this thesis project does not deal with the metaphoric transformations of space through virtual means explicitly; it is the implications of blurred boundaries on physical space that this thesis project works to explore. Furthermore, while this thesis project does not examine the forces that have contributed to the emergence of hybrid spaces and buildings, this project will allow for changes in use at the user's discretion which may result in the mixing of different programmatic elements. Thus, the design project will enable a combination of hybrid spaces, therefore making it a hybrid building.

3.2 Ways of Acquiring Change:

While the conventional life cycle of a building is design, construction, commissioning, operation, decommissioning, and demolition, a holistic architecture that includes time as a factor would render this cycle obsolete. A substitute for this conventional building life cycle would be that of an evolving architecture. Through an evolving architecture the life cycle would then become design, implementation, further design, further implementation; repeating as needed. Therefore, a building that instead responds to the time factor would have a far more efficient and inclusive life cycle, capable of capitalizing on the benefits of embodied energy.

Current methods of dealing with change in architecture are the Add-On and Add-In Methods, as well as Day and Night Arrangements, Flexible Spaces, and Adaptive Reuse. Each of these approaches and what they entail will be discussed below. In addition to this, projects that employ each of these approaches will be looked at in the Precedent Review.

As was discussed earlier, a well documented development that deals with aspects of time and architecture is Avi Friedman's Grow Home. While Avi Friedman employs the Add-In Method in order to facilitate change within the Grow Home, he does write extensively on the Add-On approach. The Add-On Method as described by Avi Friedman is a strategy that "involves the construction of additional rooms that can be attached to the original structure as the need arises for extra space."[28] Thus, substantial change and readjustment through expansion is made possible with the only major limitation to growth being the amount of available space for the original structure to expand onto.

While the Add-On Method deals with the addition of space on the exterior of the existing structure, the Add-In approach "involves the provision of unfinished spaces within the original dwelling (or structure) which can be finished at a later date as the need and means arise."[29] This approach in many ways is easier as it requires little to no alteration to the exterior facade of the building. Furthermore, "in comparison with add-on procedures, this process (add-in) requires a somewhat higher initial investment in space and in structure – compensated, in return, by a considerably smaller investment at the time of expansion."[30] Common examples of such a method would be the finishing of one's basement in a typical Canadian single family dwelling. Here additional bedrooms or recreational areas can be created to better serve the needs of a growing family.

In either case, to allow for such changes to occur through the life of a project, the initial design must anticipate and incorporate a plan that will facilitate both projected and unforeseen changes. If well integrated within the initial design, both the Add-On and Add-In Methods allow for a viable option to accommodate future needs. As the need for additional space arises, additional rooms can be attached to the original structure or constructed within the original structure depending on the method selected.

Another way of dealing with change in architecture is referred to as Day and Night Arrangements. Day and Night Arrangements is a strategy in which spaces are designed from the outset to support different programmatic uses at different times of the day; as easily executable transformations are built into the design. Examples of such alterations would be a gymnasium designed to house athletic events that is also designed to be fitted with seating and a stage in order to accommodate a performance. While this example is somewhat simplistic, the rationale of accommodating different programmatic functions within the same space, and the resulting flexibility this permits, remains true. Thus, the goal of Day and Night Arrangements is to create from the outset a symbiotic relationship between uses that facilitates a variety of functions to occur within the same space. While this approach does not necessarily enable a building to continually evolve over time as a user's needs change, it does allow for spaces to be continually transformed in order to support different programmatic functions on a daily basis. As well, spaces can constantly be used for various purposes keeping them from being left to lie vacant. This in turn increases the usability and efficiency of a building.

Flexible Spaces is a forth way of dealing with change in architecture with examples of such spaces being large multipurpose rooms that allow for a variety of programs to occur within them. The problem that arises with the use of flexible spaces is they fail to truly engage with the program and thus don't respond directly to the functions they are meant to house. This is reinforced by the quote "the desire of flexibility led to programmatically neutral, characterless buildings."[31] Therefore, flexible spaces often do not preserve or reflect the character and identity of a program, resulting in neutral spaces being created. While the goal of this project is to create spaces that are flexible in that they can be customized to meet the evolving needs of the user, the spaces should also work to maintain the identity of the users, functions, and spaces.

This point is also made clear through the readings of *Travel, Space and Architecture,* as an interesting notion put forward through this text is that of global architecture and its need for local

identity. While spaces are becoming more universal, Jilly Traganou and Miodrag Mitrašinović argue the inherent need for the spaces to remain true to their cultural setting and the need to preserve their identity. In terms of this project, this macro scale rationale can be applied on a micro scale; while the boundaries of spaces within buildings are getting more distorted through the emergence of hybrid spaces and virtual communication, there remains a need for the identity of spaces to survive.

Lastly, adaptive reuse, as has been discussed through the literature review, is a common way of dealing with change in architecture and often entails the insertion of new programmatic elements into an existing building envelope. In comparison to the other methods of designing for change previously discussed, adaptive reuse often deals with a total change in programmatic use and function. This aspect of adaptive reuse may prove to be advantageous when a total change in building use is required.

While many of the projects to be discussed through the Precedent Review are residential in nature, using the methods noted above this thesis project will apply the same ideas and design strategies to projects of other uses. In doing so, this thesis project will embrace the possibility of change within building uses not commonly thought of such as commercial, business, educational and recreational buildings. By designing from the outset ways of accommodating potential changes within a variety of building uses, an evolving architecture will target a niche that is currently neglected.

4. Precedent Review:

As has been discussed, current methods of dealing with change in architecture are the Add-On and Add-In Methods, Day and Night Arrangements, Flexible Spaces and Adaptive Reuse. In the previous section the literature regarding change in architecture and hybrid spaces was looked at, while in the following section examples of projects that employ these methods to accommodate change will be looked at in greater detail. The intention is to identify the strengths, weaknesses and limitations of each of these approaches such that they can be used as case studies for subsequent design explorations and proposals.

While each of the precedents referred to in this section puts forward valuable notions in their own regard, a criteria has been developed such that the approaches can be compared to one another. Along with a summary and critique of each case study based on scholarly works, a table has been included which aides in determining which precedents will help in achieving the desired goals of this project. Stated first within this table is the architect, location, year of completion, approximate size and programmatic use. Following this information is a series of questions used as a criteria to evaluate each precedent. As this thesis project aims to design a building capable of continually evolving in accordance with user needs, the criterion asks if this is possible in each case study. Secondly, this project will work to accommodate various programmatic uses within the same building, thus the questions are probing to reveal if the precedent allows for a change in use, program and/or function. Furthermore, this thesis project will work to engage with the program to avoid the design of generic spaces. In this regard, the desire of this thesis is also to have change in function and use be reflected on the exterior such that spaces are seen to have their own identity. Thus, the criteria ask if change can occur on the exterior or can be reflected on the exterior as well as if the design responses of the case studies work to engage with the program. In addition to this, the criteria works to establish if a change in size through growth and reduction is allowed. While this table will not identify all the notions put forward by each precedent, it is used as a tool in order to quickly summarize each case study in regards to the objectives of this project such that they can be easily compared.

4.1 Add-On Method:

The first of these approaches to be explored is the Add-On Method which is essentially a scenario in which exterior space is enclosed and added onto the original structure or conversely, separated from the original structure. Common examples of the add-on approach would be an addition to a house or a new wing in a hospital.

Add-On Method in Capsule Tower:

The Capsule Tower is a 13 storey mixed-use residential and office tower in Tokyo, designed by architect Kisho Kurokawa and constructed in 1972. The project was the first example of capsule architecture built for actual use[32] and attempted to address issues of exchangeability and recyclability. Capsule Tower was also a product of the metabolism movement which was characterised by flexible and expandable structures that reflected the process of organic growth. In terms of an evolving architecture, the modules were designed to be replaceable over time. This allowed for greater flexibility as "the capsule is designed to accommodate the individual as either an apartment or studio space, and by connecting units can also accommodate a family."[33] As the New York Times states, "the idea (of the tower) was to create a completely flexible system, one that could be adapted to the needs of a fast-paced, constantly changing society.[34]"

Figure 1 – Capsule Tower

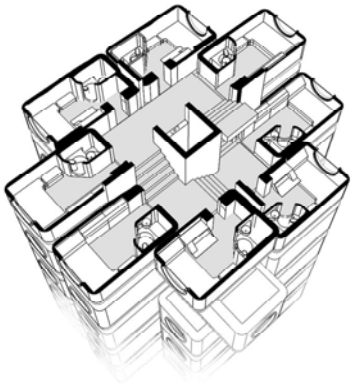


Figure 2 – Capsule Core & Arrangement

In theory, this building was designed with the intention to change over time based on user needs and desires and this change was to then be reflected on the exterior through the customization of modules. However these intentions were never manifested in the built product. While the building was designed for change, the manner in which modules were designed to be replaced made it virtually impossible and logistically challenging for an evolution to occur. As a result, no modules have ever been replaced. In 2007 building residents voted to have the building demolished, however an alternative approach still being considered is to have the existing capsules replaced with more modern ones. Regardless of what the future holds for the Capsule Tower and its obvious design flaws, what is important to remember is this was "the crystallization of a far-reaching cultural ideal.[35]" More importantly "Its existence also stands as a powerful reminder of paths not taken,

of the possibility of worlds shaped by different sets of values.[36]" Thus, the Capsule Tower was an early attempt of realizing a notion of evolving architecture. While it does have design defects, lessons can be learned from its theoretical underpinnings, rationale and causes of failure, which can then be applied to future concepts.

Add-On Method in The Highrise of Homes:

Designed as an experimental housing project by SITE Environmental Design, the Highrise of Homes is essentially a steel structural scaffold which is then plugged into and filled with typical low-rise dwellings similar to those of suburban developments. Rather than purchasing a plot of land in suburbia and then constructing a home, residents would purchase space located on these platforms and build a home to their liking. The motivation of such a radical exploration is said to be "a critique of the Twentieth Century tradition of homogenized and faceless multi-story buildings, which eliminate the possibility for urban dwellers to demonstrate any evidence of their presence in the cityscape."[37] By adopting this approach, residents could live in an urban development while still having the opportunity to design their home as they desired on both the interior and exterior. Furthermore, the high-rise building as a typology would also be transformed through this process from a monolithic structure to a diverse mosaic of smaller, unique parts.

Figure 3 – The Highrise of Homes

While this experimental project does not deal directly with change in use over time, it does work well as a precedent in conjunction with the Capsule Tower as it aims to facilitate the customization of housing, or in the case of the Capsule Tower modules, that are then reflected on the exterior. Thus, the main notion put forward through this precedent is the importance of user customization and identity in urban form; as any building, whether low or high-rise, would enable users to create spaces as they see fit; both inside and out. This is further expressed by the designer James Wines as he "wanted the singular voice of the architect to be downplayed in favour of chance and the voice of the people."[38]

Add-On Method in Growth Homes:

While Grow Homes put forward by Dr. Avi Friedman uses the Add-In method to accommodate change, Growth Homes, or Groeiwoningen, by Herman Hertzberger in Almere uses the Add-On method for a building to accommodate change over time by growing on the exterior. Designed and constructed as a series of identical, low-rise housing blocks, a zone of land is left vacant, adjacent to each individual house. This adjacent space can then be completed over time at the occupants' discretion, in any manner they see fit. This is reflected in the parti diagram depicted in Figure 5. Speaking to this the authors of *Time Based Architecture* state, "flexibility can mean the capacity of a building's interior to adapt, but the term can also be used to show that a building can be extended without difficulty. These growth homes designed by Herman Hertzberger are a good example of that latter category."[39] The architects involved in the design of this project believed that although they were designing for change, by including in their design these identical, low-rise housing blocks it "creates a mixed architectural image in a clear framework."[40] Thus, within the multiplicity of design interventions the occupants may propose, there is a constant trace of the architects initial design proposal as the framework for change to occur around.

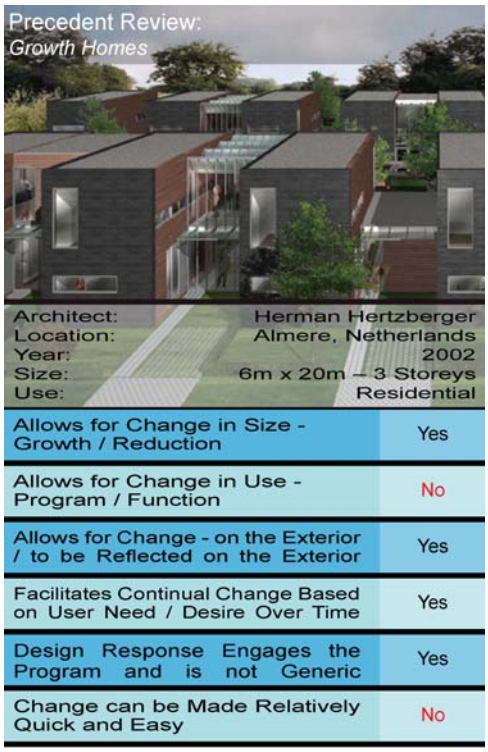


Figure 4 – Growth Homes


Figure 5 – Growth Homes Parti Diagram

This aspect of maintaining the clear architectural image as proposed by the architect is in essence a contrast to the motivations of the Highrise of Homes; as within the Highrise of Homes the desire was for users to design and construct their individual homes as they saw fit and in doing so create a diverse mosaic on the exterior. This differs to the Growth Homes for although the intention is to allow for this individuality in function, the design works to maintain clarity of the initial architectural intervention in its form. This underlying motivation may however in this case, hinder the ability of this design response to accommodate a broad spectrum of change.

Nevertheless, this rational of creating a mixed image within a clear framework is something that may prove to be beneficial as it relieves sameness yet creates a coherent underlying framework. Furthermore, while the same rational within this residential project could be applied to projects of other programmatic uses, this particular project does not facilitate a total change in use, rather an expansion or variation of a residential use. This approach has also been utilized with great success in Quinta Monroy, a Chilean social housing project by Elemental. In essence, Elemental designed and constructed an initial development that acted as a framework for additional self construction to occur around and enables residents to customize their units based on their individual needs. This initial development as well as the project following additional self customization and construction is shown in Figure 6.

Figure 6 – Quinta Monroy Before and After

Add-On Method in the Sprout Home:

Designed by Sevag Pogharian the first demonstration Sprout Home was opened in the spring of 1997. The Sprout Home began as an external research study, funded by the Canadian Mortgage and Housing Corporation with the goal of designing "a house that has the versatility to expand incrementally as the space requirements and financial resources of a household increase."[41] At the outset, the Sprout Home is designed with two finished floors providing an area of 1,152 square feet. However, through a series of expansions which includes finishing portions of the basement and attic, and growing from the rear of the house on the exterior, the final stage of provides a total area of 3,122 square feet. Thus, as a need for additional space emerges and financial resources increase, the sprout home can grow from within the original structure using the Add-In Method, as well on the outside, using the Add-On Method, in order to accommodate a user's needs. This series of expansions is depicted in Figure 8 which illustrates a sequence of sectional images that reflect the changes that are occurring.

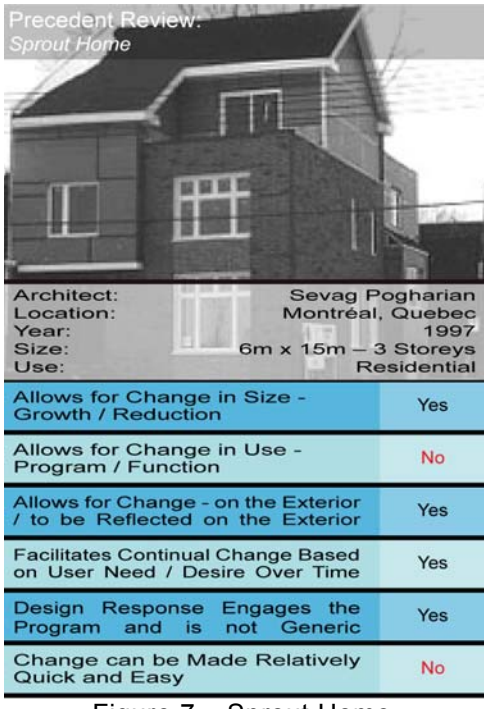
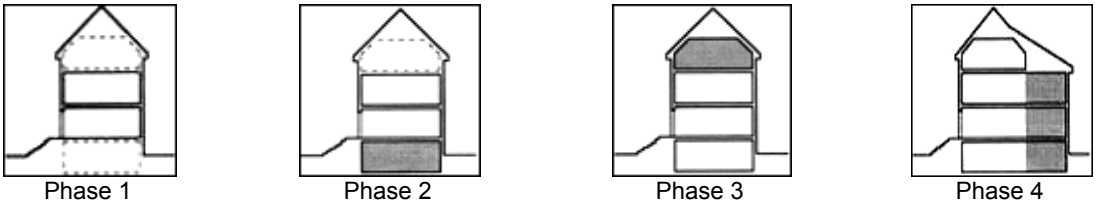


Figure 7 – Sprout Home



Phase 1
Initial House

Phase 2
Completion of Basement

Phase 3
Completion of Attic

Phase 4
Expansion

Figure 8 – Sprout Home Sectional Diagrams

As can be seen from this, the Sprout Home illustrates a scenario in which a combination of the Add-On and Add-In Methods are used in conjunction with great success. In the case of this project, this combination proves to be very beneficial as it allows for greater flexibility through expansion, while still providing a manageable alternative for attaining growth through simply finishing interior spaces. As is currently demonstrated in this project, a total change in use is not facilitated; however, using the same rational and a combination of the Add-On and Add-In Methods, it is believed that a project that does allow for a change is use is possible.

Conclusion of the Add-On Method:

As has been demonstrated by the above precedents, change can be accommodated using the Add-On Method through the addition or revisions of modules which are attached to the structural core; as well as through the expansion of an existing structure on to adjacent land. Using these techniques the Add-On Method enables buildings to be continually customized to meet the programmatic requirements of a space and function. As a result, substantial change and readjustment through expansion is made possible with the only major limitation to growth being the amount of available space for the original structure to expand onto. While these factors may prove to be very advantageous, significant alteration to the existing building exterior is often required which may prove to be very cumbersome and logistically challenging. Furthermore, “space must be available for any new construction, and will entail extra costs.”[42] Thus, the Add-On Method is only a viable option should additional land be available and financial resources permit the acquisition and development of these adjacent lands.

4.2 Add-In Method:

As the Add-On Method deals with space being added to or removed from the original structure, the Add-In Method is a scenario in which changes are made within the original building enclosure in order to accommodate change. Common examples of the Add-In method in use would be the completion of a residential basement or the addition or elimination of walls within an office floor.

