Fractal: Refaçading the Suburb for the Modern Family through Modularity

by

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Dalhousie University is located in Mi'kmaq'i,
the ancestral and unceded territory of the Mi'kmaq.
We are all Treaty people.

Contents

Abstract

Canadian cities and suburbs are littered with single-family residential housing that fails to meet the needs of modern families. The current housing model does not adequately support intergenerational living, user flexibility and community due to its inherent individualistic nature. A more adaptive strategy is needed to reconcile the existing model with contemporary family dynamics.

This thesis employs a modular framework with a fractal logic to permit adaptable and strategic dwelling environments. This method enables the blending and simultaneous separation of several different unit typologies. Through strategic repetition, the organization blurs the private and public spaces by creating central nodes of shared space which are uniquely appropriate to the population they serve. The system is scalable, due to the modular framework, which allows it to address increasing population densities and modern socioeconomic demands. Ultimately, this proposal will facilitate the refacading of suburbs into urban centers designed for the modern family.

Acknowledgements

I would like to thank Niall Savage for all the support and guidance throughout the thesis. The insightful comments and feedback aided in elevating the investigation.

A huge thank you to my other half, Luke MacLean, and my parents Glen and Darlene Wesley for the support. Couldn’t have done this without you guys.

Chapter 1: Introduction

> I am inclined while watching the turtle to turn it over and study its underbelly. From this unnatural position I see how this platonically solid creature makes its way through the world.
>
> -Douglas Darden (Darden 1993, 7)

1.1 Re-imagining the Housing Model

A place of dwelling facilitates family, community, and mutual success for the inhabitants. Historically, multigenerational frameworks, that pool resources, have been important both for international communities and more locally on rural Canadian farms. This functionality is missing from the contemporary single-family home, and this absence is particularly poignant in suburban typologies. While building rows of dwellings for single nuclear families, the large green yard was planted, and white picket fence was painted, to meet the needs of post World War II consumerism and not those of the family.

The “underbelly” of existing single-family housing reveals that it is built upon a presumption of individualism and other outdated ideologies (LaMarche 1998, 162). As a result, suburban housing models cannot adapt to modern flux in family dynamics and lifestyle. Further, modern living is unresponsive to rising socioeconomic pressures. Adaptable housing for multigenerational living is better suited to meet the needs of modern families.

In order to create a responsive typology, this thesis first analyzes the standard of single-family architecture and its relationship to the human condition. The historical paradigms that have shaped single-family housing have resulted in a typology that is ill-adapted and inaccessible to middle class families. Further, this typology is so engrained in Canadian

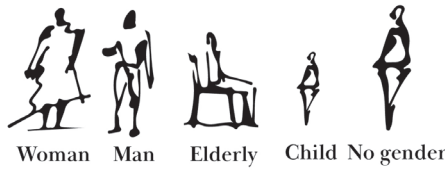
cities and suburbs that it has become unresponsive to shifting family needs. Therefore, this infrastructure must be critically dissected and reconfigured in order to better address community needs.

Hybrid design methods interconnect private and public spaces and may serve as an important tool for address the limitations of the current housing model. An environment catering to both individual and community spaces can be achieved by focusing on accessibility and multi-generational living as the key goals. The existing model completely separates private and public spaces and ultimately places a higher economic burden on middle class families. Multigenerational housing can be seen as tool for efficiently pooling resources and enabling an improved quality of life.

This thesis will focus on four key design principles in order to provide an improved housing model for the multigenerational middle-class family. First, it must be adaptable to a diverse population and be flexible enough to remain adaptable throughout the family lifecycle. Secondly, the housing must be economically accessible and sustainable within contemporary suburbia. Next, the project will employ a community centered design to cater to the complex dynamics of modern living. Finally, the resulting design should be scalable in a manner that can grow and be repeated. In summary, the four key design principles are adaptability, accessibility, communality and scalability. Overall, this analysis will elucidate the connections between housing architecture and the human experience (LaMarche 1998, 162).

1.2 Thesis Question

How can the limitations of the standard single-family residential home be overcome in order to address the economic and community needs of contemporary multigenerational living?



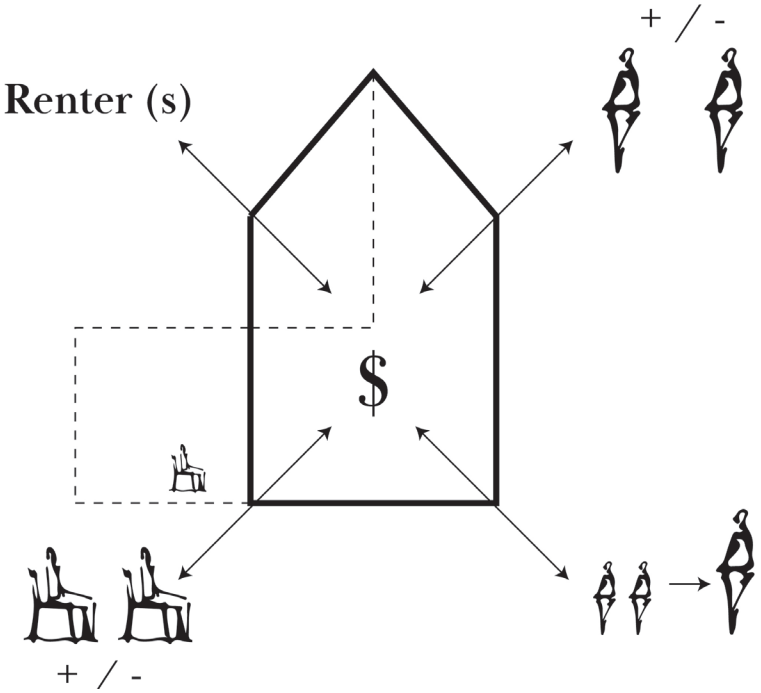


Diagram showing the sought after housing model in its adaptive abilities around the family structure and community

Chapter 2: A Shifting Paradigm: Multigenerational Living

As society advances, values are re-evaluated, and it is common for existing ideologies to shift. This theme is particularly apparent in the single-family housing model which is uniquely related to the cultural zeitgeist. Multigenerational living is part of this shift as it was historically popular, had a phase of rejection in North America and recently has been re-evaluated as a viable housing model for modern family dynamics.

2.1 Past

Historically, multigenerational living has played a major role in North America. In the early nineteenth century, 70 percent of individuals 65 years or older lived with their children in dwellings primarily on rural family farms (Lung-Amam 2019, 358). This lifestyle provided economic security in contrast to the inadequate wellfare programs that failed at protecting low-income families. With the rise of industrialization and increasing wages, agriculture and family-based professions declined which lead to a parallel decline in multigenerational living (Lung-Amam 2019, 359). With many leaving family farms for cities, the economic advantages of multigenerational living were lost. This was in tandem with the strengthening of the welfare programs such as social security, medicare and the economic boom of the mid-twentieth century (Lung-Amam 2019, 358). Ultimately, American multigenerational households declined from 25% to 12% between 1940 and 1980 (Lung-Amam 2019, 358).