Add-In Method in the Grow Home:

The Grow Home, as it is proposed at the moment, is a small three storey townhouse that contains within it a portion of unfinished, un-partitioned spaces. It begins as a simple floor plan consisting of a finished living/dining room and kitchen on the ground floor. The upper floors at the time of purchase are left un-partitioned and in some cases unfinished such that they can be altered as time progresses. Figure 10 depicts a physical model of the second floor of the Grow Home. On the right of the image is a second floor with no partitions, while the left of the image then illustrates the same plan after alterations have occurred. “The room could easily be partitioned in the future by extending the half-wall by the stairs into a full wall and including a door to create front and back rooms with a bathroom located centrally.”[43] In essence, as time progresses and the owner’s financial resources and need for additional rooms increase, they can progressively modify and alter the house to best suit their needs. In many ways this is similar to the finishing of a basement in a typical Canadian single family dwelling in which the basement can be converted to include more bedrooms, a home office, or a larger living area. Figure 10 reflects a plan containing a central U-stair at the core; however other alternatives for both the ground and upper levels are available and are shown in Figure 11. Floor plans for this “Stair Core” option as depicted in the physical model are included, as well as three other options featuring an open core, a bathroom at the core, or the kitchen at the core. Each option has implications on both the arrangement of space at the initial development stage as well as

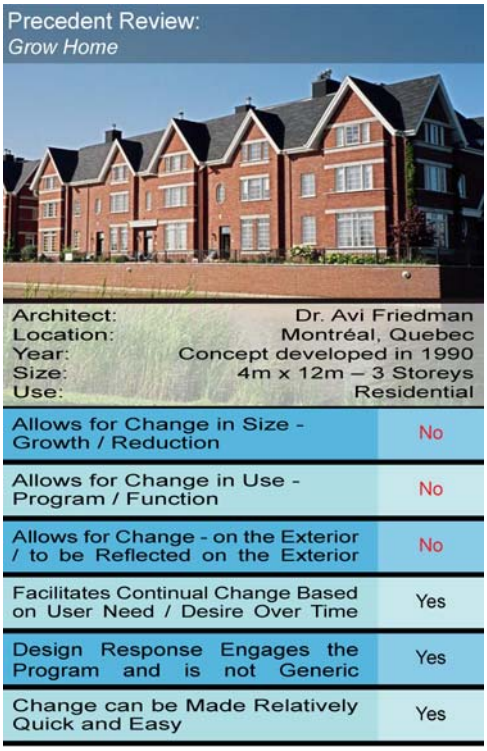


Figure 9– Grow Home


Figure 10 – Grow Home Physical Model

implications on the manner in which growth can occur in the future. The main advantage of the Grow Home is its ability to fulfill its goal as is put forward in the quote "(The goal is) to create an affordable ownership housing form where the interior can be finished incrementally to match the space requirements and financial circumstances of the homeowners.[44]"

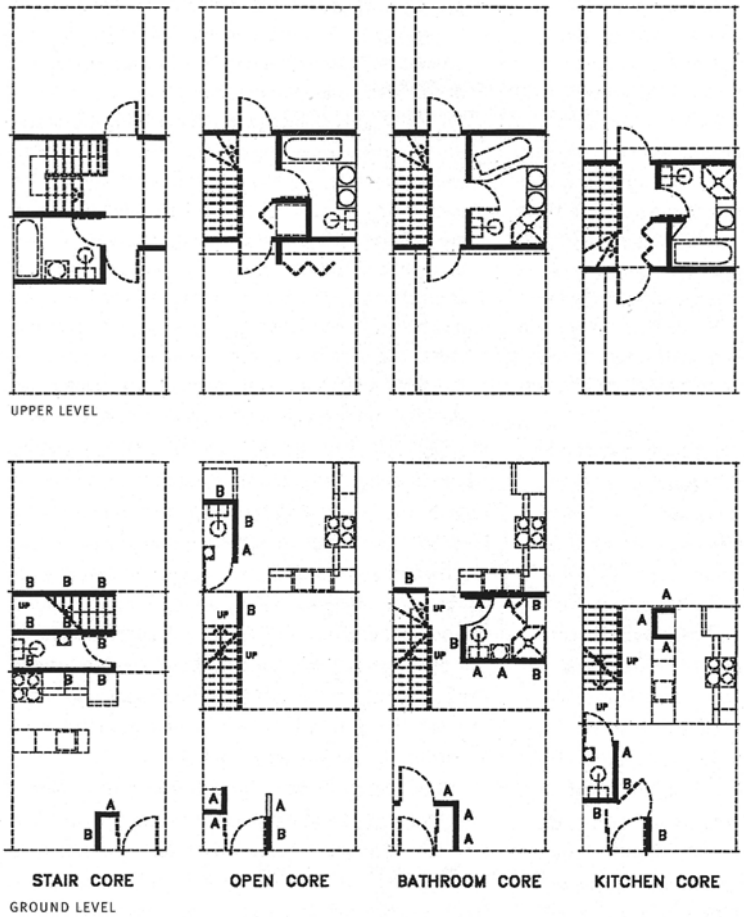


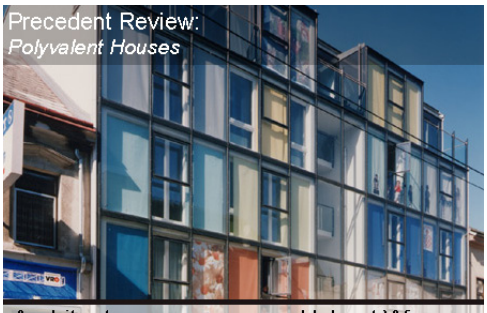
Figure 11 – Grow Home Floor Plan Options

A significant benefit of the Grow Home which employs the Add-In method is its ability to accommodate change with little to no alteration on the exterior facade of the building. Furthermore, spaces can be left unfinished in the early years therefore reducing initial costs. Only when financial resources are available and additional space is needed will the upper floors be completed according to the owner's desires. This has been shown to work in practice, as of the 10,000 Grow Homes built within North America, "research conducted by McGill University shows that two-thirds of Grow Home owners have already converted the unfinished spaces in their home."[45] Of these two-thirds, approximately 75% of owners have finished the spaces on their own, rather than have the work done by a professional builder. [46]

Although the Grow Home has been fairly successful, the disadvantage of this project in its approach of acquiring change is that initial costs of constructing this building are higher in order to include these unfinished areas in the form of the second and/or third floors. Furthermore, while the Grow Home does allow for access to more space as the need arises, the owner is still restricted by the predetermined confines of the original structure. Should the need arise for more space than what the structure permits, the Grow Home is not able to accommodate this.

Add-In Method in Polyvalent House in Vienna:

Designed by Helmut Wimmer, Polyvalent House in Vienna is a title used to describe a housing development designed and built in Vienna. This project explores aspects of time and architecture as it is designed to be occupied in various ways. Changes in the floor plan are achieved by designing large open spaces that are linked to a central hall which contains two bathrooms and an entryway. This enables the user to subdivide the larger open space as they see fit while still linking to the central hall for circulation. This is shown in Figure 13 which depicts four permutations that can be used when subdividing the unit. However, what is noteworthy about this project in particular is that change was not limited to simply altering the floor plan; rather, the facade is also meant to be altered such that it reflects the different and ever changing ways of use. This is achieved through the use of sliding panels along the exterior glass facade that enable users to control how much light and privacy they want within the space. Furthermore, residents are encouraged to paint these panels along the facade giving the building a varied appearance on the exterior as is made clear from the exterior view in Figure 12. The use of these panels as shading devices also makes for a constant change in the building exterior through the seasons. All these design elements result in a scenario in which the potential exists for building use to be directly reflected through the architecture; or in this case through the building facade. These design intentions are best summarized in an excerpt from the architect's website:



Architect:	Helmut Wimmer
Location:	Vienna, Austria
Year:	1996
Size:	9m x 18m – 5 Storeys
Use:	Residential
Allows for Change in Size - Growth / Reduction	No
Allows for Change in Use - Program / Function	No
Allows for Change - on the Exterior / to be Reflected on the Exterior	Yes
Facilitates Continual Change Based on User Need / Desire Over Time	Yes
Design Response Engages the Program and is not Generic	No
Change can be Made Relatively Quick and Easy	Yes

Figure 12 – Polyvalent House

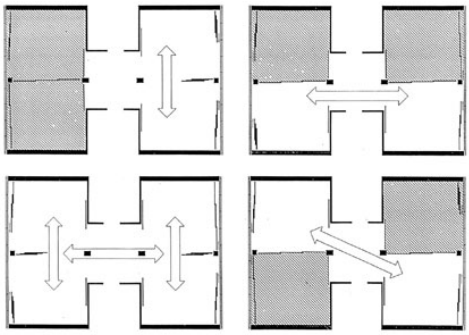


Figure 13 – Options for Subdivision

> *The essence of our architecture lies therefore not in a deterministic and formal development of the discrete layers themselves, but rather in their inherent ability to loosely overlap one another, to display their contents towards the outside, and to promote spontaneous uses. Their contents may come, go … perhaps just*

change, but nevertheless, their status quo is consistently reflected in the structure. It is an architecture which is continuously writing and then revising its own story, an architecture of metamorphosis.[47]

While the Polyvalent House does attempt to address a user's desire of flexibility in living arrangements, the extent of flexibility is limited to the subdivision of one large space into four smaller spaces based on the predetermined locations of sliding partitions, as was seen in Figure 13. Since the extent of variation on the interior is minimal at best, great change in time cannot be easily accommodated. However, what is valuable in the Polyvalent House as a precedent is the aspect of customization along the exterior facade in response to the user's need and desires. Figure 14 shows an array of possibilities, as anticipated by Helmut Wimmer, which could occur on the exterior as users alter the arrangement of panels along the facade. Similarly, Figure 15 shows what has actually manifested itself on the exterior of the building. By enabling change to occur on the facade the building's external appearance can be continuously altered through time. Through this the potential exists for the changing uses of a space to then be reflected on the exterior. Furthermore, the floor plan is designed to change around fixed features such as the bathrooms and kitchen. Thus, these "wet cells" as Wimmer call's them are located in central areas allowing for change to occur around them. This design element begins to describe a strategy of dealing with issues of plumbing and their associated functions. These Wet Cells, as well as the sliding partitions along the exterior facade can be seen in Figure 16.

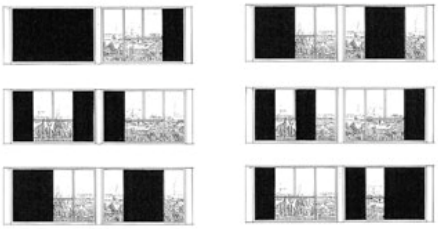


Figure 14- Sliding Panel Arrangements

Figure 15 – Diverse Exterior

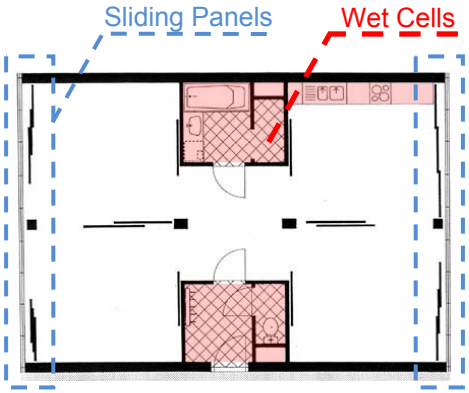
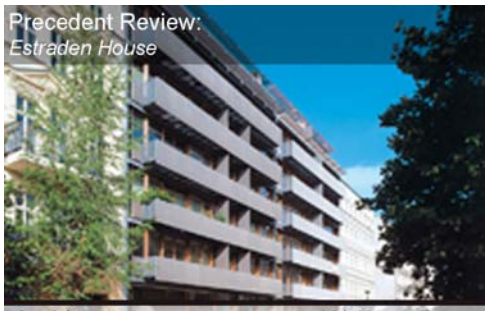


Figure 16 – Polyvalent House Plan

Add-In Method in Estraden House:

Described as the first prototype,[48] the Estraden House in Berlin was designed and constructed by architect and developer Wolfram Popp. The name Estraden emerges as a result of a major design element called “estrade” which is the French word for platform. Here these platforms form a band along the perimeter of the building separating the balcony and exterior from the freely sub-divisible interior living space. Within the interior are large central living spaces that can be customized by the residents and divided using sliding panels or semi-permanent walls. A service zone is located in the middle of the floor plate and houses ancillary spaces such as entrances, stairways, kitchens, bathrooms, and storage. Thus, large spaces located adjacent to these service zones can be customized with partitions while still connecting back to these ancillary spaces for services.



Architect:	Wolfram Popp
Location:	Berlin-Prenzlauer Berg, Germany
Year:	1998
Size:	13m x 10m – 7 Storeys
Use:	Residential
Allows for Change in Size - Growth / Reduction	No
Allows for Change in Use - Program / Function	No
Allows for Change - on the Exterior / to be Reflected on the Exterior	No
Facilitates Continual Change Based on User Need / Desire Over Time	Yes
Design Response Engages the Program and is not Generic	Yes
Change can be Made Relatively Quick and Easy	Yes

Figure 17 – Estraden House

Similar to the Polyvalent House, the extent of flexibility is limited to the subdivision of larger spaces into smaller spaces based on the predetermined locations of sliding partitions. Furthermore, while the use of the estrade is an interesting design feature, it does not do much to allow for change over time. Similar to the Polyvalent House, the use of service zones for fixed items such as stairways, kitchens, bathroom, etc. allows customization to occur in the spaces adjacent while still allowing for a practical strategy of dealing plumbing and circulation. Illustrated in Figure 18 is the typical plan of the Estraden House along with the central service zone.

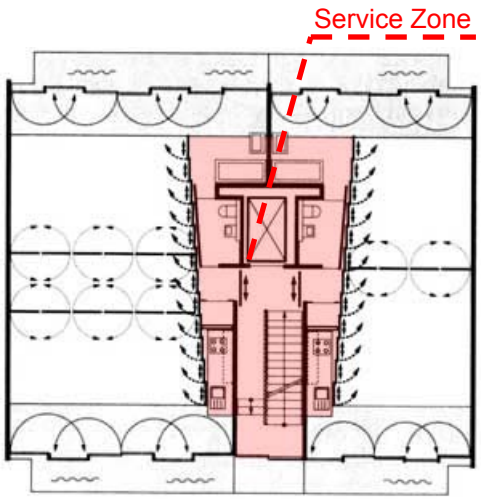


Figure 18 – Estraden House Floor Plan

Add-In Method in Structural Facades:

Structural Facades is a strategy put forward by Rapp + Rapp, a Dutch design firm in the Netherlands, when designing a mixed use project containing a housing block with a sports hall at the centre. Using structural facades, a technique sometimes used in office buildings, demising walls between units can be relocated with little concern as they are not acting as structural elements. The architects state, "the supporting structure of the block is based on three bearing rings including bearing walls. In this way a high degree of flexibility is obtained, which will benefit the life of the building."[49] As a result of this ability to relocate interior and demising walls units can be made wider or narrower at any point in time. "The advantages were there even during the development stage, as the exact width, and with it the number of units per storey, could be modified right up to the end of the process without delaying the project as a whole."[50] Thus, this approach not only allows for greater flexibility in the unit widths throughout the life of the project but also proved to be advantageous through the development stage as well.

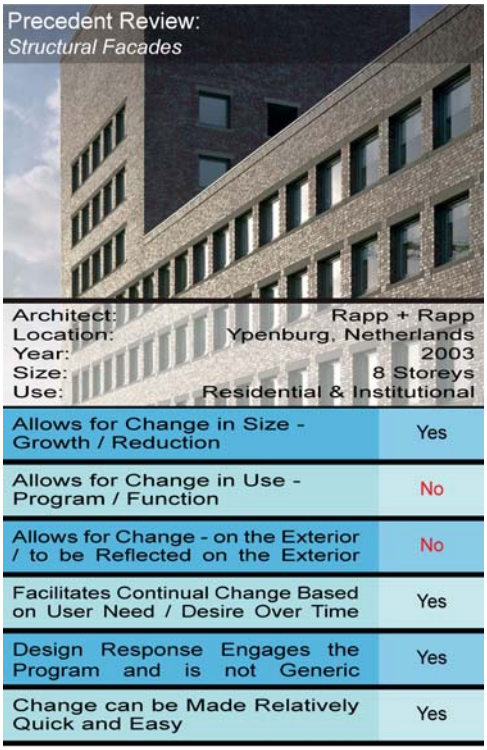


Figure 19 – Structural Facades

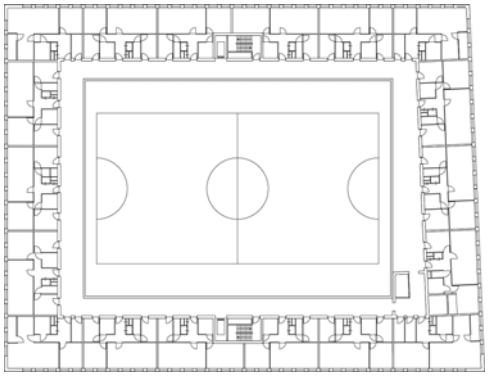


Figure 20 – Block A Ypenburg Floor Plan

Although this thesis does not aim to achieve flexibility through the development process only, the same rational that proved to be advantageous here could be used in a building of any use that aims to achieve change over time. By enabling the facade to be a structural system, or simply locating structural elements along the perimeter, interior partitions and demising walls can be relocated without concern of structural implications. This relocation of demising and partition walls would undoubtedly aid in the transformation of a building or space uses, as walls could be revised as needed to accommodate the required widths for a particular use. Furthermore, if this notion is used in conjunction with other strategies previously discussed, it would allow for a building that

could truly be transformed over time to serve both new and existing functions. Although this project contains an abundance of masonry and punched openings on the facades, it should not be misunderstood that this was necessary in order to achieve structural facades. Structural facades can still be achieved in a full curtain wall system through the use of a Diagrid structural system. A well known example of a building that employs this approach is Norman Foster's Hearst Tower in New York City as is illustrated in Figure 21.


Figure 21 – Hearst Tower

Conclusion of the Add-In Method:

As discussed in the precedents above, the Add-In Method represents a scenario in which design changes are made within the original building enclosure in order to accommodate change in program, function, need or desire. While some examples have a temporal quality through the reconfiguration of pre-existing sliding partitions, others include the construction, placement, and/or revision of interior partitions. Through these various techniques the Add-In Method enables users to constantly configure the space to best suit their individual needs at a particular point time. As a result of their inherent simplicity when compared to the Add-On Method, changes can be made relatively quickly and easily as alterations are not required on the exterior facade. However, while the Add-In approach does prove to be less logistically challenging than the Add-On Method, the disadvantage of this technique is the fact that it only allows limited change and readjustment within the predetermined confines of the original structure. Furthermore, a higher initial investment in space and structure is required to accommodate revisions.[51] This higher initial investment is however recovered through the life of the project, as changes can be made faster and with less cost than the Add-On Method.[52]

4.3 Day and Night Arrangements:

Similar in its ways of transforming interior spaces while leaving the exterior untouched, Day and Night Arrangements is a strategy in which spaces are designed from the outset to support different programmatic uses through minor alterations. This then enables the same space to function in different ways at different times of the day; creating a symbiotic relationship between uses which allows a space to address different programmatic needs. While this approach does not necessarily enable a building to continually adapt over time as a user's needs change, the ways in which the following precedents cater to different uses is worth investigating.

Day and Night Arrangements in Dwellings in Carabanchel:

Intended to be an affordable housing development, Dwellings in Carabanchel designed by Aranguren + Gallegos Arquitectos employs the notion referred to as 'Day and Night Arrangements'. Under this notion, a space can be transformed by moving partitions to serve different functions at different times in the day. The technique used to achieve this transformation is similar to that of other projects that use the Add-In method, and employs sliding partitions. Also featured in this project is a raised 60cm high floor which allows for cables, ducts and furniture to be positioned and stored beneath it. "This is by no means a new way of saving space"[53] as the intention of this feature is to accommodate an alternative use to the space giving the area two distinct arrangements; not simply to act as a means of storage. Lastly, wet services such as kitchens and bathrooms are once again located at the core in a central wet zone such that large open spaces can be transformed around it using partitions.

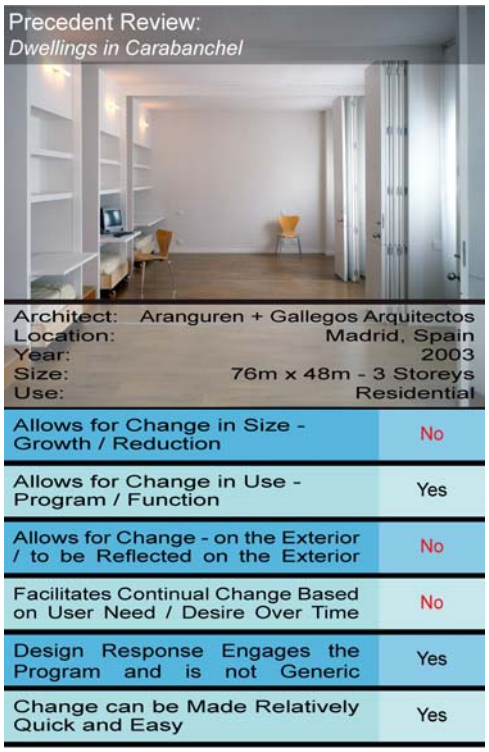
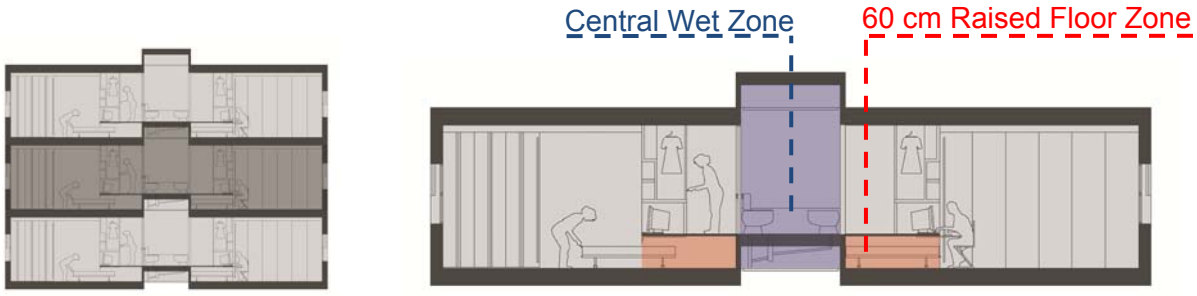


Figure 22 – Dwellings in Carabanchel

This project puts forward several interesting notions such as the raised floor system to house cables, ducts and furniture. Although this may appear as a simple gesture, greater flexibility is now permitted as a result of eliminating bulkheads. Furthermore, this space allows for a bed to be rolled away and stored, thus removing the sleeping area from this space during the day time arrangement. This raised 60cm floor area and central wet zone is shown in Figure 23.



Section of Multiple Floors

Section of Single Floor

Figure 23 – Sectional Diagrams

Furthermore, while moveable partitions is a strategy used by other projects previously discussed, Dwellings of Carabanchel is able to accommodate far greater change over time as a result of its massing. This is as a result of the other projects discussed having small square floor plates with glazing on only two sides. Here, the form of the Dwellings of Carabanchel is a more elongated rectilinear slab with opportunities for glazing on multiple facades. As a result, greater variation in the arrangements of partitions is possible which therefore allows for more adaptability over time. A comparison of the plans of Dwellings of Carabanchel to the Polyvalent House is illustrated in Figure 24. In this diagram, walls that allow access to daylight have been identified with dashed blue lines.