Several Generations living under one roof on Rural Farms (Parolek 2020)

2.2 The Nuclear Family

Along with industrialization, the emphasis on the nuclear family contributed to the decline of multigenerational living. The nuclear family was a structure that emerged in the early 1950's which comprised of a mother, father and children and each had a designated role. Fathers worked full-time jobs to provide for the family and women were responsible for household chores and raising their children. This experience was commonplace for children growing up in the 1950's (Lung-Amam 2019, 358). Notably, women worked in private spaces and men worked in public settings. This family structure was paired with the suburban single-family home. The initial success of the suburban model relied on the nuclear family because single car families were the norm, so only one parent could work out-of-home. (Hayden 2002, 207). This ideal was conceived after World War II and persisted into the 1990's. (Lung-Amam 2019, 358). While the reason for such emphasis is complex, scholars argue that the government and Manufacturers encouraged post depression consumer culture as an economic recovery tool. This dispersive approach was facilitated through the mass-production of suburbs such as the work of William Levitt (Lung-Amam 2019, 358). These suburbs were composed of single family "dream homes" which were designed for traditional gender roles and nuclear families (Lung-Amam 2019, 358). However, this ideal short lived as individual and community roles began to shift. Even though the suburban single-family home persisted into the 1990's, the family reality had started to misalign with the housing infrastructure as early as the 1960's. At this point, female roles had begun to expand and increasingly focused on education and career (Lung-Amam 2019, 358). A growing diversity of

The 1950s nuclear family ideal (Parolek 2020)

Levittown, Pennsylvania, the second mass-produced suburb in the United States (Parolek 2020)

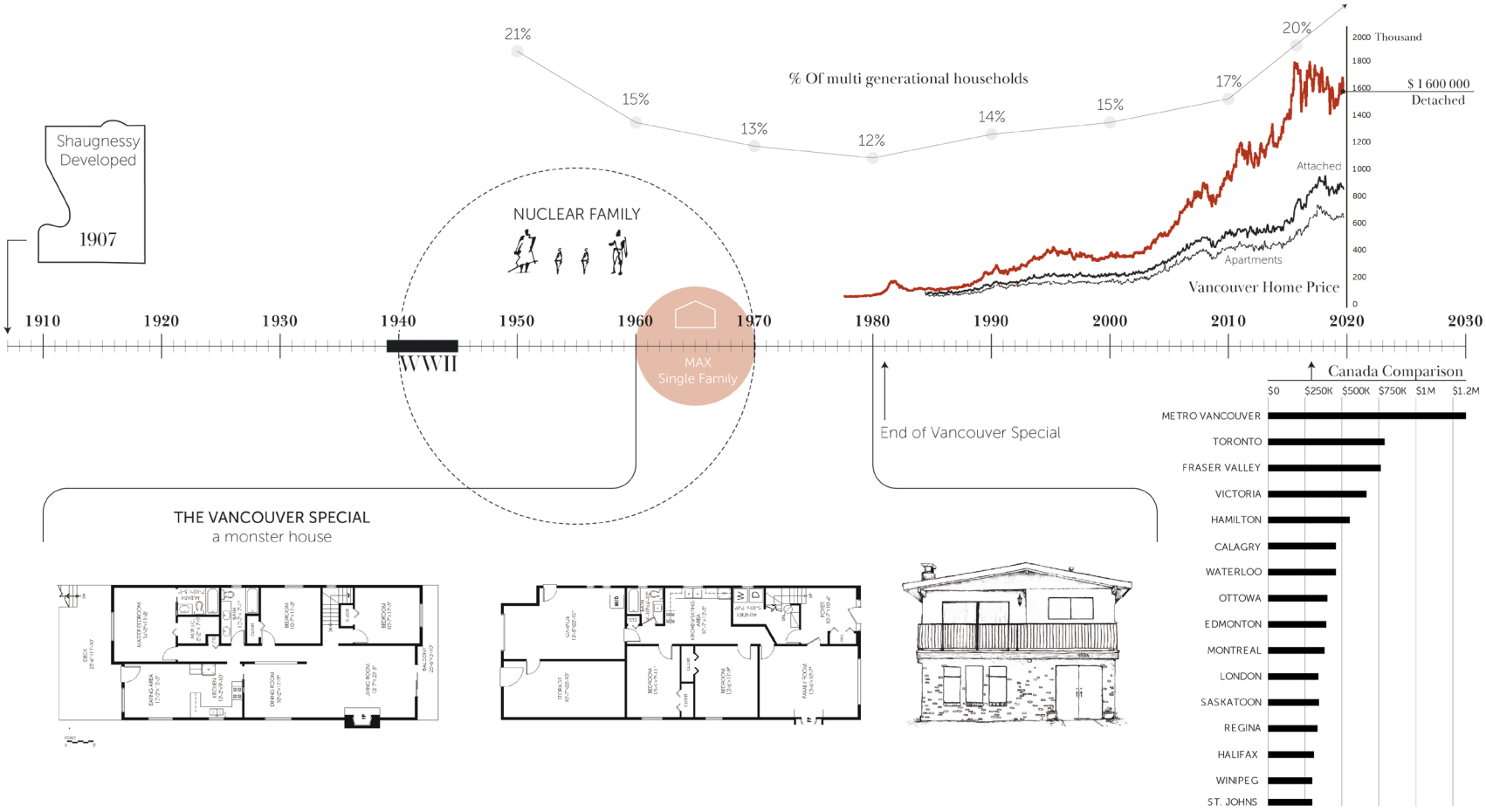
family living arrangements lead to a lack of viable housing. The emergence of family structure fluidity was ill-suited for the static composition of the dwellings.

2.3 Trending

Although the proportion of multigenerational families was on the decline throughout much of the twentieth century, rates have been climbing since the 1990s. This trend is particularly strong amongst immigrants, minorities, baby boomers and millennials. The nuclear family is no longer the standard due to an increase in the fluidity of family arrangements. In 2010, the share of the American population living in multigenerational households had climbed past its 1960s levels, to around 16% (Taylor 2010). It is important to critically analyze the factors that have motivated this transition. Academic literature identifies five primary causes for the increasing prevalence of multigenerational households over the past several decades (Lung-Amam 2019, 359). These five factors are the changing family structure, increasing life expectancy, the increase in childcare, increasing racial and ethnic diversity and economic pressure, and they are described in following.