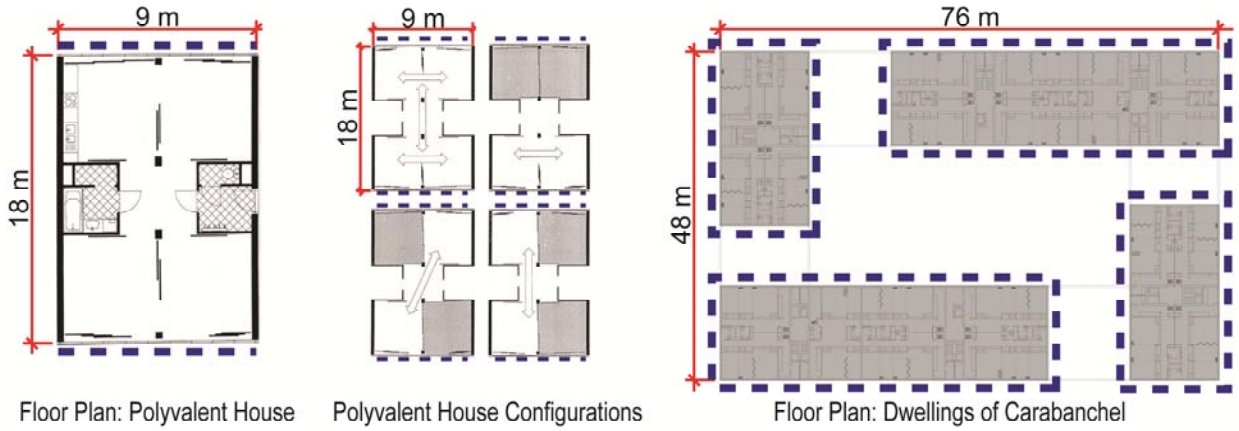


Figure 24 – Plan Comparison: Polyvalent House vs. Dwellings of Carabanchel

As can be seen in the diagram “Polyvalent House Configurations,” the smaller floor plate and minimal access to daylight results in fewer permutations for the arrangement of spaces. In contrast, the floor plan of Dwellings of Carabanchel is much larger and elongated allowing for more variability in the widths of units. This coupled with the fact that greater access to daylight is also permitted results in more permutations being possible for the way in which the building is subdivided and used. Furthermore, what is in essence a large courtyard building has also been divided into four separate buildings such that that fewer dark areas are created and more daylight is available. Thus, with an elongated massing and greater access to daylight, more flexibility is permitted.

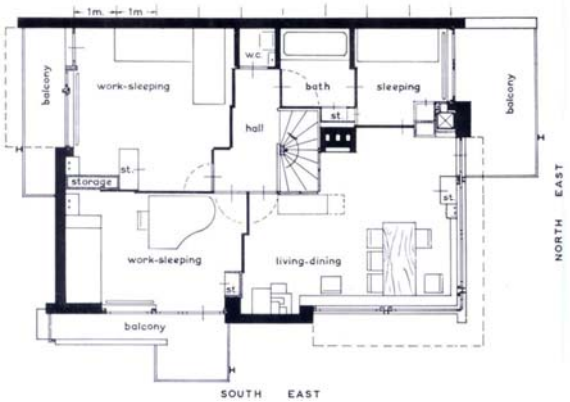
Day and Night Arrangements in the Schröder House:

The Shröder House, constructed in 1924, is an early example of a building designed to allow the occupant to alter its floor plan. While the ground floor can be seen as fairly traditional, the upper floor was not designed to be a static accumulation of rooms; but rather a dynamic and changeable open zone. This is achieved using a system of sliding panels that enable the upper floor to be arranged in a variety of permutations ranging from a completely subdivided to an open arrangement. Figure 26 below depicts the second floor plan in both a fully subdivided arrangement as well as a fully open arrangement. Through these arrangements and the multiple permutations of it, the upper floor is able to function in different ways in order to serve different functions, while providing varying levels of privacy from within.

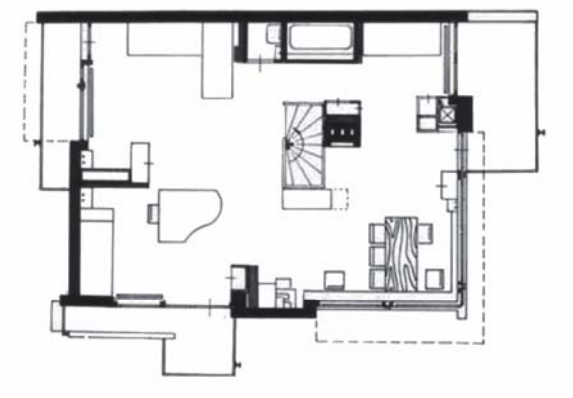
Architect:	Gerrit Rietveld
Location:	Utrecht, Netherlands
Year:	1924
Size:	8m x 10m – 2 Storeys
Use:	Residential
Allows for Change in Size - Growth / Reduction	No
Allows for Change in Use - Program / Function	No
Allows for Change - on the Exterior / to be Reflected on the Exterior	No
Facilitates Continual Change Based on User Need / Desire Over Time	No
Design Response Engages the Program and is not Generic	Yes
Change can be Made Relatively Quick and Easy	Yes

Figure 25 – Shröder House

Transformations in the case of moveable partitions can occur quickly and easily while still enabling the space to function successfully. However, the changes that have been facilitated through the design of the sliding partitions does not accommodate a broad spectrum of programs and functions. Thus, the Schröder House may not be able to accommodate dramatic changes in program over time. Furthermore, a total change in use would not be possible and changes on the interior are not capable of being reflected on the exterior.



Subdivided Plan

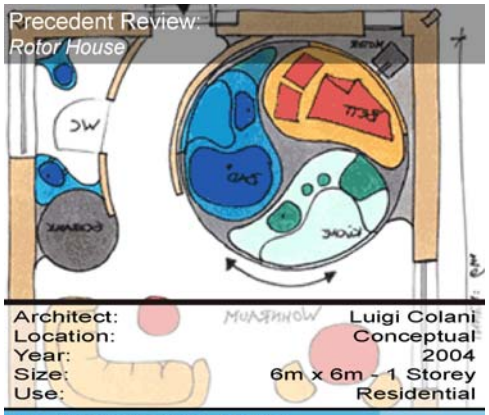


Open Arrangement Plan

Figure 26 - Shröder House Second Floor Plans

Day and Night Arrangements in Rotor House:

Luigi Colani of the Austrian design studio AllesWirdGut "has designed a home like an item of furniture"[54] referred to as the Rotor House. Through this notion, a circular piece of furniture is subdivided into three parts, the kitchen, the bathroom and the bedroom, and is shown in plan in Figure 27. As this object rotates it allows the user to access each of these individual spaces separately. The ability to access these areas then gives the adjacent space a different use. An example of this would be the rotation of this piece of furniture to allow access to the sleeping quarters. When this structure is in this position, the space adjacent to the bed is then used as a bedroom. This is emphasised by the designers who explain that from 36 m² of living space arises, thanks to the rotor technology, the living room, kitchen, bathroom and bedroom; therefore a far larger space is perceived.[55]



Architect:	Luigi Colani
Location:	Conceptual
Year:	2004
Size:	6m x 6m - 1 Storey
Use:	Residential
Allows for Change in Size - Growth / Reduction	No
Allows for Change in Use - Program / Function	No
Allows for Change - on the Exterior / to be Reflected on the Exterior	No
Facilitates Continual Change Based on User Need / Desire Over Time	No
Design Response Engages the Program and is not Generic	Yes
Change can be Made Relatively Quick and Easy	Yes

Figure 27 – Rotor House

The effect is very similar to Day and Night Arrangements discussed above, as the space is given a different function as the user wishes by repositioning the rotor. Figure 28 below depicts the rotor technology in its three positions.

Bathroom Bedroom Kitchen

Figure 28 – Rotor House Arrangements

There exists an inherent simplicity to the overall design solution of the rotor house. While this system does not facilitate extensive change in function or use over time, it does demonstrate at a small scale how the function of a space can be dramatically altered with few interventions.

Conclusion of Day and Night Arrangements:

As can be seen from these two examples, Day and Night Arrangements as a strategy of designing for change can aid in allowing the same space to address several different programmatic functions at different times of the day. While this may allow for the accommodation of different programmatic uses, it doesn't necessarily address a change in program or function of a space over extended periods of time.

4.4 Flexible Spaces:

Flexible space as it applies to architecture, is essentially a building design that can be used in different ways with little to no adjustment to the essential form and structure. In some cases this can simply be a large multipurpose space used for various events and activists.

Flexible Spaces in Unconventional Dimensions:

Unconventional dimensions is a notion put forward by architect Riegler Riewe that was implemented in two housing developments in Austria. In accordance with this notion, spaces were given unconventional dimensions such that they could double in use as they resident desired. An example of this is some residential units were designed to have oversized entrances which would then enabled these spaces to be used for additional uses such as play areas or storage spaces. Another example found within these housing developments is that of extra large bedrooms that could then function as another living room. Essentially spaces were designed to facilitate a transprogramming of spaces.

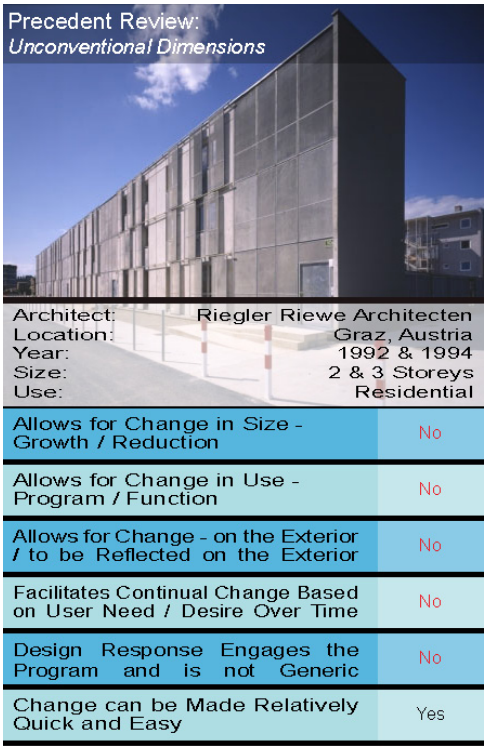
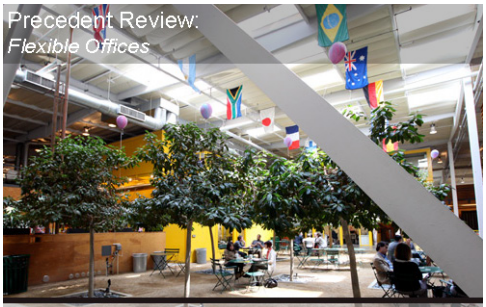


Figure 29 – Unconventional Dimensions

Although an interesting notion, unconventional dimensions as a strategy will not necessarily facilitate a user's change in needs over time. Furthermore unconventional dimensions, as proposed through these projects, will not aid in enabling a total change in programmatic use over time. Nevertheless, the use of unconventional dimensions as a strategy used in conjunction with other approaches of evolving architecture may allow for greater flexibility at all times.

Flexible Spaces in Flexible Offices:

As the name of this project implies, “Flexible Offices” designed by Gaetano Pesce is an office space built in New York that is intended to allow for greater flexibility of movement. Based on this principle, the space is designed to have no fixed desks but rather large open space in which workers can sit where they choose and plug their laptops in. This notion is said to be in response to “research (that) has shown that in traditional offices the workspaces stood empty for most of this day which is a waste of space and energy.[56]” By having flexible offices, more work places can be achieved in a smaller footprint. In addition to this flex space, smaller work areas have also been included for meeting rooms or private offices if the need arises.



Architect:	Gaetano Pesce
Location:	New York, USA
Year:	1994
Size:	Office Interior
Use:	Office
Allows for Change in Size - Growth / Reduction	No
Allows for Change in Use - Program / Function	Yes
Allows for Change - on the Exterior / to be Reflected on the Exterior	No
Facilitates Continual Change Based on User Need / Desire Over Time	Yes
Design Response Engages the Program and is not Generic	No
Change can be Made Relatively Quick and Easy	Yes

Figure 30 – Flexible Offices

A common criticism to such flexible spaces is they can appear to be neutral and impersonal[57] as they often fail to engage with the program. This critique is centered on a lack of personalization as spaces are not customized. However in an attempt to alleviate this, the office has been designed to mimic various settings such as a park or living room in order to give the spaces a defined character. While greater flexibility is made possible in this “Flexible Offices” project, the opportunity for changes on the interior to be reflected on the exterior is minimal.

Another noteworthy item within this project is the notion put forward by Gaetano Pesce of technology’s implications on space as he states “today office spaces no longer have defined and fixed functions. Current technology allows a greater liberty of movement and offers a larger selection of workspaces to office users.”[58] Thus, as technology is eliminating the need for traditional office spaces, one can only speculate what implications this has for all future construction. As technology continues to impact how users function within a space, a new type of architecture is needed.

Flexible Spaces in Developers' Freedom:

Designed by Ana-architecten, Multifunk is an interchangeable housing and/or office development located in Ijburg; a residential neighbourhood in Amsterdam. Parties involved in the development of this project realized future events, such as the occupation of the suburbs, may cause a change of use to occur within the surrounding context.[59] Thus, Multifunk employed a notion referred to as Developers' Freedom which would enable these anticipated changes within the surrounding context to be reflected in a change of the building use. By creating residential floors with greater floor to ceiling heights then what is normally done, a transformation of use from residential to office is facilitated. Furthermore, to aid in the transformation, multiple elevator cores were included, as can be seen in Figure 32, enabling portions of the building to be converted into a functionally separate office zone while the remainder of the building continued to function as residential units. In essence, greater flexibility in terms of programmatic function was achieved, thus allowing the building to serve various programs over time. In the case of Multifunk, this rationale proved to be extremely advantageous as during the construction process there was an economic downturn. As a result, while 80% of the building was originally planned to be offices this was later reduced to only 20%.[60] Since the building was designed to easily accommodate this change only minor modifications were required; therefore validating the statement, "Multi-Funk responds to all possible developments in the residential and office markets through a changeable building."[61]

Architect:	Ana-architecten
Location:	Ijburg, Amsterdam, Netherlands
Year:	2005
Size:	82m x 18m – 5 Storeys
Use:	Residential and/or Office
Allows for Change in Size - Growth / Reduction	No
Allows for Change in Use - Program / Function	Yes
Allows for Change - on the Exterior / to be Reflected on the Exterior	No
Facilitates Continual Change Based on User Need / Desire Over Time	Yes
Design Response Engages the Program and is not Generic	Yes
Change can be Made Relatively Quick and Easy	Yes

Figure 31 – Developers' Freedom

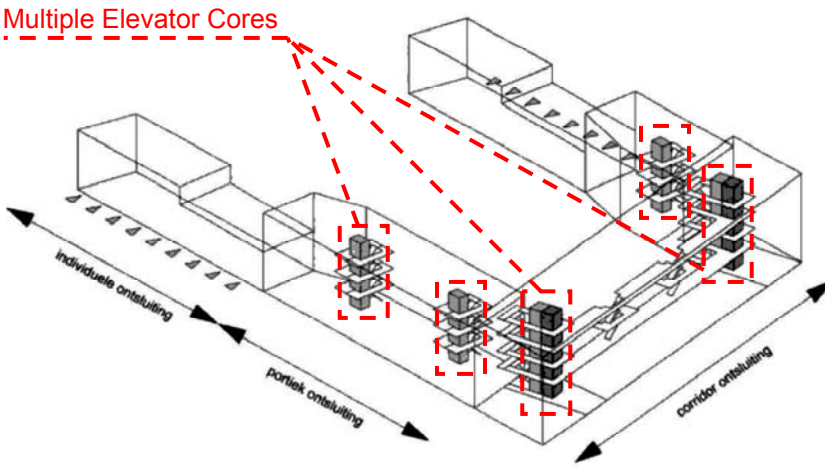


Figure 32 – Multifunk Elevator Cores

While the Add-In method enables for the insertion or movement of partitions in order to accommodate change over time, the additional strategies implemented at Multifunk including raised ceiling heights and multiple elevator cores proves to be very beneficial when a total change in use is required. Furthermore, the rationale regarding a change in building use as an outcome of changes occurring within the surrounding context is noteworthy as this building can now not only respond to shifting desires of a user, but to the changes that occur around it. Although this does prove to be very beneficial, a shortcoming of this particular proposal is its inability for the change of use to be reflected on the exterior. As a result, no distinct or identifiable characters are evident from the exterior which can aid in differentiating office zones from residential areas.

Conclusion of Flexible Spaces:

Similar to Day vs. Night Arrangements, flexible spaces allows for a building to accommodate a variety of programmatic functions. However as a strategy, it does not necessarily accommodate dramatic changes in program over time. In addition to this, and as has been previously discussed, flexible spaces can result in programmatically neutral, impersonal, characterless buildings. Although the goal of this thesis project is to create spaces that can be customized to meet the evolving needs of the user, the spaces should reflect the identity of the users, functions, and spaces. Thus, this thesis project will aim to create a flexible building that is capable of being both customized and personalized by the users. Furthermore, the notion of Developers' Freedom as presented through this section does put forward several invaluable ideas that may prove to be fundamental when designing spaces capable of facilitating a total change of use.

4.5 Adaptive Reuse:

As has been previously discussed through the texts of the background information and literature review, adaptive reuse does address a total change in programmatic use of an existing building. As was previously mentioned an example of this would be the conversion of industrial buildings into residential lofts. However, adaptive reuse does not necessarily facilitate an ongoing change for current users over time. Once again this time factor and continual adaptation separates evolving architecture from this method, as this thesis project is intended to be adjustable from the outset such that it can better serve the needs of its current and future user rather than take on a new purpose all together.

Adaptive Reuse in the Gemini Residences:

The strategy of a totally changing use is demonstrated through MVRDV's Gemini Residences. Initially designed and constructed as two concrete silos, upon the threat of abandonment and subsequent demolition an alternative proposal was made to transprogram these silos into residential condominiums. MVRDV came up with an undoubtedly remarkable scheme in which the interior of the silos formed large atrium spaces for lobby and circulation. This interior atrium spaces within the silos is depicted in Figure 34. From this atrium space, the residential building essentially cantilevered out using the thick concrete silo walls as structural elements. The rationale behind this design decision is explained through a quote from MVRDV which states:

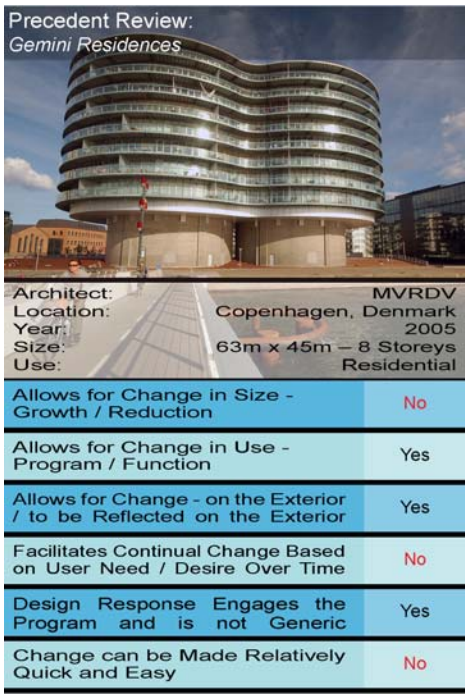


Figure 33 – Gemini Residences

> *In the structural limitations of the silo lies the solution of the intervention. Making big openings in the concrete rings of the silo is difficult and limited. Making door-high openings is possible but complicated and can only be made in limited amounts. If there were apartments to be situated in the silos this would mean that in an area where views count, the apartments are inwardly directed. And if you would fill up the silo houses and floors, it would destroy the most exciting aspect of its present state, its emptiness. By flipping the projected floor inside out, this potential problem is eliminated, and turned to its advantage. Maximum views are possible and maximum flexibility can be achieved.*[62]


Figure 34 – Interior Silo Atrium

While this is a viable option for a total change in use, it is in a sense a last resort to preserve a building as it can no longer serve its existing function, or is no longer required. Thus, adaptive reuse is not applicable in a scenario where transformation and modification can be continual to better serve the existing user. Furthermore, as extensive renovations are required in order to retrofit an adaptive reuse building, changes cannot be made relatively quickly and easily compared to other strategies previously discussed.

5. Design Project:

As stated earlier in this report, the objective in conducting the precedent review was to identify and put forward a series of design notions which could be evaluated and used as strategies when developing an Evolving Architecture. Through the use of a combination of aspects of various methods previously discussed as well as their associated precedents, a very dynamic and flexible system can be created; one that can not only adapt to change in an existing use, but also constantly evolve to accommodate the many different programmatic requirements that may arise over time. This will be achieved by combining and capitalizing on the strengths of each of the methods. While some methods do have their shortcomings, the combination of approaches will address these weaknesses to result in a diverse yet malleable system.

With the development of an Evolving Architecture, the time factor and its implications on the use of a building will be taken into account. Then with this as the foundation, a building that responds directly to change over time will be proposed. Thus, by such means an architecture that can constantly be transformed to accommodate a function and its inevitably changing programmatic needs will be created.

Through the following sections of site selection, program, building modules, building proposal and lastly building exterior, the development of a proposed system for an Evolving Architecture will be systematically presented. While a building has been designed in direct response to a specific site in Toronto, the intention of this thesis project is that the same rationale and ideology could be applied elsewhere. Therefore, the objective of this thesis project is to develop a system of architecture or a “kit of parts” that embraces the possibility of change from the outset. Similar to Herman Hertzberger and the designers of Growth Homes, this project will work to allow for a “mixed architectural image in a clear framework;” [63] in which the mixed image is created as a result of the individual customization by users, and the clear framework is the system as proposed through this thesis design project.

Figure 35 – Building Proposal

5.1 Site selection:

The site selected for this project will be 117 Jarvis Street which lies on the Northeast corner of Richmond and Jarvis Streets in Toronto. This site, as is depicted in Figure 36, was selected as a result of it being located on a key transition zone within the city. While to the west of Jarvis Street is the downtown core where substantial development as occurred over many years, the east side of Jarvis Street has only become the product of intensification in recent years.

This notion is further reinforced by the City of Toronto. As can be seen in Figure 37, according to the 2010 Toronto Land Use Plan, this site exists in what has been deemed by the city to be a Regeneration Area. As is explained by the City of Toronto in the *King-Parliament Secondary Plan*, this regeneration area of Jarvis to Parliament as shown in Figure 36, "will be regarded as an area targeted for significant growth, having a mix of compatible land uses including commercial, industrial, institutional, residential, live/work, and entertainment uses within new buildings and existing ones, including the numerous historically and architecturally significant buildings in the area."[64]

Figure 36 – Subject Site

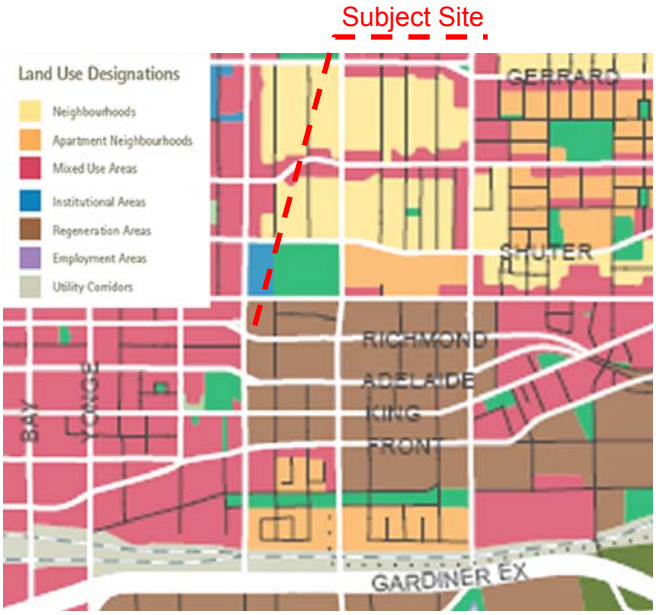


Figure 37 – Portion of City of Toronto Land Use Map

Thus, as the area is the focus of future development within the city, significant changes will likely be brought to the area over the coming years. Since this site lies in such a volatile area for change and regeneration, a building that can change in accordance the surrounding context will likely be advantageous; as was the case of Multifunk in Ijburg. Furthermore, this site proves to be very beneficial as it lies in close proximity to Toronto's subway line.

5.2 Program:

Many of the projects discussed through the Precedent Review were primarily of a residential use. This project however, proposes a rationale that can be applied to buildings of all uses. Thus, this thesis intentionally targets a niche that is currently evident by developing a holistic approach that can be used to accommodate a variety of programmatic functions. Through this the possibility of change to occur within a building of any use will be embraced from the outset.

Furthermore, with the rationale presented through the material of Hybrid Spaces and the notion of designing for total change in both function and use, this thesis project focuses on the design of a building that can accommodate a variety of programs. This is in accordance with the objective of this project which is to allow for changes in use to occur at the user's discretion, which may result in a mixing of different programmatic elements within the same building. Thus, the design is a building that combines different programs within one "container"[65] which therefore makes it a hybrid building. In addition, this project attempts to design the spaces in such a way that unforeseen programs can also be accommodated through minor revisions.

This proposed program of a hybrid building is also in direct response to the site selection of 117 Jarvis Street in Toronto. As this regeneration area is zoned for a mix of uses such as commercial, institutional and/or residential, a building that facilitates a mixture of these uses is appropriate. Furthermore, as was briefly mentioned through the text of the Site Selection, this area will likely be the focus of significant redevelopment over the coming decades. As a result, unanticipated changes may occur in the surrounding context that may require a change in the programmatic elements or uses within this proposed development.

5.3 Building Modules:

The first step in developing an evolving architecture was to design a building module that could accommodate both continual changes within an existing use as well as facilitating a total change in programmatic use. As can be seen in Figure 38, a larger building module of 19.5x9m was created, which could then be subdivided into three smaller modules of 6.5x9m. Within these modules structure is located along the perimeter such that demising walls can be relocated at anytime with no implications on structure. As well, a central service or wet zone is located within the public corridors to allow for the distribution of services through the building. Thus, the strategies identified through the precedent study of Structural Facades and Estraden House, to name a few, are now being utilized and implemented within the module design.

In terms of the section of the module, and as can be seen in Figure 39, a floor to floor height of 6.15m is used such that a second floor division can be implemented should the user require it. This potential for the addition of a second floor uses the notions identified through the study of the Add-On/Add-In Methods in which revisions can be made in order to accommodate changes in programmatic requirements. This larger floor to floor height also enables a transformation in programmatic use as commercial spaces often require larger floor to floor height then what is typically used for residential construction. Greater sunlight penetration is also made possible as a result of this increased height. In addition to this, a 61cm raised floor zone is also used allowing services such as mechanical, plumbing, and electrical to be distributed without the need for bulkheads. This improves the level of flexibility as demising walls and interior partitions can be relocated without any concern of bulkhead locations.

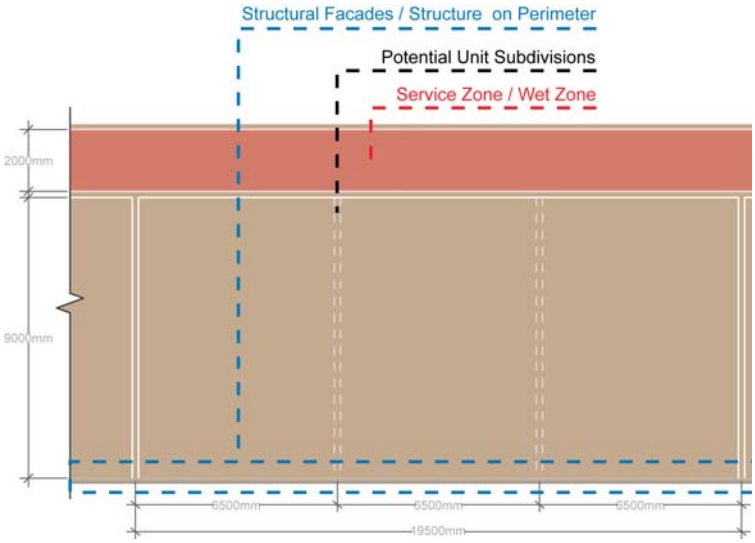


Figure 38 – Module Plan

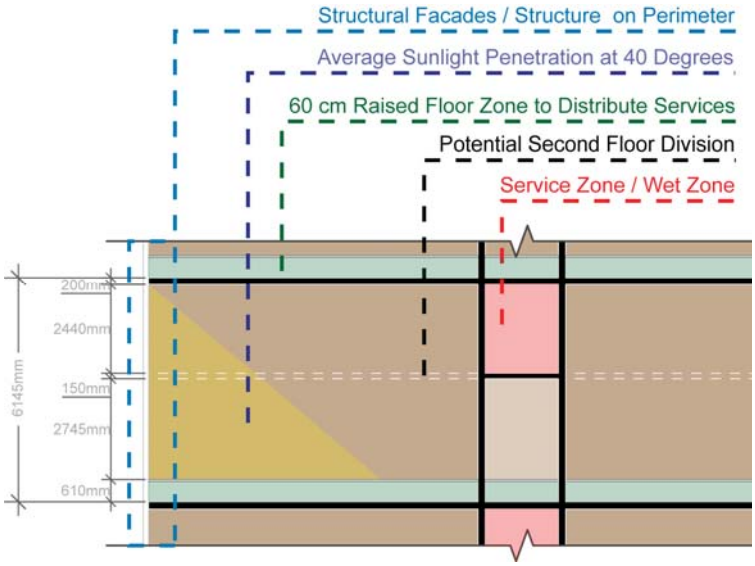


Figure 39 – Module Section

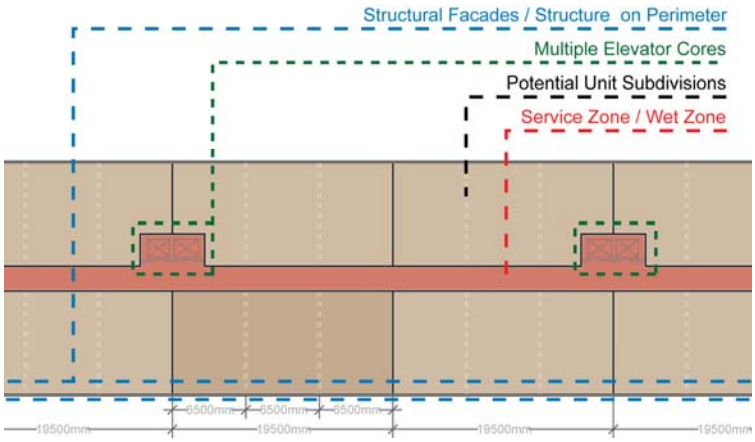


Figure 40 – Diagrammatic Floor Plate with Multiple Elevator

When combined, these modules then essentially form a building floor plate. Another strategy used in Multifunk, as was previously discussed, was the implementation of multiple elevator cores such that portions of the building could be partitioned off in order to serve a larger use. In this regard, multiple elevator cores will also be included in the building proposal and have been diagrammatically indicated in Figure 40.

In terms of implementation and functionality of this building module, Figure 41 depicts the three smaller modules forming one larger module of 19.5x9m and functioning as an office space. As can be seen in the plan as well as the axonometric view in Figure 42, an office space comprising of 13 desk spaces, two private offices, one conference room and a waiting area is provided. However, in terms of change over time, a second floor can be added should the need arise and is demonstrated in Figures 43 and 44. Through this addition via the Add-On/Add-In methods, an

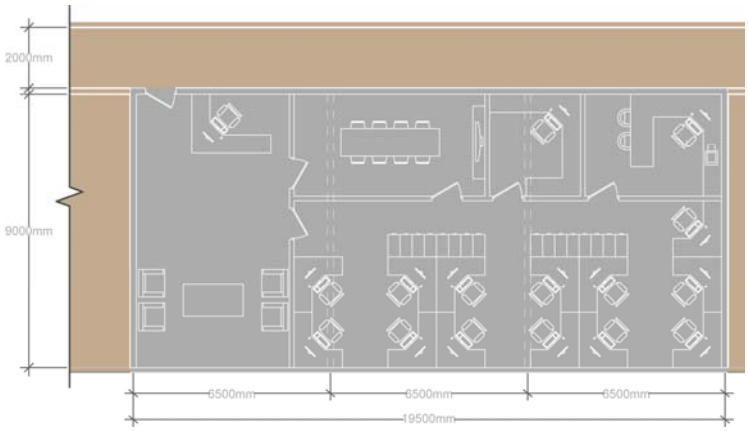


Figure 41 – Module as Commercial Office Space

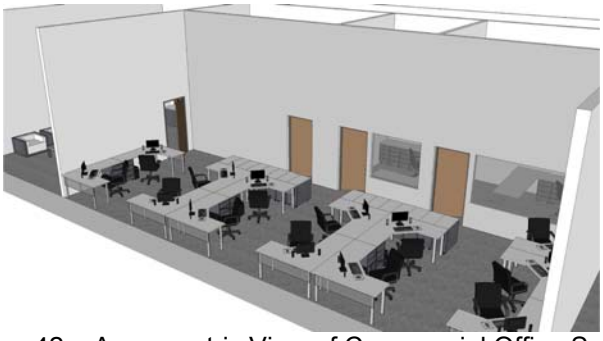


Figure 42 – Axonometric View of Commercial Office Space

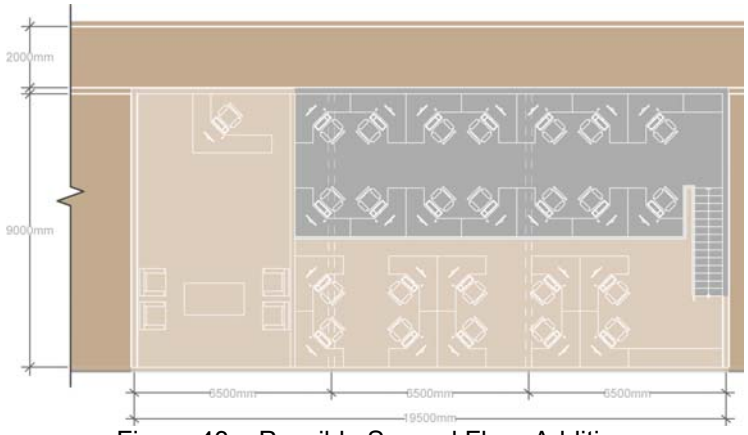


Figure 43 – Possible Second Floor Addition

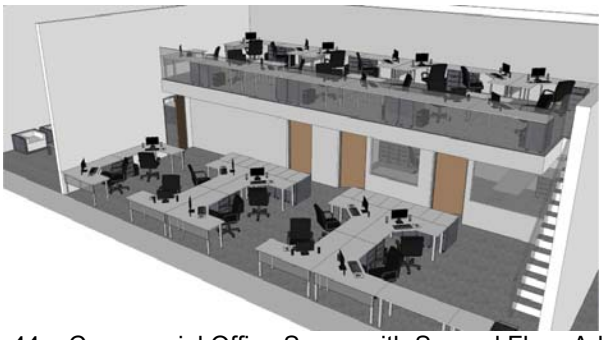


Figure 44 – Commercial Office Space with Second Floor Addition

additional 11 desks can now be accommodated bringing the total up to 24 desk spaces. While this design proposal demonstrates how the module may evolve in order to accommodate a change in need for a single use; it does not demonstrate at this point how a total change in programmatic use can be accommodated through this proposed building module. In this regard, Figure 45 depicts how the larger commercial module can again be broken down into three smaller modules, each of which having a different use. In this scenario, the red shade indentifies a smaller commercial office space, the blue shade indentifies a Live / Work arrangement and the green shade indicates a module which is a strictly residential use.

Figure 45 – Different Uses Emerging Over Time

The Live/Work unit employs the Day and Night strategy such that the same space can function in different ways at different times of the day. In this case, the unit is designed to function as an office space during the day, a living space during the evening hours and a sleeping area at night, as is shown in Figure 47. This is achieved through the use of the raised floor system to store a roll out bed, as well as a sofa/desk component which can be positioned in different ways depending on the programmatic requirements. When extended, it functions as a sofa, when the

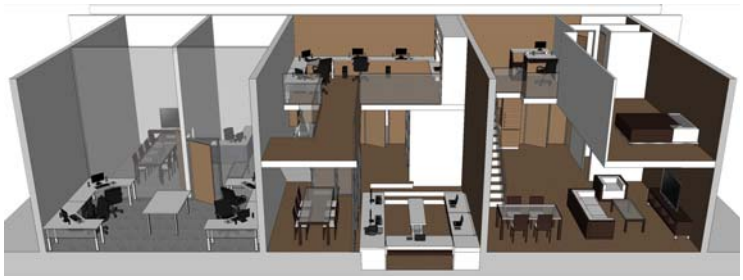


Figure 46 – Axonometric of Three Different Uses

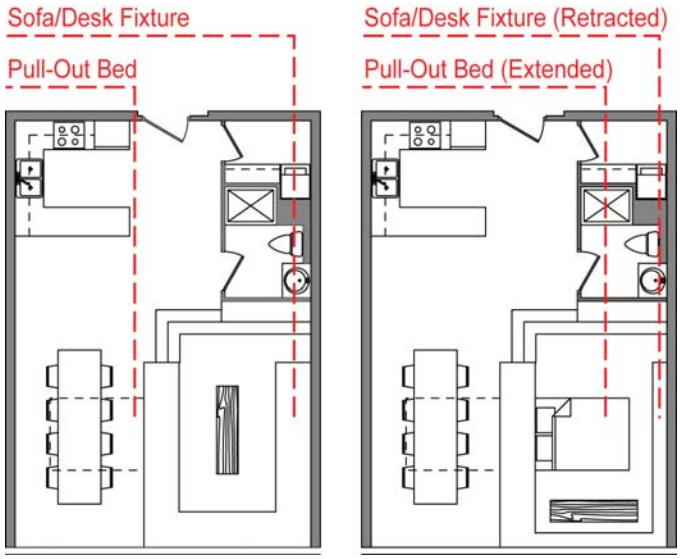


Figure 47 – Live/Work (Work & Sleep Arrangements)

backrest is folded down it provides a surface to be used as a desk, and when not needed it can be retracted allowing for more space to be used for the bedroom arrangement. This can be better understood in the axonometric views shown in Figures 48 and 50, in which Figure 48 shows the unit in its live arrangement while Figure 50 represents the unit functioning in the work arrangement.

Similar to the office space previously discussed, the potential exists here as well for a second floor addition using the Add-On/Add-In methods. This increases the area available which can be used to provide more desk spaces while also adding an additional sleeping area through the use of a Murphy bed which is stored within a shelving unit. Figure 49 depicts the unit plans for this additional floor while in the work arrangement. In addition to this, Figure 50 is an axonometric view showing the second floor addition as well as the unit in the work arrangement. Also featured in this design is a sliding partition which

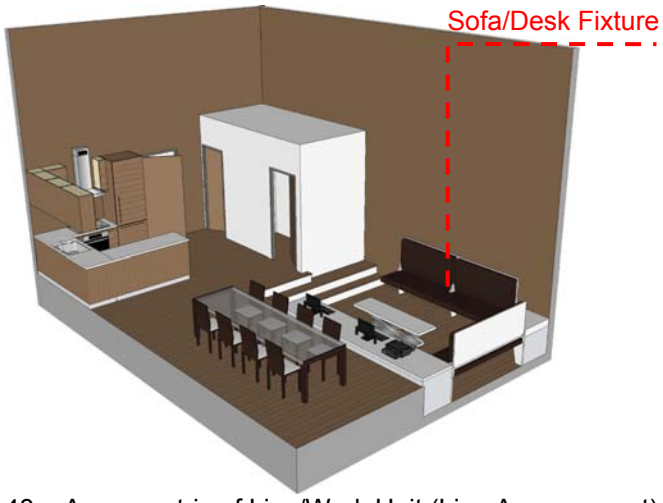


Figure 48 – Axonometric of Live/Work Unit (Live Arrangement)

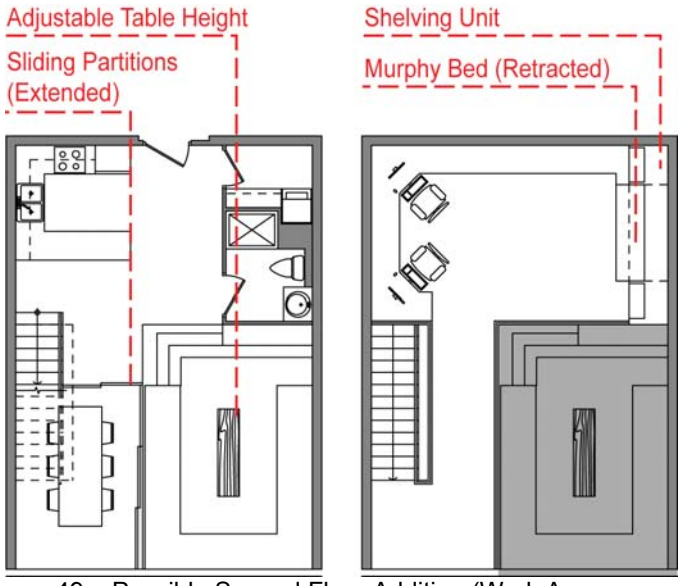


Figure 49 – Possible Second Floor Addition (Work Arrangement)

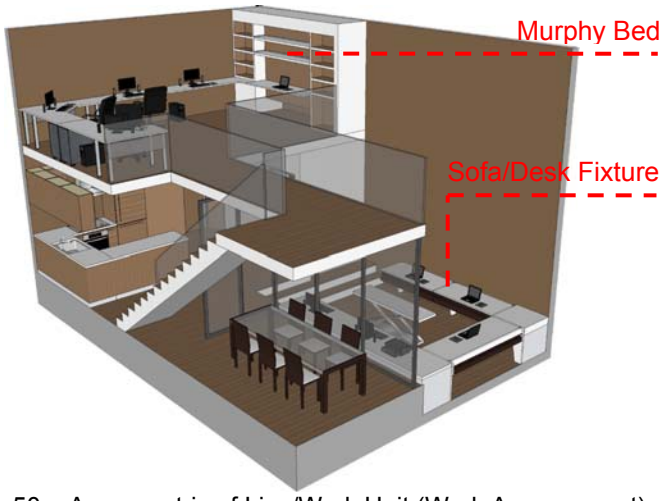


Figure 50 – Axonometric of Live/Work Unit (Work Arrangement)

can be used to transform the public dining room into a private conference room such that this unit can function more successfully as an office space.