2.3.1 Changing Family Structure

The structure of what constitutes family has greatly changed. The number of unmarried adults has increased, due to personal choice, and the median age of first marriages has risen by six years between 1960 and 2010 (Lung-Amam 2019, 359). This trend is also coupled with a changing, and largely declining, role of children within the family dynamic due to later childbearing, lower fertility rates, and the rise in cohabitation and adoption (Lung-Amam 2019, 359). These shifts have incentivized alternative household structures



This timeline shows the trajectory of multigenerational living in Canada as it relates to historically significant contributors. There is a significant decline following World War II due to heightened nuclear family social constructs, with a more recent incline due to modern socioeconomic pressures on the family

and young adults to live with their parents for longer (Lung-Amam 2019, 359).

2.3.2 Increasing Life Expectancy

With significant advances in medical care and health services, life expectancy in North America has an increased significantly. This corelates with a rise in healthcare related costs that now represent a greater proportion of household expenses. This economic burden and need for care has encouraged multigenerational living structures. The incidence of chronic health conditions and disability also increases with age. Therefore, more long-term care is required which can be subsidized with assistance from a multigenerational framework. Between increasing costs and inaccessibility to senior care, adult children, particularly in low-income households, are now playing a greater role in supporting their parents (Lung-Amam 2019, 360).

2.3.3 Childcare

Modern family dynamics often involve both parents working in the public sphere, so childcare is no longer innately provided like it was within the nuclear family. There is also an economic burden to hiring professional childcare during work hours. Therefore, young families are more likely to seek aid from their parents or other family members to take on financial, physical, and emotional responsibilities in the home (Lung-Amam 2019, 359).

2.3.4 Racial and Ethnic Diversity

The rise of globalization has increased the accessibility of North American living and consequently increased rates of transcultural immigration. This immigration, particularly from Asia and Latin America, has led to an increase in racial and

ethnic diversity. Further, many of these cultural groups value multigenerational living which has contributed to its higher prevalence amongst immigrant housing. Between 1980 and 2012, immigrant households doubled from 7% to 14% (Lung-Amam 2019, 360). Due to racialized economic inequity and cultural driven values, higher rates of multigenerational households are found in immigrant communities compared to native born (Lung-Amam 2019, 359). In 2012, roughly 27% of Asian Americans, 25% of African Americans, and 24% of Latinos lived in multigenerational households. In contrast, only 14% of non-Hispanic Whites were living in a similar multigenerational structure (Lung-Amam 2019, 360). These higher rates are associated with the pre-existing cultural values of elder care, inherent language barriers, and lack of resources. Other economic factors that encourage multigenerational living within immigrant communities include higher unemployment rates, more single-parent households, lower wages and strong extended family networks (Lung-Amam 2019, 360).

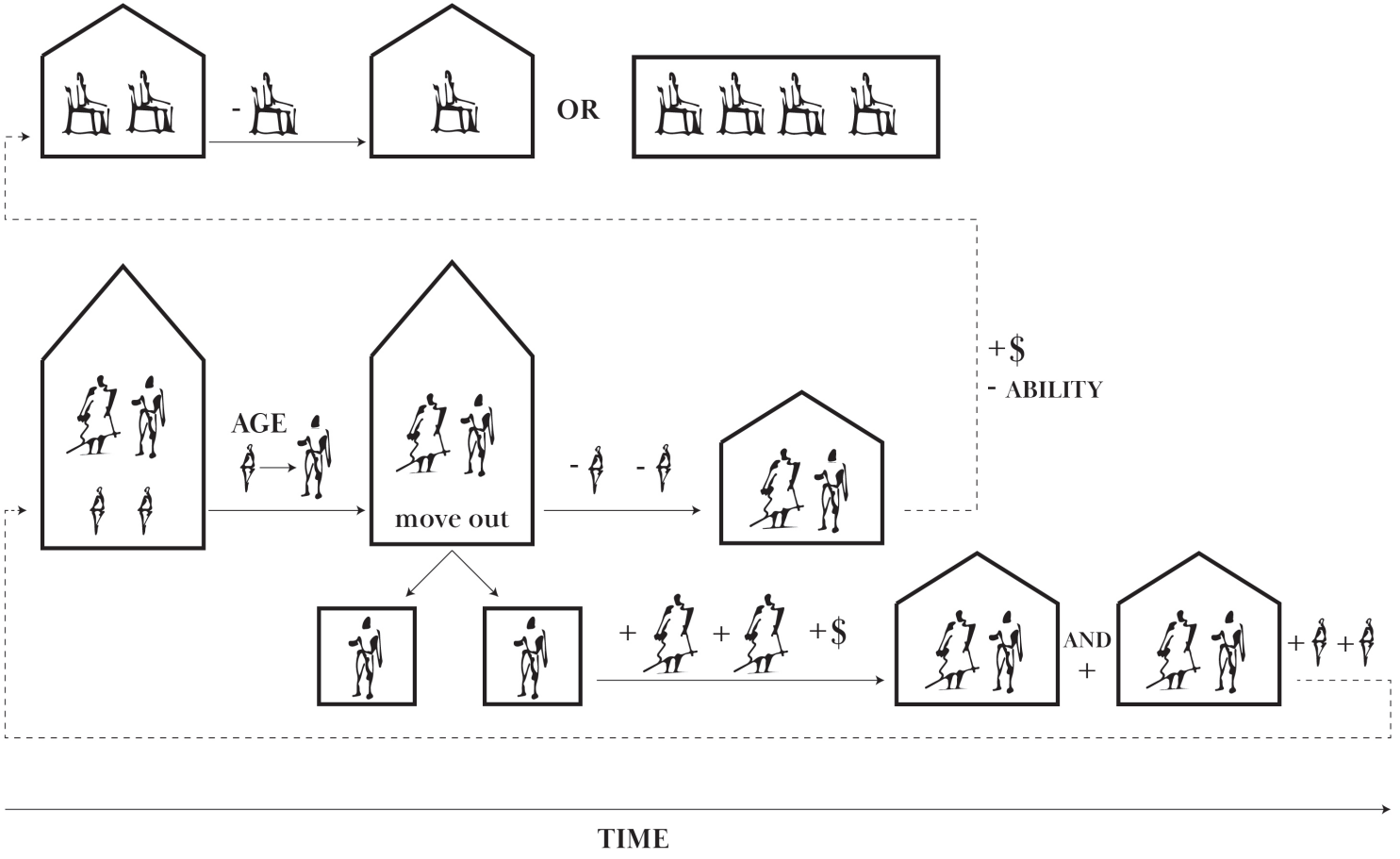
2.3.5 Economics

External economics and personal finances are significant factors in encouraging multigenerational housing. This association was observed during the Great Recession from 2007-2009 which resulted in the highest unemployment rates in North America since the mid-1980s (Lung-Amam 2019, 360). The number of Americans living in multigenerational families rose from 15.4% to 16.7% between 2007 and 2009 (Lung-Amam 2019, 360). The economic instability made it hard for many young adults to maintain a job and forced them to move back in with parents. By 2011, 55% of young adults between 18-24 lived with their parents (Lung-Amam 2019, 360). Despite relatively improved labour markets,

multigenerational living amongst young and old adults continues to persist. Though unemployment rates have dropped 5 points, multigenerational living has increased by 2 between 2010 and 2015 (Lung-Amam 2019, 360). This has been termed the “boomerang” generation where young adults frequently move back in with their parents due to financial pressures within the current economic climate.