While this scenario demonstrates how the notions of Day and Night Arrangements can be utilized to enable spaces to function in different ways at different times of the day, it does so in a relatively conventional manner which hinders the ability for the space to truly transform. This is as a result of several fixed items such as the kitchen and dining/conference table, which are always evident within the space. Thus, the next exercise was to once again utilize the strategies of Day and Night Arrangements, however to do so in such a way that was truly dynamic and ever changing.

This was achieved through the development of additional changeable components, similar to the sofa/desk component as was previously discussed. Figure 51 depicts as series of these retractable components such as kitchen component, office desk component, and entertainment component. These components can then be installed within a Live/Work unit to move on tracks, similar to sliding or compactable bookshelves in libraries. The premise of this strategy is that components can be moved along tracks, opening and closing as required, therefore enabling a user to access them when needed. Plumbing

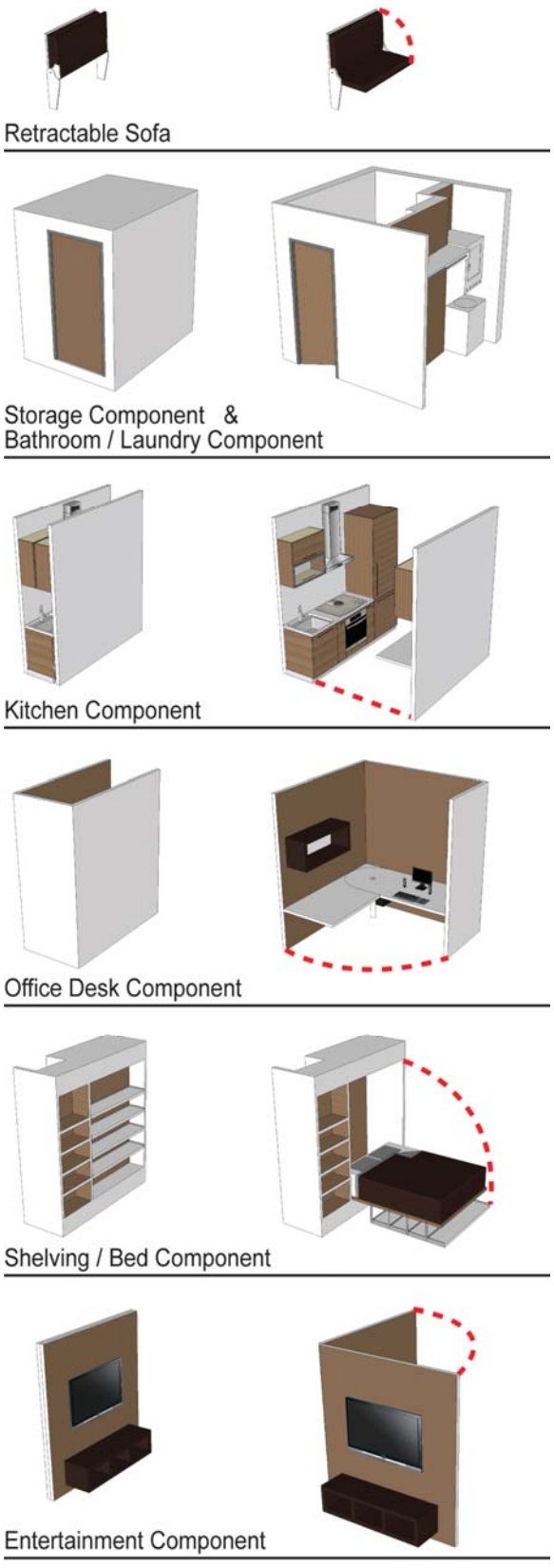


Figure 51 – Changeable Components

fixtures have been positioned adjacent to the central service zone and have been designed to remain stationary while enabling change to occur around them. In addition to these changeable components, fixtures can be suspended from the ceiling enabling them to be raised or lowered as needed. This is similar to Wyly Theater by REX in Dallas; in which fixtures are lowered in order to transform the use of the space so it can house different events.

Figure 52 illustrates one possible plan configuration in which a majority of the changeable components have been positioned on the right of the unit, thus allowing for a larger open space on the left. This larger open space functions as an office area while the suspended desk is lowered as in Figure 53, and when raised functions as a living room. Furthermore, the office desk component has been opened, while sliding partitions have been positioned in order to enable the space to function as a private office. Once again, this office component can be closed in the evening hours therefore facilitating the transformation of the space from the work arrangement into the live arrangement. As well, the entertainment component has be rotated and positioned such that it creates an employee lounge area. This

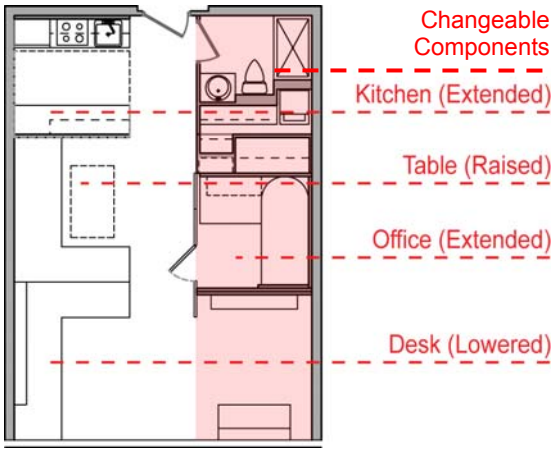


Figure 52 – Live/Work Unit in Work Arrangement

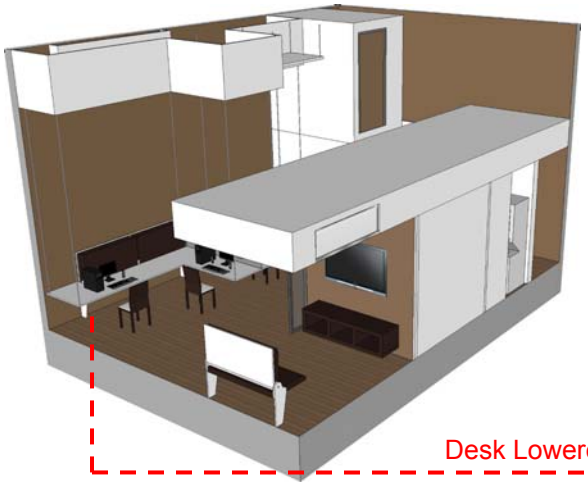


Figure 53-Axonometric View of Unit in Work Arrangement

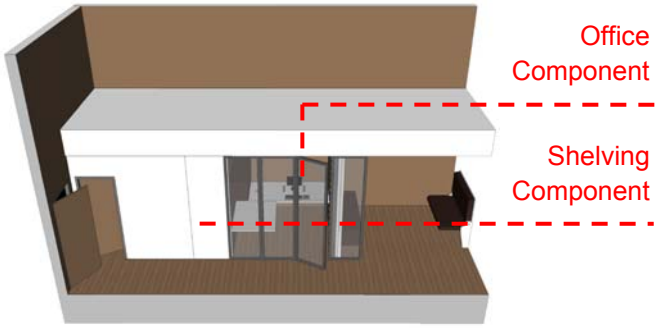


Figure 54 – Sectional Perspective View

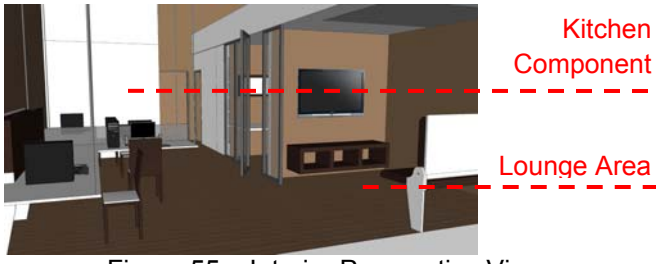


Figure 55 – Interior Perspective View

configuration of the changeable components is made clearer in the sectional perspective depicted in Figure 54, as well as the interior perspective view in Figure 55.

Figure 56 illustrates the same space now functioning in the Live Arrangement. While the arrangement of the changeable components and the lowering of the large desk enables the space to function as an office, in the evening hours the desk is raised; thus eliminating it from the space. Subsequently, through the opening of the retractable sofa component the space can now function as a living room; while a dining table can also be lowered from the ceiling thus facilitating the use of a portion of the space as a dining room. In addition to this, the entertainment component has been rotated enabling it to be viewed from the living room, thus adding to the transformation of the space. Furthermore, the office component is now shown closed providing additional space for the lowering of a bed that had been previously stored in the ceiling; as is depicted in Figure 57. As a result of all these changes the unit can quickly transition from an office space to now functioning as a one bedroom unit with a large living and dining room. Should an

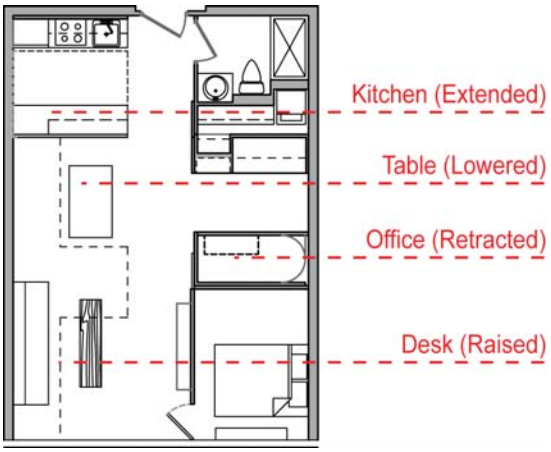


Figure 56 – Live/Work Unit in Live Arrangement

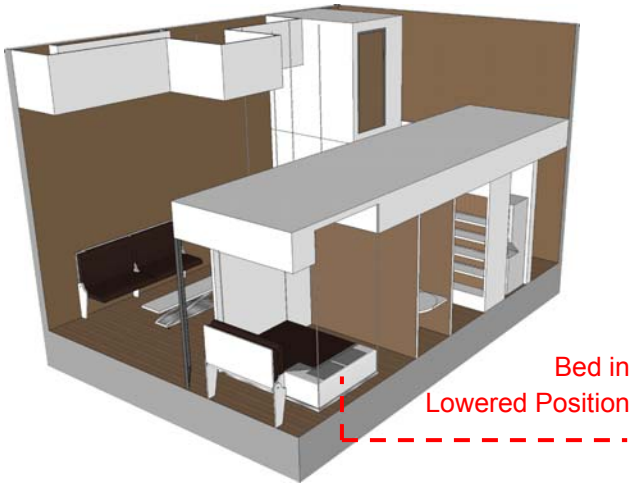


Figure 57-Axonometric View of Unit in Live Arrangement

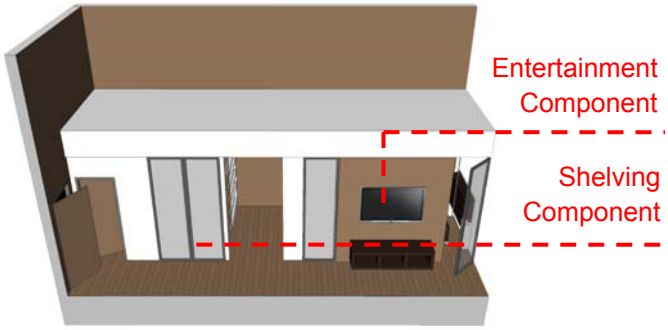


Figure 58 – Sectional Perspective View

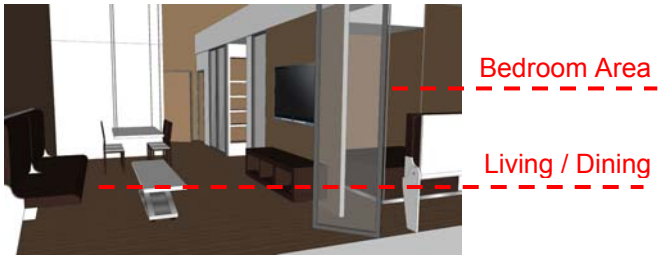


Figure 59 – Interior Perspective View

additional bed be needed the components could again be repositioned allowing for Murphy bed within the shelving component to be opened; as is shown in Figure 60. As well, the kitchen component can be compacted allowing for the storage component to be lowered when needed.

The intent of this exercise is to demonstrate how the possibility of change can be embraced, and a design that facilitates change to occur can do so on different time scales. While this scenario illustrates a more dynamic system that is intended to change constantly through the day, other variations of more traditional arrangements designed to change gradually over time are possible. In this respect the following exercise is of a residential unit that is also designed to change over time; however in a more gradual, conventional manner.

The residential unit employs the Add-On/Add-In methods in order to facilitate changes over time. This scenario demonstrates how a traditional unit can be used, if

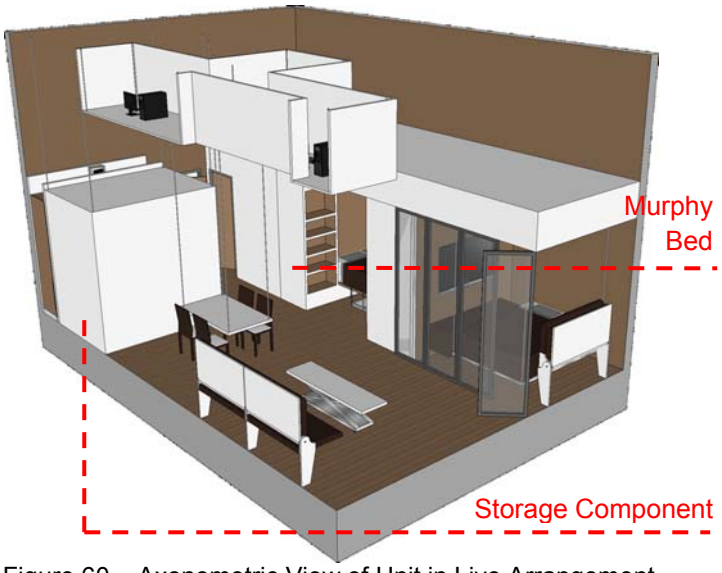


Figure 60 – Axonometric View of Unit in Live Arrangement

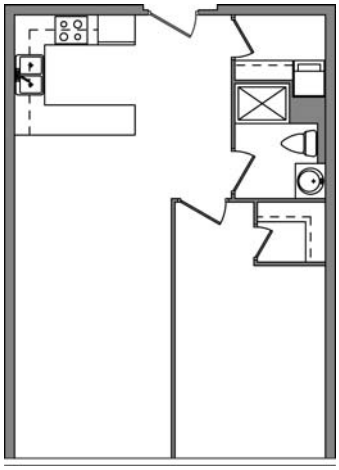


Figure 61 – Conventional One Bedroom Residential Unit


Figure 62 – Axonometric View of One Bedroom Residential Unit

preferred by the user, while still allowing for a means of change over time in order to respond to changes in needs, such as life cycle changes, or changes in desires. Thus, a daily reconfiguration, as was the case with the Live/Work units, is not necessary in order to accommodate changes over time.

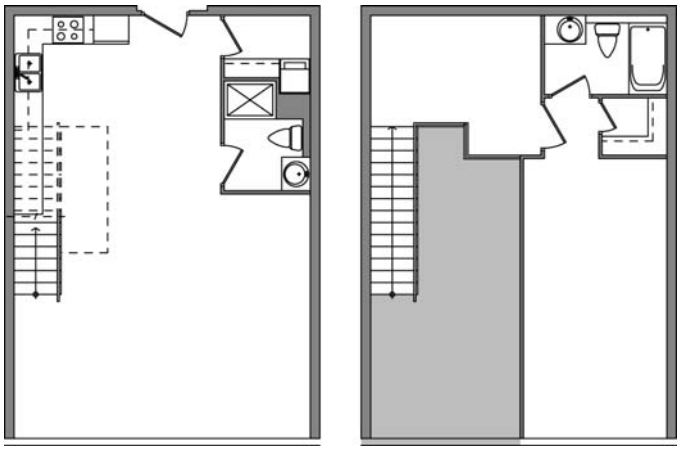


Figure 63 - Two Storey Residential Unit with One Bedroom

Figure 61 depicts the floor plans of a conventional one bedroom unit while Figure 62 illustrates the corresponding three-dimensional axonometric view. Again through the use of the Add-On/Add-In methods, a second floor can be constructed should the user require additional space. The floor plans in Figure 63 show the addition of a second floor while still remaining a one bedroom unit. This allows for more space to be available on the ground floor serving as a larger living and dining area, while providing a larger bedroom, a second bathroom, a computer nook and a double height space on the second floor. However, should an additional bedroom be required as a result of life cycle changes, this double height space can then be revised to include a second bedroom. This revision is demonstrated in the floor

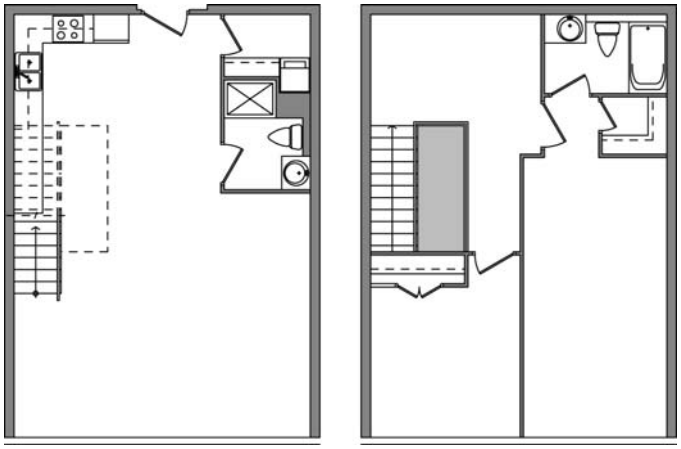


Figure 64 - Two Storey Residential Unit with Two Bedrooms

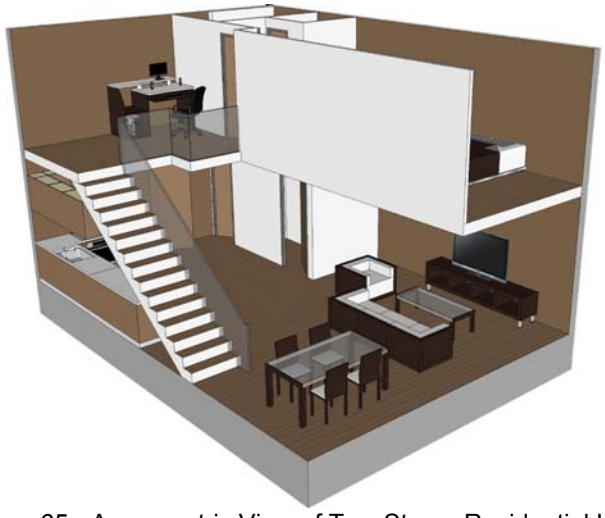


Figure 65 - Axonometric View of Two Storey Residential Unit

plans in Figure 64. The axonometric views for each of these variations are shown in Figures 65 and 66.

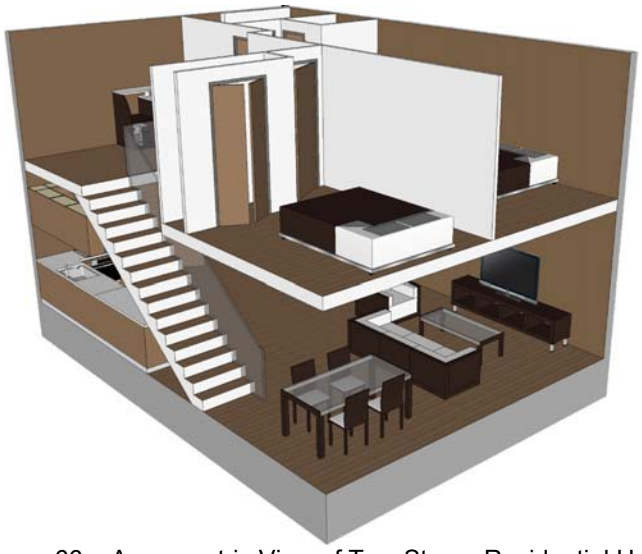


Figure 66 – Axonometric View of Two Storey Residential Unit

While a study of these proposed modules does illustrate how a change in function and programmatic use can been facilitated, the extent of variation is not limited to what has been shown here. These illustrations show only a few of the possible configurations. Furthermore, while the residential and live/work modules are shown as singular entities, that is not to say multiple modules could not be joined forming one larger unit. In this regard, Figure 67 represents a scenario in which two modules have been joined forming a large two bedroom unit. Once again the potential for a space to evolve over time based on user needs and desires is evident; as is illustrated in Figure 68. Through the addition of a second floor using the Add-On/Add-In methods, a three bedroom unit is created featuring a double height space above the living and dining areas, a home office space and a den located within a loft space. Another variation of this is depicted in Figures 69 and 70, in which a corner unit has been expanded to occupy two modules. Figure 69 illustrates the corner unit as a single module whereas Figure 70 demonstrates its expansion. Similar to the previous scenario, a three bedroom unit is created featuring a large double height space, a home office and a computer

Figure 67 – Axonometric View of Joining Modules Scenario

Figure 68 – Axonometric View of Joining Modules Scenario

nook located within a loft space. Thus, the design proposal and use of these building modules as is currently shown is not intended to be a full study of what is possible. Rather these scenarios serve to demonstrate how these modules work as a part of a designed system which facilitates an evolution over time. Therefore, as is currently proposed, these modules could be utilized to fulfill a variety of programmatic uses, taking shape in a variety of different ways.