2.4 Unique Pressures on the Modern Family

Changes to North American lifestyles have led to an expanded definition of the family unit and an associated rise in multigenerational living. Families are now forming new associations in order to share resources and cultivate mutual success. Despite the noted increases in multigenerational living, developers have continued to build single-family homes for nuclear families. These homogeneous neighbourhoods support individualism and private living but are ill-equipped for the demands of the modern family. After peaking in 2004, home ownership has fallen to its lowest level since 1990 (Taylor 2010). Simultaneously, the percentage of Americans living in multigenerational households rose by 27% between 2000 and 2010 (Taylor 2010). The steady decline in individual home ownership and the rapid growth of multigenerational living, suggest that available housing is inadequate and inflexible to the diverse needs of modern families. Given the continued entrenching of single-family homes, the housing market needs to be critically analyzed. Understanding the individual and socioeconomic pressures on the housing market will allow for opportunities to be identified that can make contemporary housing more adaptable to modern families.



The current housing model showing how a family is supposed to relocate as they go through changes over time

Chapter 3: Causality of Contemporary Housing

In order to understand the single-family housing model and why it persists, we must chronical the history of the current model and the pressures that it attempts to address. In doing so, we can then consider alternative approaches that similarly respond to those needs while also remaining versatile for the modern family. British Columbia is marketed as ‘the most beautiful place on earth’ and Vancouver is especially internationally recognized. The city is a popular tourist destination which has made it an important real estate market for global investors. This influx of foreign interest and capital creates an increased prominence of multigenerational values in Vancouver. However, these investments have also increased housing costs. With increasing economic pressures, houses are divergent from contemporary family needs.

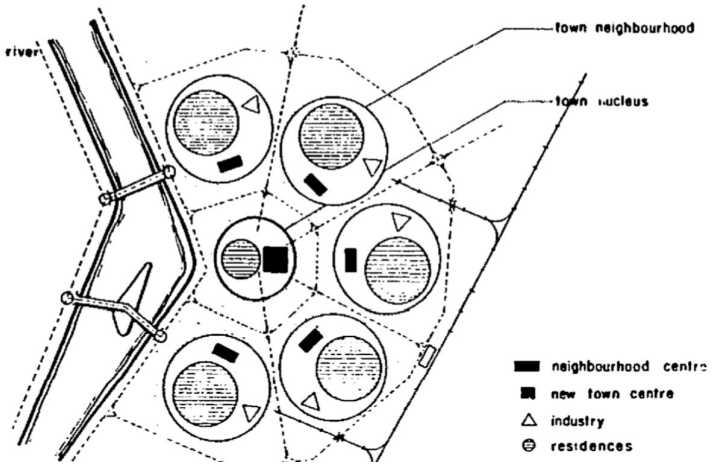
3.1 West Coast Modern: “A Whole Way of Life”

West Coast style was recognized internationally for its domestic architecture built with modern methods and materials that were sensitively adapted to the regions landscape and climate. Built by post and beam construction homes first associated with the West Coast style were flexible, affordable and an expression of Canada’s burgeoning maturity. (Shaw 1995, 4)

Before external pressures, Vancouver intended to develop a community centered framework that was responsive to family, the environment, flexibility, and affordability. On a large scale, the master plan involved components that would repeat around central community nuclei in order to create scalable community centers. However, contemporary pressures have altered the overall city planning of Vancouver and homes are now the most expensive in the country.

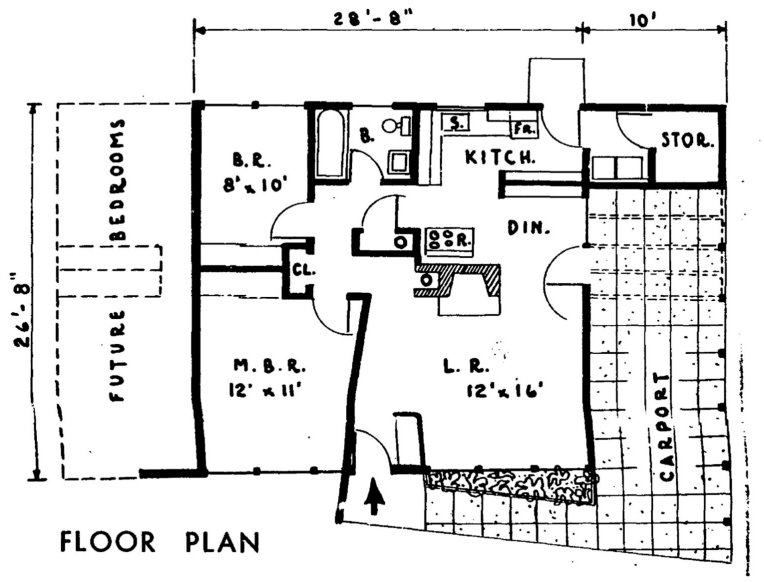
WCM Post and Beam Construction (Shaw 1995)

Vancouver architecture is notably characterized by a West Coast Modern (Shaw 1995) style. The architectural character of WCM was created to affirm a sense of national



A new town: diagrammatic pattern of its components (Shaw 1995)

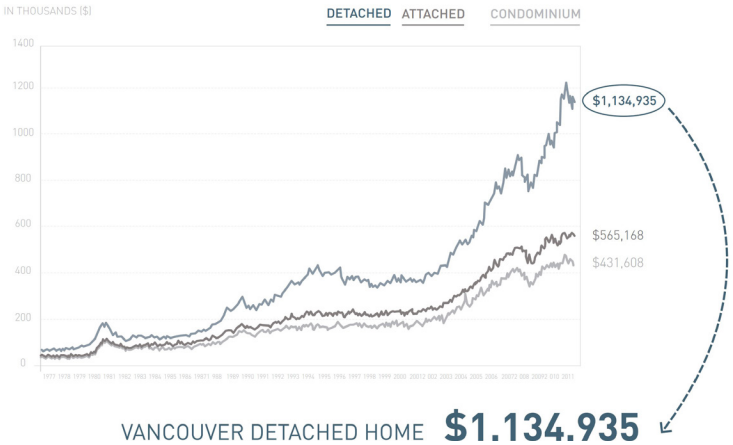
identity. It employs a framework based on regionalism and lifestyle which acts as a defence against post modernism and eclecticism (Shaw 1995, 4). Responsive to the west coast conditions and an expanding middle class, WCM was applied to both domestic architecture and community planning (Shaw 1995, 7). This style manifested as post and beam constructions that permitted open plans which were flexible to sunlight, views and landscape. Large overhangs provided shelter from rain and allowed the extending of the exterior into living space and vice versa (Shaw 1995, 12). Now seen in commercial and public buildings WCM has persisted and been adapted to a variety of modern buildings. Post and beam construction offered flexible methods…. Extendable and easily renovated these modern homes could accommodate a changing family size and needs (Shaw 1995, 12).