Figure 69 – Axonometric View of Joining Modules Scenario

Figure 70 – Axonometric View of Joining Modules Scenario

Furthermore, the intention through the design of these modules is to also allow for the possibility of unforeseen programmatic uses taking place within this building. In this regard, the notions of structural facades, raised floor systems, central wet zones, and higher floor to ceiling heights, etc, yet again allow for this possibility. For example, should this building be converted at a later date into a hotel, the same rationale demonstrated here of relocating demising walls could be used in accordance with the preferred hotel unit design.

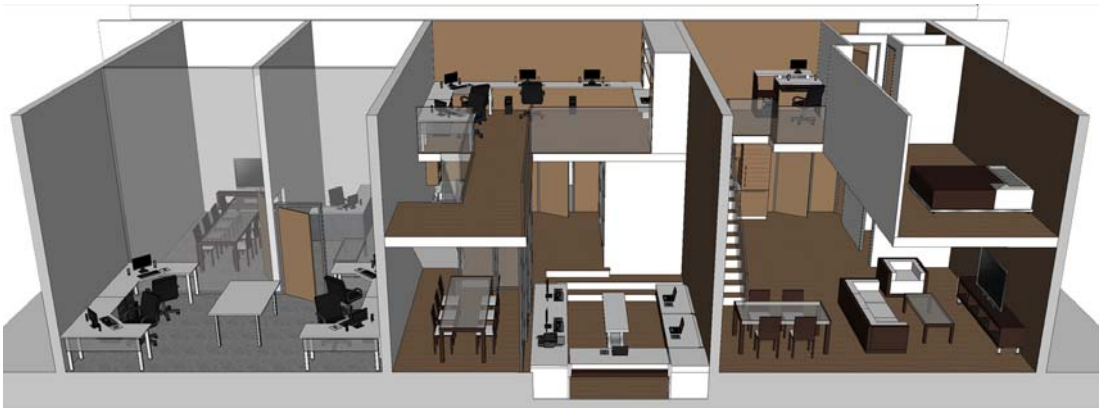


Figure 71 – Axonometric of Three Different Uses

5.4 Building Proposal:

These building modules, as has been discussed, essentially form the building blocks of this thesis design. Although the modules as a system could be used in a variety of different building typologies, for this particular scenario they will be used in a manner that best responds to site conditions. Thus, this particular building proposal is simply one possible scenario for this system; however the same rationale could also be applied to other sites and other building typologies. In addition to the modules, other strategies are utilized in the building design creating a system that works together in order to provide flexibility in both function and programmatic use. These strategies include multiple elevator cores, customizable facades (as in the Polyvalent House), and variation in structural systems.

The initial design sketch proposed a taller building component which responds to the tall built context along Jarvis Street as well as addressing the bend in the road that occurs at Richmond Street and Jarvis Street. In addition to this, a podium component forms the base of the building and addresses the low rise character of the buildings along George Street. This initial design sketch is depicted in Figure 72; whereas Figure 73 illustrates the more refined site plan, location of loading entry points into the site and access to the underground parking ramp off of George Street.

Figure 72 – Proposed Site Plan Sketch

The following pages illustrate the building plans for this 13 storey building as well as the building section and structural diagram. While programmatic uses have been indicated through the use of colours, the possibility still exists for changes in the arrangement and presents of these uses to occur. Thus, while retail is currently shown within the base along Jarvis Street, that is not to say this area could not be transformed to serve a different use. Therefore, these plans as currently shown only depict one possible scenario for a particular point in time.

Figure 73 – Proposed Site Plan

Ground Floor Plan

The building is intentionally set back from the street edge in order to create a landscaped buffer which can be modified to suit different programmatic uses. Currently shown on the ground floor as one possible scenario is a retail component along Jarvis Street, a residential / commercial lobby on the corner of Jarvis and Richmond Streets, and the lobby for a larger single tenant on the corner of Richmond and George Streets.

Second Floor Plan

While in this case the larger single tenant is shown to function as a part of George Brown College, this single tenant space could also function as a large retailer or large commercial space. Thus, multiple elevator cores are used to serve the building in order to facilitate this separation for a larger single use. Also featured on this floor is the commercial lobby/waiting area, bookable conference rooms for the offices above, and larger seminar rooms.

Third Floor Plan

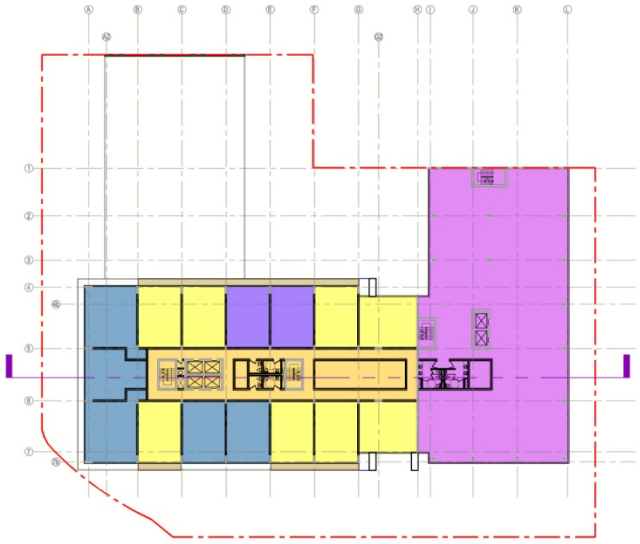
Located on this floor is an outdoor amenity space which would serve the building users.

Legend:

- Retail Area
- Common Area
- George Brown College / Single Tenant
- Commercial Office Space
- Residential Area
- Live / Work Area
- Green Space / Amenity Area
- Service Areas / Back of House

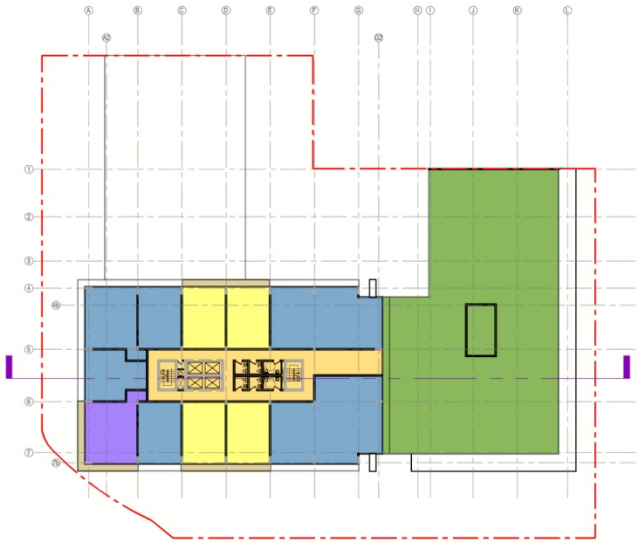
Forth Floor Plan

Shown on this floor are five commercial office units, two live/work units and eight residential units. As was mentioned before, these plans represent one possible scenario however other variations are possible, such as the entire floor being one commercial tenant or the entire floor being only residential units.



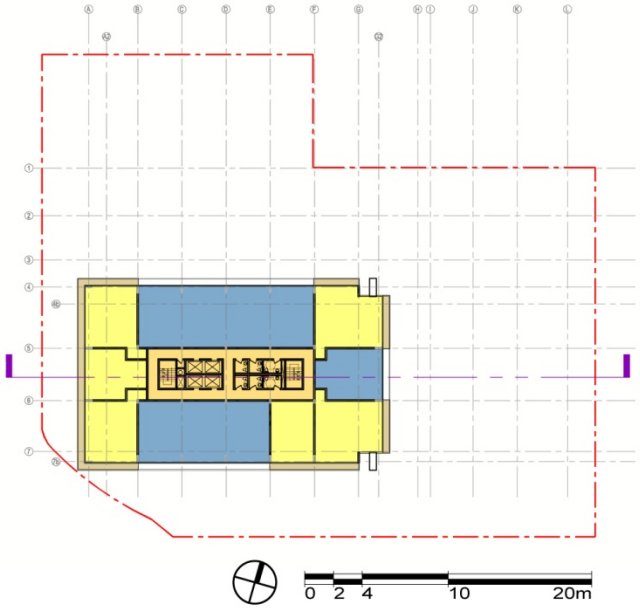
Fifth Floor Plan

Featured on this floor is a productive green roof which will serve George Brown College's culinary school. This particular green roof is ideal for this as it has southwest exposure allowing for an abundance of sunlight.



Sixth Floor Plan

While floors 6 to 8 and 10 to 12 have the same building floor plate, they have each been shown individually in order to illustrate the numerous variations in programmatic uses.



Legend:

- Retail Area
- Common Area
- George Brown College / Single Tenant
- Commercial Office Space
- Residential Area
- Live / Work Area
- Green Space / Amenity Area
- Service Areas / Back of House

Seventh Floor Plan

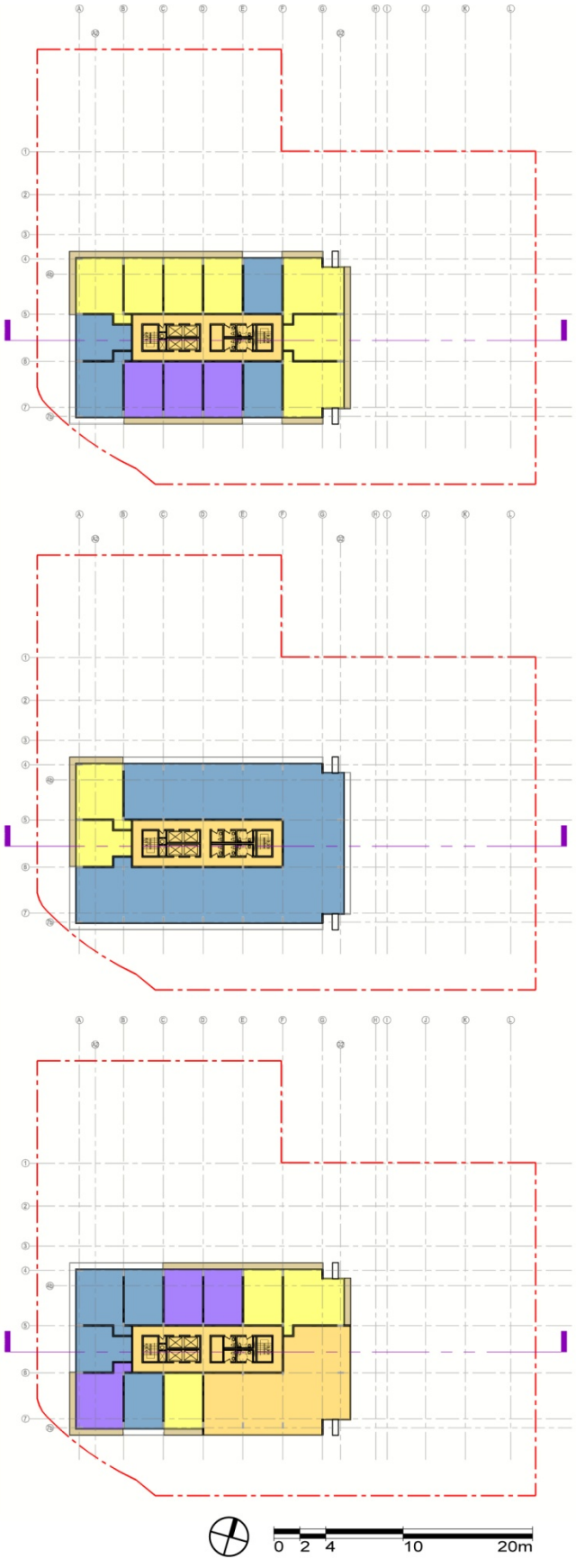
Also featured in the building design is a modular washroom system located within the common areas. Since commercial office spaces require washrooms based on the floor area, modular washrooms can be fitted in accordance with the building code requirement for each floor. Should commercial offices spaces no longer exist on a particular floor, the washrooms can be removed and the vacated space transformed into common amenity areas or storage.

Eighth Floor Plan

Since a large portion of this floor is used for commercial offices, six washroom modules have been shown. However, as is shown on the seventh floor plan above, since a smaller portion of units are commercial office spaces only four washroom modules have been included. Also represented on this floor plan is the use of the commercial office space with no demising walls. Thus, the area is capable of serving a single large tenant.

Ninth Floor Plan

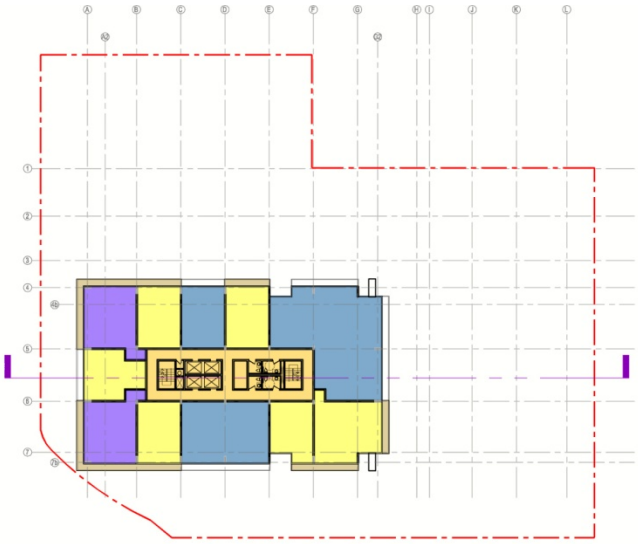
Present on this floor is a large indoor amenity area on the southwest corner of the building.



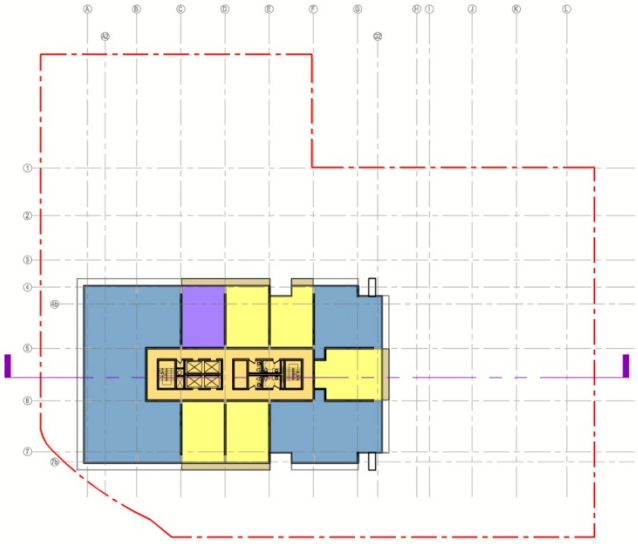
Legend:

- Retail Area
- Common Area
- George Brown College / Single Tenant
- Commercial Office Space
- Residential Area
- Live / Work Area
- Green Space / Amenity Area
- Service Areas / Back of House

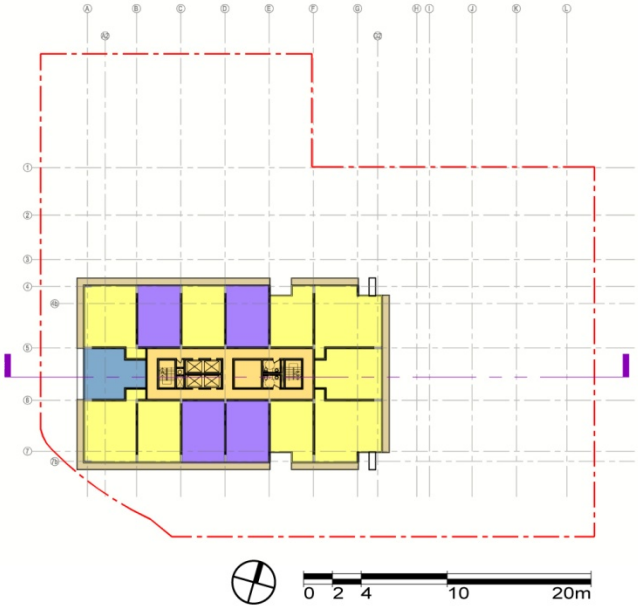
Tenth Floor Plan



Eleventh Floor Plan



Twelfth Floor Plan

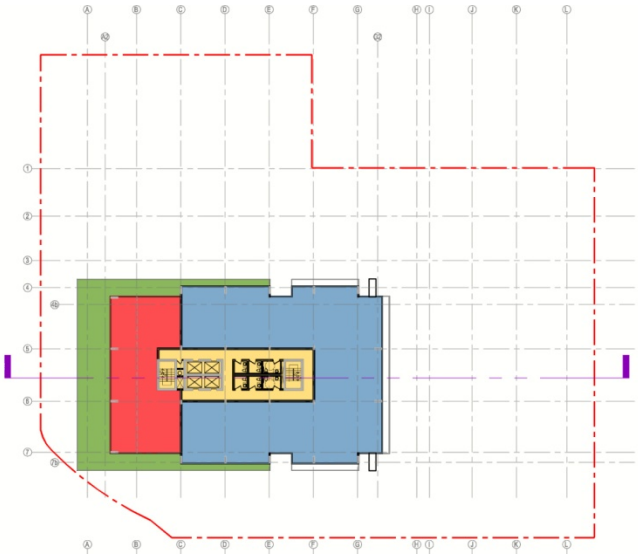


Legend:

- Retail Area
- Common Area
- George Brown College / Single Tenant
- Commercial Office Space
- Residential Area
- Live / Work Area
- Green Space / Amenity Area
- Service Areas / Back of House

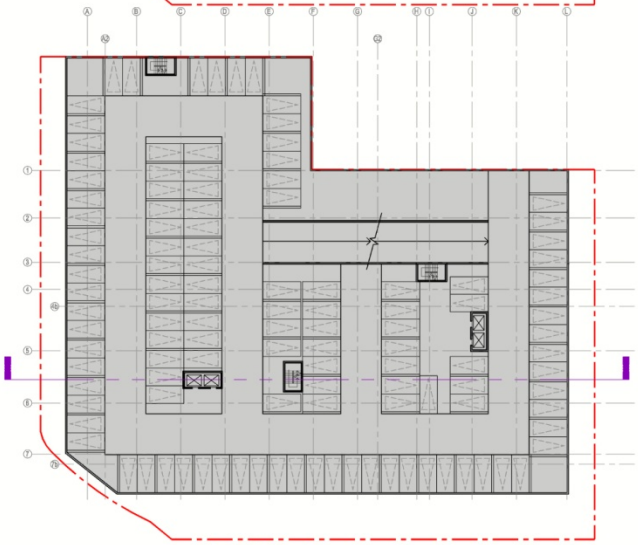
Thirteenth Floor Plan

Lastly, featured on this floor is a sky lounge serving as an amenity area as well as an outdoor patio.



Underground Parking Levels

Servicing this proposed 13 storey building would be two levels of underground parking, each of which having 113 parking spaces. Also present would be bicycle parking spaces and shower facilities in order to meet the requirements for additional LEED points.



Building Section

An 800mm transfer slab is located between the floors 2 & 3 allowing for the redistribution of loads from above. As well a blue shade along the facade of the building indicates areas with a balcony / double skin facade.

Legend:

- Retail Area
- Common Area
- George Brown College / Single Tenant
- Commercial Office Space
- Residential Area
- Live / Work Area
- Green Space / Amenity Area
- Service Areas / Back of House

Figure 74 below illustrates the corresponding structural diagram for the proposed building. As can be seen, the 13 storey building component will be constructed using a concrete column grid structure; whereas the western portion of the base building will be constructed using a steel system. As this area is intended to function as a larger single tenant space, a steel system, as is indicated by the red columns and red floor slabs, is utilized to facilitate changes which may require revisions to the floor system. Examples of such revisions would be the insertion of an auditorium or the creation of a double height space.

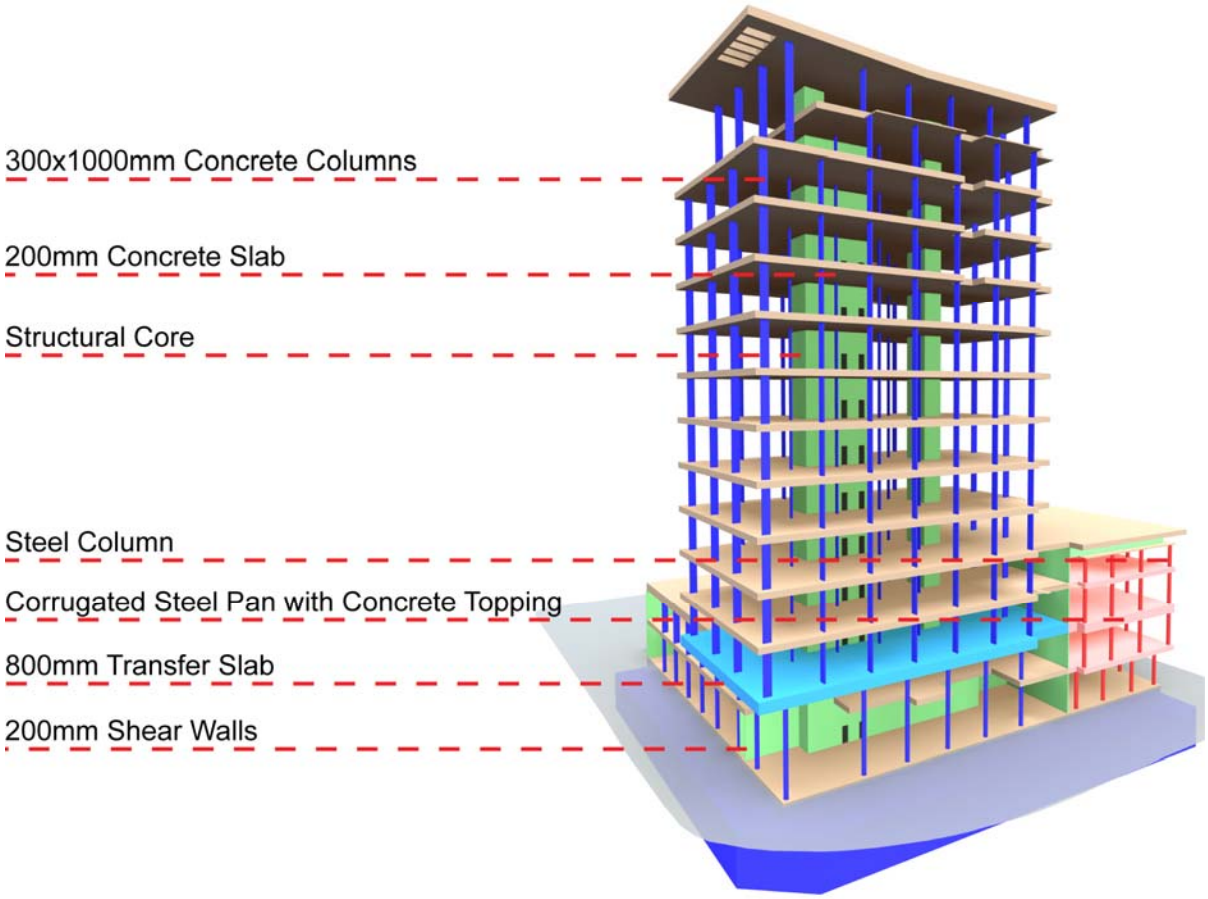


Figure 74 – Structural Diagram

5.5 Building Exterior:

Lastly, the design for the building exterior will now be discussed, beginning with a brief study of the exterior treatment of the modules. As was the case in Polyvalent House, this project intended to provide aspects of customization on the exterior. This allows for change to occur not only within the interior of a building, but rather on the exterior as well. Through this, user's can continually customize how the interior space relates to the exterior as well as how their unit is viewed from outside.

Similar to 41 Cooper Square in New York by Morphosis Architects, a double skin facade is proposed; comprising of one skin as a window wall system and the second skin constructed from perforated stainless steel. Depicted in Figure 75 is an illustration of this double skin system applied onto a building module. When functioning as a double skin, the system creates a buffer zone which aids in mitigating excess heat gains while still allowing for the penetration of daylight. However this double skin facade as proposed is not meant to function as a stationary system. Rather, the panels have been designed to open, thus exposing a balcony component which can be seen in Figure 76. In addition to this, and as was also depicted in Figure 76, the perforated skin can also be partially extended, adding variety and flexibility to the system. This system can be automated allowing the skin to open and close depending on the desired level of sunlight permitted to enter into the space. However, should the user want the second skin to remain in a particular position, a manual override will be available. Furthermore, sliding glass panels are included on the lower portion of the window wall allowing the ground floor to be opened to the exterior. These glass panels are shown in the open position in Figure 77. As well, through the use of LEDs along the supporting frame of the second skin, light can be projected onto the perforated stainless steel in varying colours at the user's request. A detailed rendition of how this system would be constructed in order to function as proposed is depicted in Figure 78.

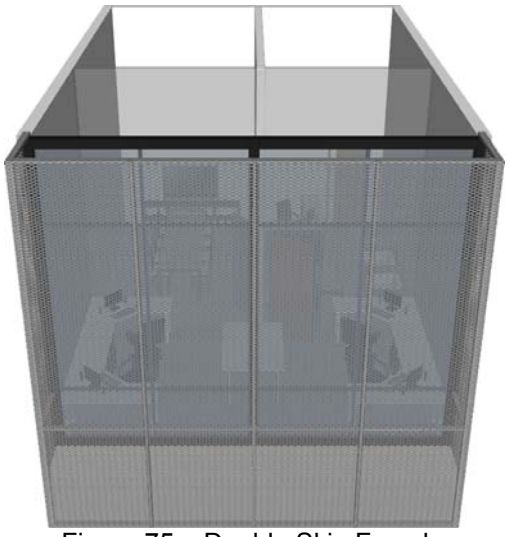


Figure 75 – Double Skin Facade

Figure 76 – Perforated Skin Partially Extended

Figure 77 – Operable Panels

The intention is to create a series of adjustable components which can then be manipulated by the user in accordance to their changing needs and desires. In this regard, this project is an architecture of metamorphosis; an architecture that is continuously writing and revising its own history while consistently reflecting it on the exterior;[66] in accordance in Helmut Wimmer's rationale.

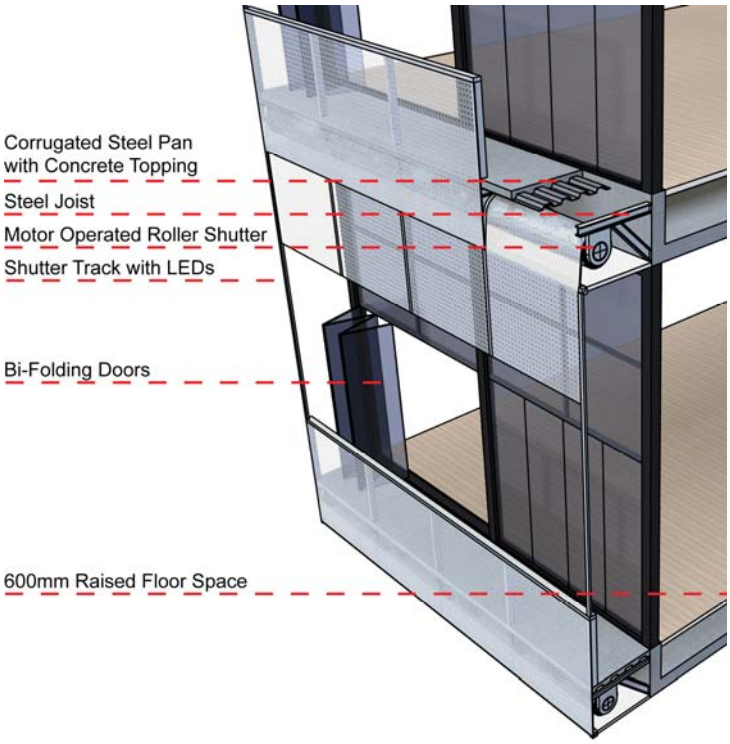


Figure 78 – Exterior System Detail

When this system is applied to the building design, it creates a pixilated building facade. This pixilation serves to emphasize the variations possible within the building system. While not done for the same reason, this pixilation on the exterior is similar to what Saucier + Perrotte often do on their projects. Figure 79 and 80 below illustrates the proposed building facade on the left with two projects from Saucier + Perrotte that utilize this technique on the right.

Figure 79 – Proposed Building Facade

Perimeter Institute

Thompson Residences

Figure 80 - Saucier+ Perrotte

Through the use of this exterior system an array of variations is made possible as shown in Figure 81. Possibilities range from a scenario in which all the perforated panels are closed, thus functioning as a double skin facade; to a scenario in which all the panels are open, thus exposing the balcony railing. Adding to the infinite permutations of exterior treatments is the use of coloured light that could then be projected onto the perforated stainless steel at the user's discretion.

Also visible in these aerial views is the exterior treatment given to common areas such as the lobbies, 9th floor amenity area and 13th floor sky lounge. By featuring only a single skin curtain wall system, these areas are easily identifiable and reflect on the exterior their special functions.

Perforated Panels Extended

Perforated Panels Retracted

Perforated Panels Extended and Retracted

Figure 81 – Perspective View with Exterior Variations

5.6 Landscape System:

The landscape system is designed in accordance to the notion of embracing the possibility of change both on the interior and exterior. Designed as a series of modules 1m x 1m in footprint, the planter modules reference the design of palettes or skids which are commonly used for the distribution of products. Each planter module is designed as a self-contained planter and features a series of indentations along the base. These indentations allow for the insertion of pump truck which can be used to raise the modules off the ground before relocating them elsewhere; which is very similar to the process of relocating palettes or skids. Since the modules are designed to be self-contained, they can easily be transported and moved without disrupting the vegetation growing within them. Furthermore, when placed together they form a larger planter arrangement that can continually evolve based on a user's changing needs and desires. These planter modules are illustrated in Figure 82. Also present within Figure 82 is a sectional drawing which illustrates how the modules can be installed together, therefore forming a larger planter. In addition to this, the section illustrates how trees are located within predetermined areas such that adequate soil depths can be provided.

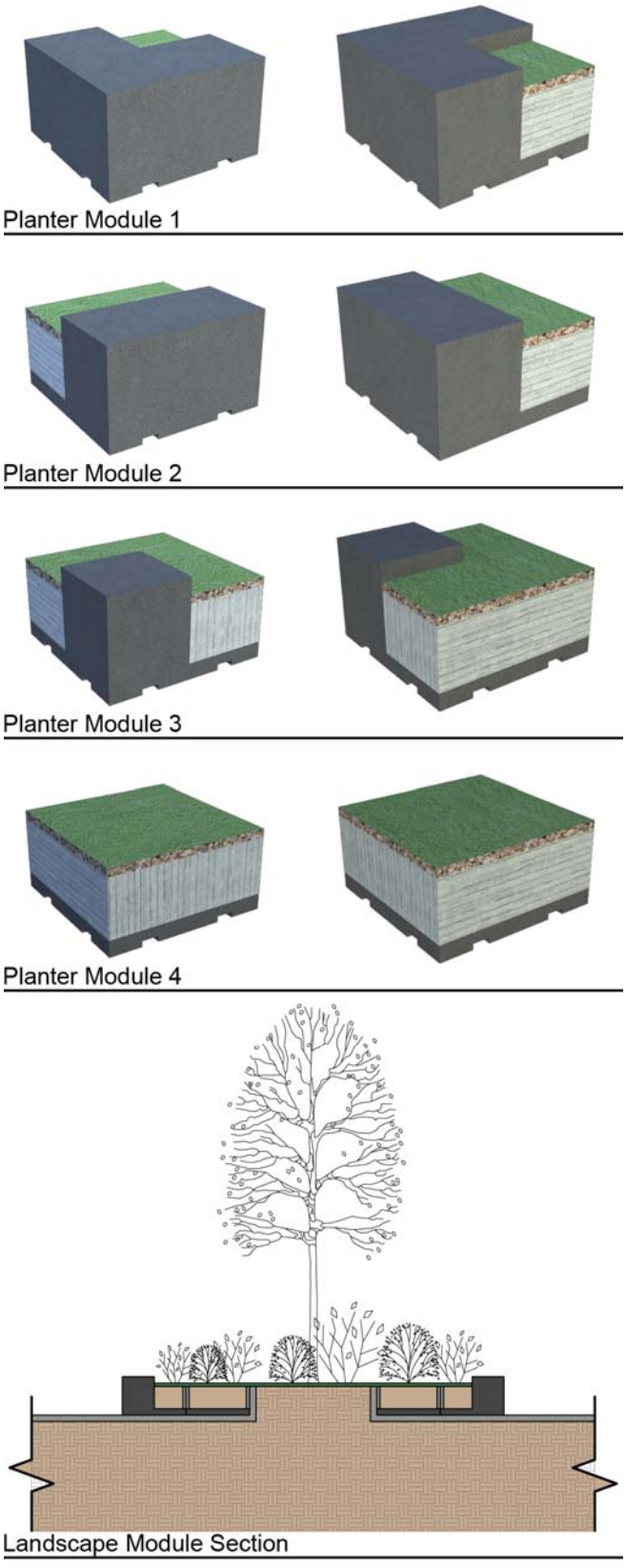


Figure 82 – Landscape Planter Modules and Section

As was previously stated, this modular landscape system allows for variation based on changing needs and desires. For the purpose of this exercise, a landscape design was proposed based on the notion of convenience or desire paths. Thus, modules were arranged to facilitate this design rationale featuring numerous direct routes which enable pedestrians to access entry points quickly and easily. This landscape arrangement is shown in Figure 83.

Figure 83 – Landscape System and Design

Also shown in greater detail within Figure 83 is the implementation of a landscape buffer space off of Jarvis Street. While the building does set back from Jarvis Street, a series of light posts work to continue the existing building line, maintaining a consistent street edge condition. This landscape buffer allows for variations based on programmatic uses within the podium. Should a different program reside within this portion of the podium, the landscape system can then respond to these changes accordingly. To further illustrate this notion, a scenario was created depicting a revision to the landscape design and is depicted in Figures 84 and 85 below.

Figure 84 – Landscape System

Figure 85 – Revised Landscape System

Figure 84 shows a view of one arrangement of the landscape system along Jarvis Street; whereas Figure 85 illustrates a variation to this arrangement which then creates an outdoor patio condition. This revision would likely arise following the conversion of building space into a restaurant. Although this example is simplistic in nature, it demonstrates the capabilities of the landscape system to respond to changes in programmatic uses within the building. Another example of such changes occurring within the landscape system could be as a result of residential uses being introduced into this portion of the building. Following this programmatic change, the landscape system could yet again be revised in order to respond accordingly at the user's discretion.

5.7 Overall Building Design and Renditions:

While the views depicted above have shown George Brown College as a single large tenant located within the western portion of the building along George Street, other uses could also exist within this space. Figures 86 and 87 show a pedestrian view from the corner of Richmond and George Streets in order to demonstrate how this portion of the building could evolve in order to serve other uses such as a Sobeys Grocery Store.

Figure 86 – George Brown College

Figure 87 – Sobeys Grocery Store

The following pages contain a series of rendered perspective views which illustrate the overall building design. Following these renditions are a series of before and after images which depict the building within its current context; and thus serve to better illustrate the building design and its response to its surrounding context and site conditions. Figures 88, 89 and 90 are aerial views of the proposed development. Figure 88 gives an overall view of the building and its relation to the street corner of Jarvis Street and Richmond Street; as well as a view of the sky lounge located on the 13th floor. Figure 89 depicts the southeast corner of the building which features a productive green space on the roof of the podium. This function of a productive green

space is ideal for this portion of the development as this use is facilitated through direct exposure of southern sunlight. Furthermore, this productive green space can be used by George Brown College's Culinary School, thus exemplifying the buildings capability to evolve in order to cater to different programmatic requirements. Should George Brown College not be located within the development, or not require a productive green space, this area can be used as an additional outdoor amenity area for the commercial and residential programs. Depicted in Figure 90 are two other outdoor green spaces which can be used as outdoor amenity areas or alternatively as outdoor patios for cafes and restaurants as required.

Key Plan:

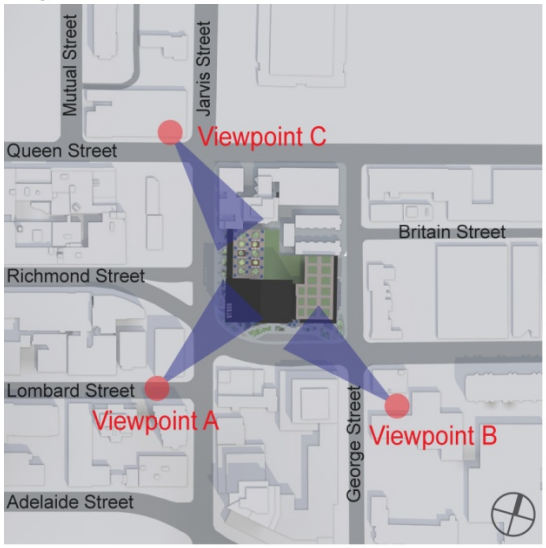


Figure 88 - Aerial View Looking Northeast (Viewpoint A)

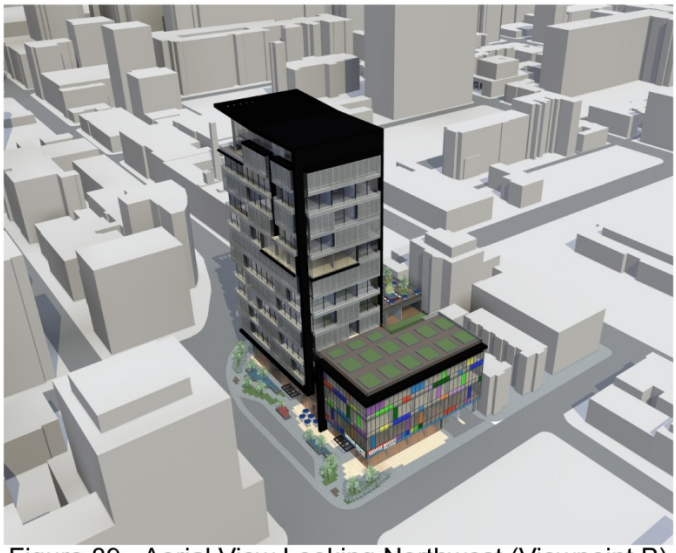


Figure 89 - Aerial View Looking Northwest (Viewpoint B)

Figure 90 - Aerial View Looking Southeast (Viewpoint C)

Figure 91 illustrates the modular landscape system as well as the ground floor lobby. As can be seen, the lobby is a large double height space which contains a cafe with both indoor and outdoor seating. Escalators located adjacent to the Jarvis Street entrance move commercial users to the second floor commercial lobby which features bookable conference rooms and larger seminar rooms. Figure 92 is an aerial view looking at the east and south building facades, and illustrates the single skin facades of the 9th and 13th floor amenity areas as compared to the double skin facades of the residential and commercial uses. Figure 93 is a pedestrian view of the building from the corner of Richmond and Jarvis Streets.

Key Plan:

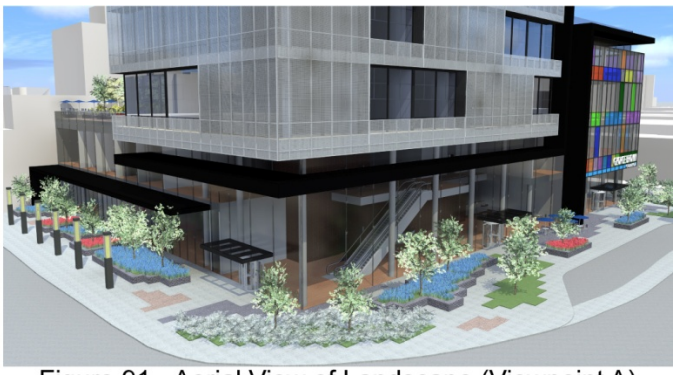


Figure 91 - Aerial View of Landscape (Viewpoint A)

Figure 92 - Aerial View Looking Northeast (Viewpoint B)

Figure 93 - Pedestrian View Looking Northeast (Viewpoint C)

The three main entry points to the building are identified in Figures 94, 95, and 96; in addition to this, the landscape design notion of convince or desire paths are also evident through these images. Depicted in Figure 94 is the Jarvis Street entrance with the commercial / residential lobby beyond, while Figure 95 illustrates the entry point of the large single tenant space which has been shown here as George Brown College. Lastly, Figure 96 illustrates the second entry point to the commercial / residential lobby. This entry point is located off of the vehicle drop-off on Richmond Street, and adjacent to it is the outdoor seating area for the cafe which is located within the lobby.