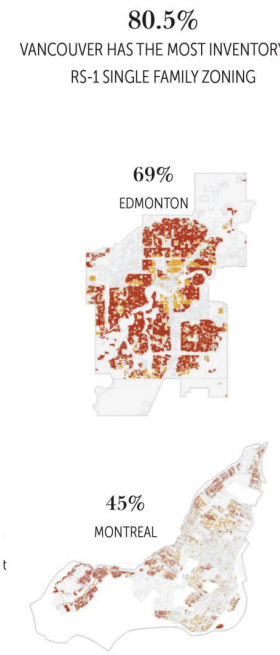
Flexible and expansive nature of post and beam (Shaw 1995)

3.2 The Vancouver Housing Climate

Contemporary media discusses the anxiety of the Vancouver housing market to the point of exhaustion. A more concrete understanding of the market can be gained by analyzing recent data trends. A comparison of housing prices between Vancouver and the rest of the country illustrates the extent to which Vancouver has become unaffordable. The Figure below shows these pricing trends between 2001 and 2010.

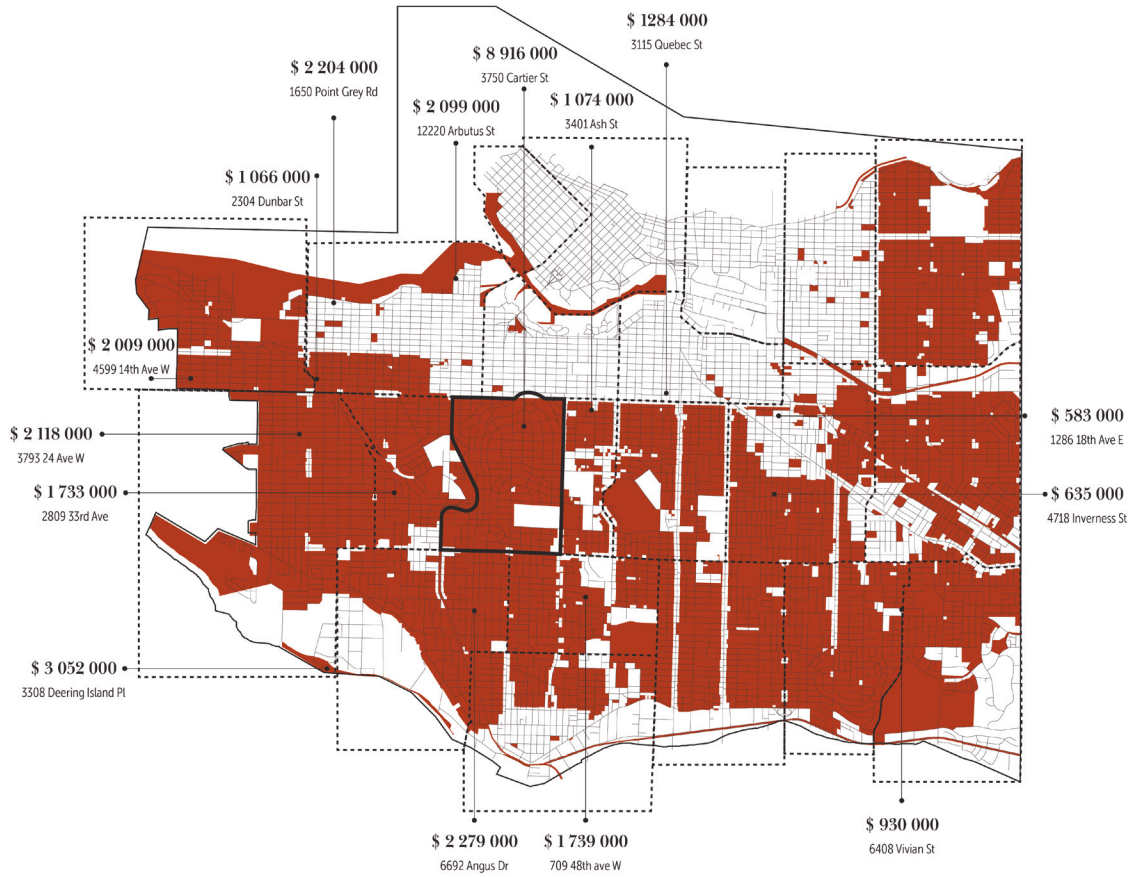


Vancouver average residential sale price Jan 1977 to Nov 2011 (Arndt 2015)



Residential zoning (Datalab 2019)

Generally, British Columbia and specifically Vancouver were significantly more expensive places to live than the rest of the country. There is a widening gap between Vancouver and Canadian home prices. Vancouver has the highest housing prices in the country at around $1.6 million for a single-family home. Therefore, homeownership is increasingly unsuited and unattainable for modern middle-class families.



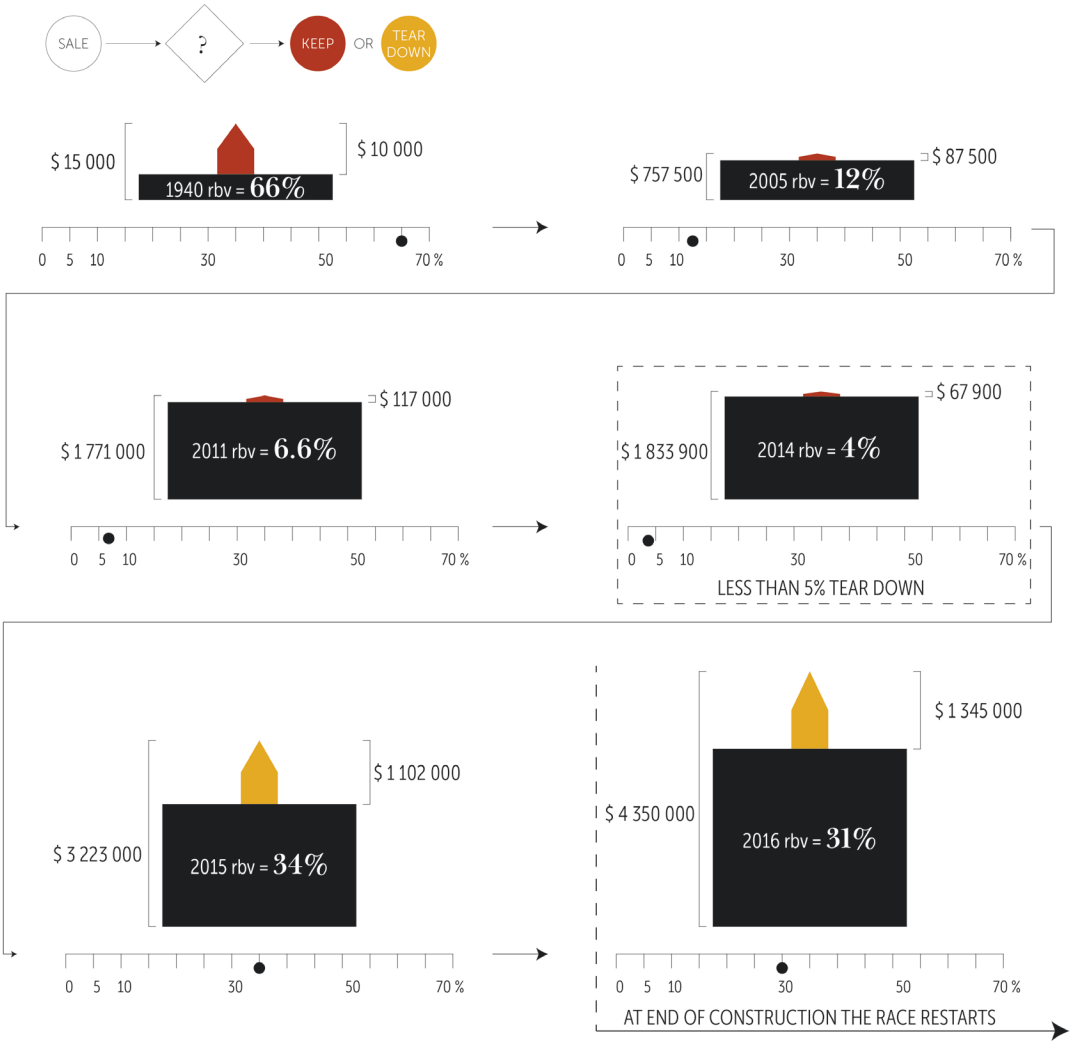
Mapping district specific sales prices in Vancouver residential zoned areas (Datalab 2019)

3.3 Cottage to Compound

For the reasons outlined previously, urban centers have become unobtainable for most modern families. Well resourced individuals are purchasing this lang, building very large homes and consequently appreciating the land value. Carol Burns described the three primary site components as (1) the area of control, (2) the encompassing forces, and (3) the domains (Burns and Andrea 2005, XII). The encompassing forces in this case are the economic pressures which incentivize the construction of increasingly larger homes. This has resulted in a positive feedback loop where the large homes appreciate the land, and the more expensive land leads to larger constructions.

As time progresses, the increases in the land value lead to decreases in the relative building value (Burns and Andrea 2005, 144). This associated is illustrated by the case study diagrammed. By far the most important predictor of whether a single-family home gets torn down when it is sold is the Relative Building Value (RBV) (Dehman 2017). The RBV is the percentage of the market value of the property that is attributed to the physical structure of the house (Dehman 2017). Consider the case study house which cost $10,000 in 1940 dollars to build. The difference between the value of the structure and the purchase price is called the land value (Dehman 2017). This property has a land value of $5,000 and an RBV of $10,000 / $15,000, or 66%, as indicated on the relative building value scale. An RBV value of 66% is generally considered healthy for a new building (Dehman 2017). A combination of depreciation and inflation cause the fluctuations of land value and RBV. Once the RBV reaches 5%, the home is in teardown danger zone. The most common intervention is to tear down the house, rebuild and

consequently increase the RBV. The new build is constructed with a floor area is over twice the size of the previous house, and the final home value reflects the encompassing forces. However, once the build is completed, the race between building and total value restarts. Therefore, houses become increasingly large while the family size is relatively static. Hence, there is also an increase in unoccupied private space. An alternative form of intervention is required that can continually grow as the land value increases. However, it must also increase population density and capitalize on these inevitable trends.



A case study illustrating the depreciation of the RBV over time and the consequential long-term increases to the overall home value (Dehman 2017)

3.4 Inevitable

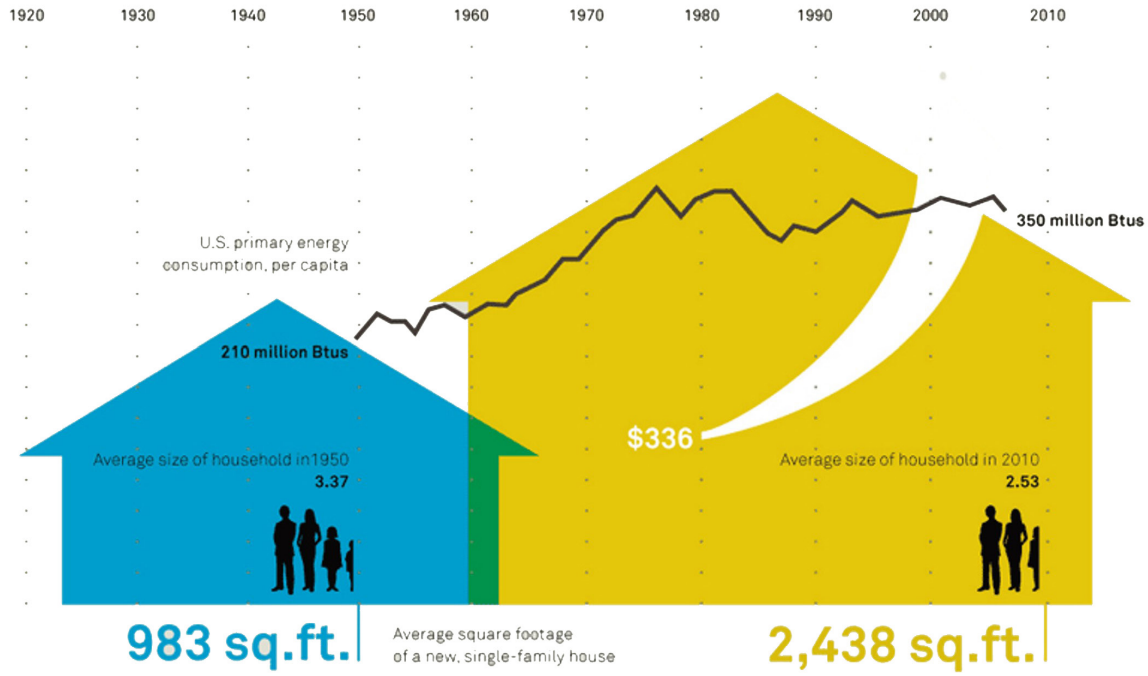
Increasing land value in metro Vancouver has caused homes to become increasingly larger. The first mega houses in Vancouver were in Shaughnessy which is now a mostly heritage district (Mason 2015). New mega houses are now in other Vancouver neighbourhoods, which are also likely to become heritage housing, and Vancouver undergoes this constant evolution (Mason 2015). In order to realize the value of the land, these new builds are custom catered (Mason 2015). The building must be appropriate for the land value in order to achieve financial security and make the retail value worthwhile (Mason 2015). It's really a classic case of the irresistible force and immovable object (Mason 2015). The transition from cottage to compound neighbourhoods is creates social tension in communities throughout Vancouver. These homes do meet the needs of flexibility and adaptability but in an excessive and individualistic style only accessible to the rich. The nature of this excess also leaves the majority of the house unused due to limited occupancy. Economic drivers support developing metro Vancouver but not in a style that benefits the entire community. The large scale of these homes, well above the national average of 2000ft2, means there is increasing inequity in the allocated living space per individual. New multigenerational living dynamics, with static middle-class housing infrastructure, also worsen this living space inequity (The Return 2010). This contrast is most notable in suburban homes.