Key Plan:

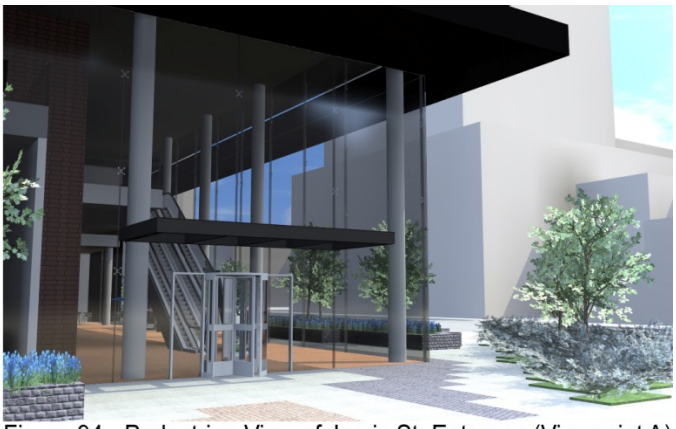


Figure 94 - Pedestrian View of Jarvis St. Entrance (Viewpoint A)

Figure 95 - Pedestrian View of Richmond St. Entrance (Viewpoint B)

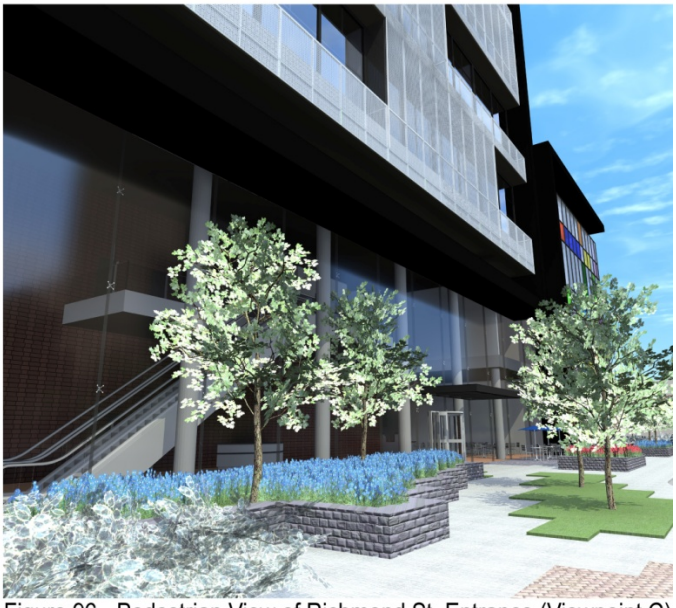


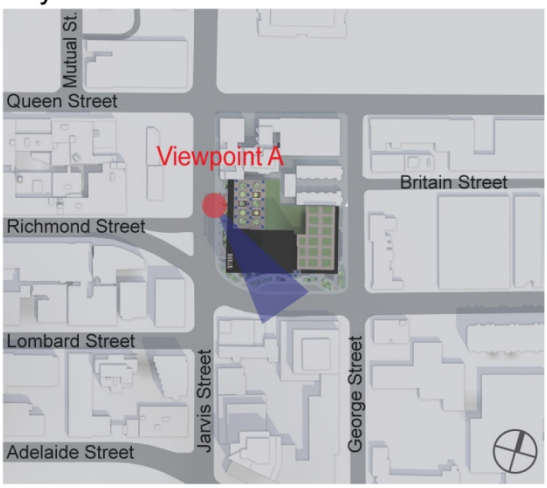
Figure 96 - Pedestrian View of Richmond St. Entrance (Viewpoint C)

Figure 97 is a pedestrian view from Jarvis Street looking up at the northern facade of the building. Also evident in this view is the outdoor amenity area on the third floor as well as the light posts which work to maintain the street edge condition. Figures 98 and 99 are the first of five sets of before and after images which provide an accurate rendition of how this proposed development will look within its context. While Figure 98 is a before image of an aerial view from Bing Maps, Figure 99 illustrates how the proposed development would look on the site. It should however be noted that base image in these figures from Bing Maps is out of date and thus does not depict the high-rise development located to the south of the subject site.

Figure 97 - Pedestrian View From Jarvis St. (Viewpoint A)

Figure 98 - Bing Maps Aerial View - Before

Key Plan:



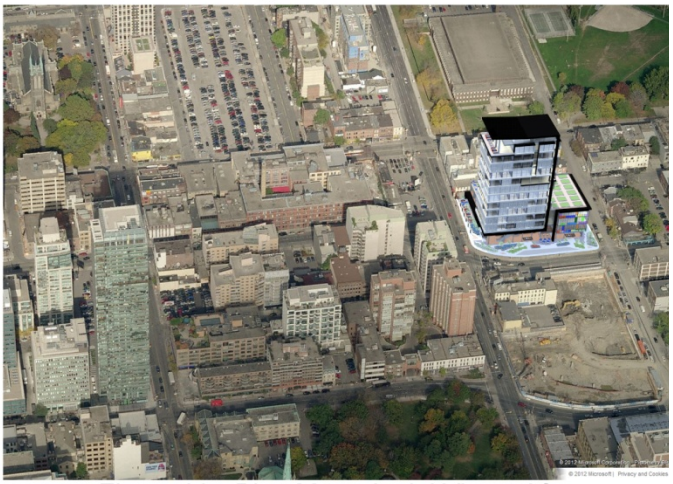


Figure 99 - Bing Maps Aerial View - After

Figure 100 depicts a before and after pedestrian view looking south on Jarvis Street, from the corner of Jarvis and Queen Street. Figure 101 also depicts a pedestrian view looking south on Jarvis Street, however this view occurs closer to the intersection of Jarvis and Richmond Streets. Featured in these views are the light posts which maintain the street edge condition as well as the outdoor amenity area on the third floor, and a possible outdoor patio on the ground floor.

Key Plan:

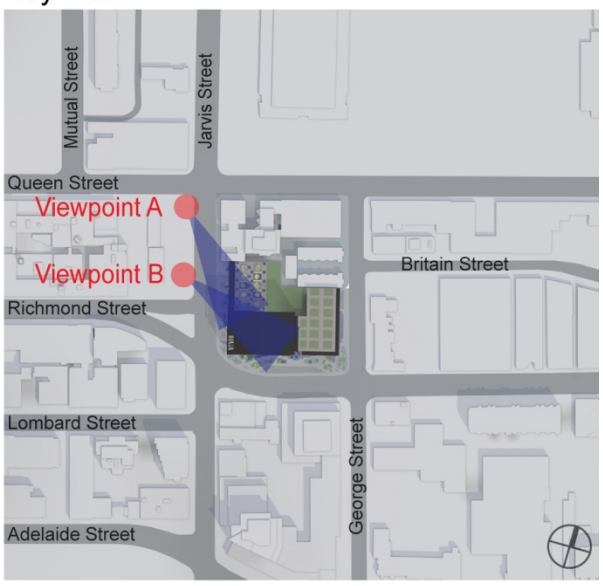


Figure 100 - Pedestrian View Looking South on Jarvis Street - Before vs. After (Viewpoint A)

Figure 101 - Pedestrian View Looking South on Jarvis Street - Before vs. After (Viewpoint B)

Figure 102 illustrates a pedestrian view looking west on Richmond Street, from the south-east corner of Richmond and George Streets. Present in this view is the large single tenant of George Brown College, as well as the commercial / residential lobby adjacent to the corner of Richmond and Jarvis Streets. Figure 103 is the last set of before and after images and depicts a pedestrian view looking north on Jarvis Street from the corner of Jarvis and Lombard Streets.

Key Plan:

Figure 102 - Pedestrian View Looking West on Richmond Street - Before vs. After (Viewpoint A)

Figure 103 - Pedestrian View Looking North on Jarvis Street - Before vs. After (Viewpoint B)

6. Conclusion:

By means of strategies such as the Add-On and Add-In methods, raised floor zones, central wet zones, structural facades, developers' freedom and customizable exteriors, a diverse and malleable system has been proposed. A system that functions as a framework within which change and customization can occur; one that not only allows for continual change of programmatic requirements, but a system that allows for total change in programmatic use as well. These notions, as well as many others, that were extrapolated from precedent review and design research have all been used in conjunction to develop this thesis project of an Evolving Architecture.

Although this thesis project has been conducted in a systematic way and has attempted to be conceptually resolved, further work is needed in order to ensure the full refinement and successful implementation of the proposed system. Furthermore, this thesis attempts to add to the literature by investigating and developing these strategies, however it only begins to scratch the surface of this new field of inquiry.

While this design project is simply one possible scenario for one particular site, in order to further develop this system additional tests and studies are needed. Examples include the testing of this system on other sites, and the testing of this system and its ability to successfully accommodate programmatic uses, other than those which have been explored here. As well, while the design project has been formulated with the intention of being a LEED development, additional work and engineering expertise would be required in order to determine if this could be achieved.

Though the objective of this design project was to develop a system comprised of a series of components, a greater analysis and an in-depth look at each of these components would also be necessary in order to fully develop and resolve the notions put forward. That said, the true measure of success of these components could only be understood after a building is constructed and a post occupancy study is conducted. Thus, following the further refinement and implementation of these components, a study of each component through the post occupancy study would be necessary in order to measure success and to determine if the overall system functions as anticipated.

While the above mentioned issues deal largely with the need for additional work, limitations are also evident in the work that has been conducted thus far. The main limitation of this project, as it is currently shown, is the lack of appropriate resources required to determine the feasibility of the concept and the proposed design project. Although this thesis does argue that financial incentives for implementation are derived from a reduction in the need and associated expenses of relocation, the cost of constructing a system designed to change has not been determined. Furthermore, other associated costs for accommodating change have not been studied in great detail. Therefore, in order for this system to be truly successful, the financial as well as architectural feasibility of this approach needs to be established.

Should this additional work be completed and the limitations addressed, it is arguable that an evolving, changeable system can in fact be created. With an evolving architecture strategy, an architecture that can constantly be transformed and redesigned at the user's discretion, and in accordance to changing needs and desires, can be created. As well, an architecture that takes into account the time factor and works to accommodate functions and changing programmatic needs, day by day, can be produced. As the successful functionality of a space is often dependent on several programmatic elements which may change over time, architecture as a notion cannot afford to be static. Thus, Evolving Architecture ensures that it is not static in time through the creation of a flexible building which is capable of constantly changing, adapting, transforming and evolving as required.

Endnotes:

[1] Trachtenberg, M., & Hyman, I. (2003). *Architecture: From Prehistory to Postmodernity* (Second ed.). New Jersey: Prentice Hall, Inc.-pg 465

[2] Ibid., pg 465

[3] Ibid., pg 517

[4] Ibid., pg 508

[5] Solomon, N. B. (2008). *Architecture: Celebrating the Past, Designing the Future*. New York: Visual Reference Publications.-pg 28

[6] Weiss, P. (1961). *Nine Basic Arts*. Carbondale: Southern Illinois University Press.-pg 84

[7] Ibid., pg 69

[8] Solomon, N. B. (2008). *Architecture: Celebrating the Past, Designing the Future*. New York: Visual Reference Publications.-pg 29

[9] Ibid., pg 29

[10] Ibid., pg 29

[11] Bristol, K. G. (1991). The Pruitt-Igoe Myth. *Journal of Architectural Education*, *44*(3), 163-171.-pg 169

[12] Ibid., pg 167

[13] Ibid., pg 167

[14] Ibid., pg 169

[15] Leupen, B, Heijne, R, & Zwol, J. v. (2005). *Time-Based Architecture*. Rotterdam: 010 Publishers-pg 9

[16] Ibid., pg 9

[17] Ibid., pg 9

[18] Ibid., pg 9

[19] Friedman, A. (2001). *The Grow Home*. Montréal: McGill-Queen's University Press.-pg 18

[20] Ibid., pg 50

[21] Rodwin, L. (1961). *The Future Metropolis*. New York: G. Braziller.-pg 71

[22] Per, A., Mozas, J., Arpa, J., & Holl, S. (2011). *This is Hybrid: An Analysis of Mixed-Use Buildings by a+t*. Vitoria-Gasteiz: a+t architecture.-pg 43

[23] Ibid., pg 13

[24] Ibid., pg 54

[25] Dale, K., & Burrell, G. (2008). *The Spaces of Organisation and the Organisation of Space: Power, Identity and Materiality at Work*. Basingstoke: Palgrave Macmillan.-pg 100

[26] Ibid., pg 100

[27] Ibid., pg 101

[28] Friedman, A. (2001). *The Grow Home*. Montréal: McGill-Queen's University Press.-pg 18

[29] Ibid., pg 19

[30] Ibid., pg 19

[31] Leupen, B, Heijne, R, & Zwol, J. v. (2005). *Time-Based Architecture*. Rotterdam: 010 Publishers-pg 9

[32] Nakagin Capsule Tower. (n.d.). *Kisho Kurokawa*. Retrieved from http://www.kisho.co.jp/page.php/209

[33] Ibid.

[34] Ouroussoff, N. (2009, July 6). Architecture - Kisho Kurokawa's Future Vision, Banished to Past. *The New York Times*. Retrieved from http://www.nytimes.com/2009/07/07/arts/design/07capsule.html

[35] Ibid.

[36] Ibid.

[37] The Highrise of Homes. *SITE | architecture, art & design*. Retrieved from www.siteenvirodesign.com

[38] Highrise of Homes by SITE. (2005, August 8). *A Weekly Dose of Architecture*. Retrieved from http://www.archidose.org/books/highrise.html

[39] Leupen, B, Heijne, R, & Zwol, J. v. (2005). *Time-Based Architecture*. Rotterdam: 010 Publishers-pg 220

[40] Ijsseling + Van Der Werff Architecten | Groeiwoningen. (n.d.). *Ijsseling + Van Der Werff Architecten*. Retrieved from http://www.ijsselingvanderwerff.com/0206AlG01.html

[41] Sprout Home — Montréal, Quebec | CMHC. (n.d.). *Canada Mortgage and Housing*. Retrieved from http://www.cmhc-schl.gc.ca/en/inpr/afhoce/tore/afhoid/cohode/buhoin/buhoin_006.cfm

[42] Friedman, A. (2001). *The Grow Home*. Montréal: McGill-Queen's University Press.-pg 19

[43] Ibid., pg 50

[44] Grow Home — Montréal, Quebec | CMHC. (n.d.). *Canada Mortgage and Housing*. Retrieved from http://www.cmhc-schl.gc.ca/en/inpr/afhoce/tore/afhoid/cohode/buhoin/buhoin_005.cfm

[45] Ibid.

[46] Ibid.

[47] Wimmer, H. (n.d.). The End of Four Walls - Housing Grieshofgasse. *Arch. DI. Helmut Wimmer*. Retrieved from http://wimmerundpartner.com/ende4waende1_e.htm

[48] Leupen, B, Heijne, R, & Zwol, J. v. (2005). *Time-Based Architecture*. Rotterdam: 010 Publishers-pg 148

[49] Blok A, Centrum Ypenburg. (n.d.). *Rapp+Rapp*. Retrieved from http://www.rappenrapp.nl/#/nl/projecten/blok-a-centrum-ypenburg

[50] Leupen, B, Heijne, R, & Zwol, J. v. (2005). *Time-Based Architecture*. Rotterdam: 010 Publishers-pg 19

[51] Friedman, A. (2001). *The Grow Home*. Montréal: McGill-Queen's University Press.-pg 19

[52] Ibid., pg 19

[53] Leupen, B, Heijne, R, & Zwol, J. v. (2005). *Time-Based Architecture*. Rotterdam: 010 Publishers-pg 152

[54] Leupen, B, Heijne, R, & Zwol, J. v. (2005). *Time-Based Architecture*. Rotterdam: 010 Publishers-pg 160

[55] Hanse Colani Rotor House. *Fertighaus von Hanse Haus.* Retrieved from http://www.hanse-haus.de/

[56] Ibid., pg 144

[57] Ibid., pg 144

[58] Ibid., pg 144

[59] ANA architecten - Multifunk Steigerdam. *ANA architecten* . Retrieved from www.ana.nl/multifunk.html

[60] Leupen, B, Heijne, R, & Zwol, J. v. (2005). *Time-Based Architecture*. Rotterdam: 010 Publishers-pg 212

[61] ANA architecten - Multifunk Steigerdam. *ANA architecten* . Retrieved from www.ana.nl/multifunk.html

[62] Gemini Residences. *MVRDV*. Retrieved from http://www.mvrdv.nl/#/projects/129geminiresidences.

[63] Ijsseling + Van Der Werff Architecten | Groeiwoningen. (n.d.). *Ijsseling + Van Der Werff Architecten*. Retrieved from http://www.ijsselingvanderwerff.com/0206AIG01.html

[64] City of Toronto (2010). *King – Parliament Secondary Plan.*

[65] Per, A., Mozas, J., Arpa, J., & Holl, S. (2011). *This is Hybrid: An Analysis of Mixed-Use Buildings by a+t*. Vitoria-Gasteiz: a+t architecture.-pg 43

[66] Wimmer, H. (n.d.). The End of Four Walls - Housing Grieshofgasse. *Arch. DI. Helmut Wimmer*. Retrieved from http://wimmerundpartner.com/ende4waende1_e.htm

Bibliography:

Books / Articles:

1. Arieff, A., & Burkhart, B. (2002). *Prefab*. Salt Lake City: Gibbs Smith.
2. Brebbia, C., & Carpi, A. (2010). *Design & Nature V: Comparing Design in Nature with Science and Engineering*. Southamption: WIT Press.
3. Bristol, K. G. (1991). The Pruitt-Igoe Myth. *Journal of Architectural Education*, *44*(3), 163-171.
4. Duran, S. C. (2008). *New Prefab Architecture*. Barcelona, Spain: Loft.
5. Dale, K., & Burrell, G. (2008). *The Spaces of Organisation and the Organisation of Space: Power, Identity and Materiality at Work*. Basingstoke: Palgrave Macmillan.
6. Davies, C. (2005). *The Prefabricated Home.*. London: Reaktion.
7. Farias, I., & Bender, T. (2010). *Urban Assemblages: How Actor-Network Theory Changes Urban Studies*. London: Routledge.
8. Friedman, A. (2001). *The Grow Home*. Montréal: McGill-Queen's University Press.
9. Kotnik, J. (2008). *Container Architecture*. Barcelona, Spain: Links Books.
10. Leupen, B., Heijne, R., & Zwol, J. v. (2005). *Time-Based Architecture*. Rotterdam: 010 Publishers.
11. Per, A., Mozas, J., Arpa, J., & Holl, S. (2011). *This is Hybrid: An Analysis of Mixed-Use Buildings by a+t*. Vitoria-Gasteiz: a+t architecture.
12. Prudon, T. H. (2008). *Preservation of Modern Architecture*. Hoboken, N.J.: Wiley.
13. Rodwin, L. (1961). *The Future Metropolis*. New York: G. Braziller.
14. Scoates, C. (2003). *LOT-EK: Mobile Dwelling Unit*. New York, NY: Distributed Art Publishers.
15. Solomon, N. B. (2008). *Architecture: Celebrating the Past, Designing the Future*. New York: Visual Reference Publications.
16. Trachtenberg, M., & Hyman, I. (2003). *Architecture: From Prehistory to Postmodernity* (Second ed.). New Jersey: Prentice Hall, Inc.
17. Traganou, J., & Mitrašinović, M. (2009). *Travel, Space, Architecture*. Farnham, England: Ashgate.
18. Weiss, P. (1961). *Nine Basic Arts*. Carbondale: Southern Illinois University Press.

Websites:

19. About AR.info. (n.d.). *Adaptive Reuse: Finding opportuinity in our vacant built assets*. Retrieved September 10, 2011, from http://adaptivereuse.info/about-ar-info/
20. ANA architecten - Multifunk Steigerdam. (n.d.). *ANA architecten* . Retrieved October 3, 2011, from http://www.ana.nl/multifunk_text.html
21. Aranguren + Gallegos Arquitectos. (n.d.). *Aranguren + Gallegos Arquitectos*. Retrieved September 12, 2011, from http://www.arangurengallegos.com/
22. Blok A, Centrum Ypenburg. (n.d.). *Rapp+Rapp*. Retrieved October 5, 2011, from http://www.rappenrapp.nl/#/nl/projecten/blok-a-centrum-ypenburg

23. Grow Home — Montréal, Quebec | CMHC. (n.d.). *Canada Mortgage and Housing | Société canadienne dhypothèques et de logement*. Retrieved October 29, 2011, from http://www.cmhc-schl.gc.ca/en/inpr/afhoce/tore/afhoid/cohode/buhoin/buhoin_005.cfm
24. Gemini Residences. (n.d.). *MVRDV*. Retrieved September 12, 2011, from http://www.mvrdv.nl/#/projects/129geminiresidences
25. Hanse Colani Rotor House. (n.d.). *Fertighaus von Hanse Haus.* Retrieved November 15, 2011, from http://www.hanse-haus.de/
26. Highrise of Homes by SITE. (2005, August 8). *A Weekly Dose of Architecture*. Retrieved November 21, 2011, from http://www.archidose.org/books/highrise.html
27. Ijsseling + Van Der Werff Architecten | Groeiwoningen. (n.d.). *Ijsseling + Van Der Werff Architecten*. Retrieved December 3, 2011, from http://www.ijsselingvanderwerff.com/0206AlG01.html
28. Multifunk, ANA Architecten | Amsterdam | Netherlands . (n.d.). *MIMOA*. Retrieved October 5, 2011, from http://mimoa.eu/projects/Netherlands/Amsterdam/Multifunk
29. Nakagin Capsule Tower. (n.d.). *Kisho Kurokawa*. Retrieved September 13, 2011, from http://www.kisho.co.jp/page.php/209
30. Ouroussoff, N. (2009, July 6). Architecture - Kisho Kurokawa's Future Vision, Banished to Past. *The New York Times - Breaking News, World News & Multimedia*. Retrieved October 28, 2011, from http://www.nytimes.com/2009/07/07/arts/design/07capsule.html
31. Rietveld Schröderhuis | Centraal Museum Utrecht. (n.d.). *Centraal Museum Utrecht*. Retrieved September 12, 2011, from http://centraalmuseum.nl/bezoeken/locaties/rietveld-schroederhuis
32. Quinta Monroy. (n.d.). *ELEMENTAL*. Retrieved November 28, 2011, from http://www.elementalchile.cl/viviendas/quinta-monroy/quinta-monroy/
33. Sprout Home — Montréal, Quebec | CMHC. (n.d.). *Canada Mortgage and Housing | Société canadienne dhypothèques et de logement*. Retrieved November 21, 2011, from http://www.cmhc-schl.gc.ca/en/inpr/afhoce/tore/afhoid/cohode/buhoin/buhoin_006.cfm
34. The Highrise of Homes. (n.d.). *SITE | architecture, art & design*. Retrieved October 30, 2011, from http://www.siteenvirodesign.com/ex.hoh.php
35. Wimmer, H. (n.d.). The End of Four Walls - Housing Grieshofgasse. *Arch. DI. Helmut Wimmer*. Retrieved October 29, 2011, from http://wimmerundpartner.com/ende4waende1_e.htm