3.5 Divergence

There is a divergence between the single-family housing model and the contemporary family structure. The existing infrastructure can be large or small but is not adaptable to

intermediate contexts. The ideology of the post-WWII single family home has had a lasting effect on the current housing model.

During the second half of the 20th century, family and house sizes trended in opposite directions. Increasingly large houses were built for a static or decreasing family size. For example, in 1940 24.7% of Americans lived in a multigenerational household composed of at least two adult generations (Taylor 2010). These living arrangements occurred with an average housing unit of 1170 square foot. By 2000, only 15.1% of Americans lived in a multigenerational setting and the mean house size had increased to 2150 square foot (Taylor 2010). With home size nearly doubling despite the decreasing number of inhabitants, the result is an excessive living arrangement. Post-WWII individualistic ideals doubled the American housing stock compared to its population between 1940 and 1990, and homeownership



Trends in house and family sizes between 1950 and 2010 (Schute 2011)

rose by 21% (Taylor 2010). Dolores Hayden noted that by “2000, Americans enjoyed the largest amount of private housing space per person ever created in the history of civilization” (Hayden 2002, 54). This dispersive trend—enforced by the “dream home” ideal—has defined American home design and construction since its introduction.

Chapter 4: Refaçading: Addressing the Lack of Community

The current suburban housing model hinders community and the individualistic ideals upon which its built limit the mutual success of the inhabitants. New economic pressures are worsening these issues and the result is ill-suited for the contemporary family.

4.1 The Lack of Belonging

> A house may be large or small, but as long as the surrounding houses are equally small, it satisfies all social requirements of a dwelling place. But let a palace arise by the side of this small house, and it shrinks from a house into a hut. (Marx 1891, 35)

As previously established, the single-family housing model is based on an individualistic and consumer-oriented society. This a part of what Veblen calls the “conspicuous consumption” of goods and services that are motived by the public display of wealth and observation of what others consume (Dehman 2017). Satisfaction is based largely on its context and how it compares to the goods consumed by others. The increase in status that comes with possession of a large home comes at the expense of others. The status of these secondary actors declines as the frame of reference is altered (Frank 1985). This model explains the steady increase in the size of single-family housing over time and the related decreases in the sense of community

4.2 Presumptuous Individualism in Single Family

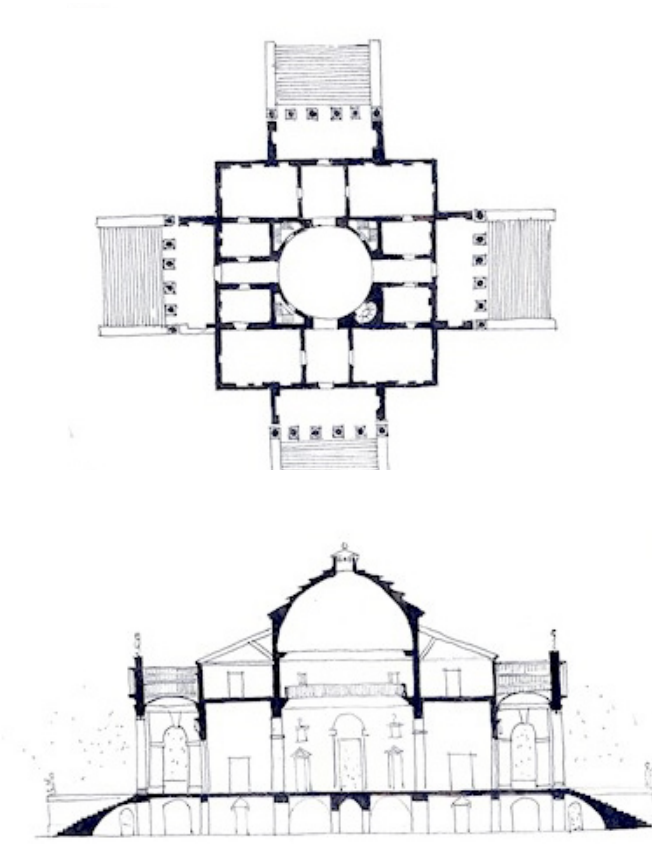
Because they were built based on individualistic ideals, many suburban homes are due for retrofitting. The existing infrastructure is not sustainable in the long-term and is isolating homeowners from their communities (Williamson

2021). In many ways, this trend is encouraged by the phenomenon of urban sprawl which undercuts the benefits of suburban living. Individual home ownership is causing areas of dead space between the homes. For example, these dead spaces could include the front and side yards. The previously discussed conspicuous consumerism creates an environment of competition amongst neighbours. Modern suburban homes illustrate architectural expressions of wealth. This flaunting nature is borrowed from estates and villas, but is now being scaled down to single-family residential.

As introduced about conspicuous consumerism it creates an individualistic environment of competition. As seen in the housing model for suburbs architectural expressions of displaying wealth and power have been borrowed from estates and villas, scaled down and similarly applied to single family residential. This design principle conflicts with community centered values and is particularly notable in the fences, subdivisions, luxury home-fronts, rear oriented homes and the dead side yards. The following two case studies exemplify this flamboyancy and offer insight into how this style is being incorporated into modern residential builds.

4.2.1 Palladio's Villa Rotonda

Palladio's Villa Rotonda exemplifies the authority, ownership and power found in single family residential. The symmetrical nature and application of façade elements allow for the structure to display status and power. The large and gratuitous front, grand entrances, and extensions all demonstrate the ownership over the land and are self oriented instead of community focussed. These elements

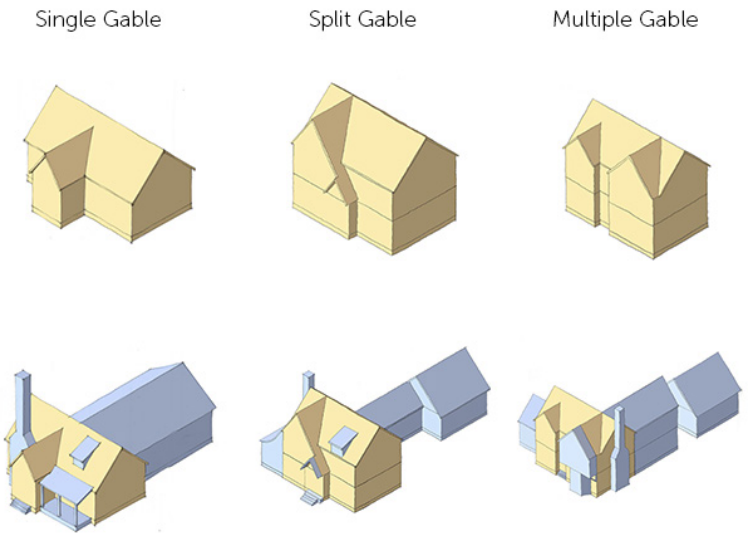


Left: Palladio, Villa Rotonda: Aerial view photograph (Arth 2010)
Right: Palladio, Villa Rotonda: Axial plan with four authoritative fronts claiming ownership over the landscape (Palladio 1570)

are scaled down in suburban architecture but are very much present. The homes act as individual structures in the landscape as opposed to working together as a cohesive whole.

4.2.2 Tudor Architecture

Tudor architecture is a site-specific example of similar design principals to those found in the Villa Rotonda or an estate. It constitutes a primary hip roof dwelling with the application of objects and extensions that cater to the specific residents. The figure bellow diagrams the three main types: a single gable, split gable and double gable. All of these add to the basic housing type by including custom elements like porches, upstands and bay windows. These elements are primarily decorative and often lack architectural function. Consequently, they help to signal ownership over the land. Because these facades work against community-centered design, a form of refacading will be required to retrofit a single-family home in a manner that encourages a sense of community.

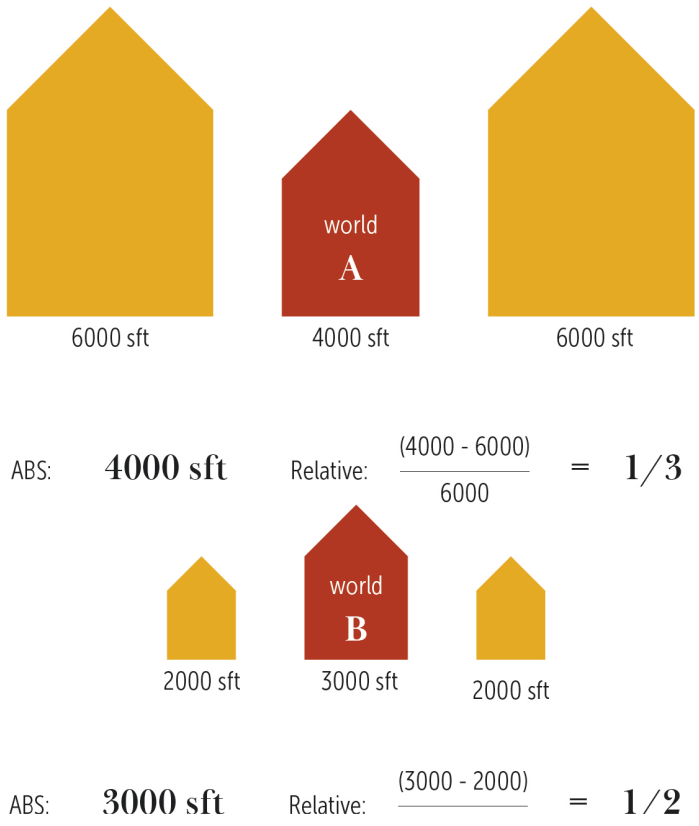


Tudor architecture and its similar use of gable and facade

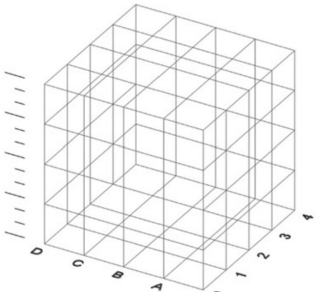
Chapter 5: Self Similarity

> You must choose between two worlds that are identical in every respect except one. The choice is between world A, in which you will live in a 4000-square-foot house and others in 6000-square-foot houses; and world B, in which you will live in a 3000-square-foot house, others in 2000-square-foot houses. Once you choose, your position on the local housing scale will persist. If only absolute consumption mattered, A would be clearly better. Yet most people say they would pick B, where their absolute house size is smaller, but their relative house size is closer. (Frank 2005, 137)

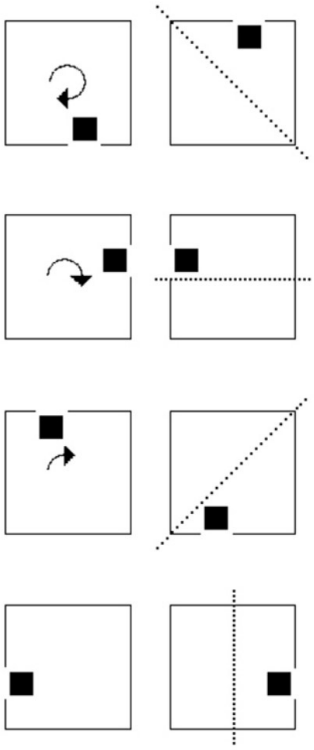
This example is compelling because it contradicts the intuitive assumption that people would prioritize absolute consumption instead of the human desire to fit in. In case B, the overall square footage is less but the closer relative size allows for a better social context. This result is aligned



The human desire to fit into cohesive environments (Frank 2005, 138)



Schindler Grid relating to human and building scale (Park 2018)



Axis of symmetry in a square (Park 2018)

Puebloe RIbera court repeated unit (Park 2018)

with environmental psychology that found more stylistically and physically cohesive environments are more visually appealing.

5.1 Modularity and Repeatability

A strong sense of community can be achieved, and the inherent flaws of individualistic construction can be overcome, by employing a modular and repeatable approach. This method will act to defacade the pretentious and authoritative principles of single family residential and facilitate a cohesive community. A standard housing unit will be designed and then repeated. Careful consideration needs to be given to the organization of these units. Modularity and symmetry can be important tools for organizing homes in a way that supports a sense of community. Rudolf M. Schindler explored these concepts when he used a grid of 64 cubic feet blocks within a set of repeated subdivisions (Park 2018, 336). This was chosen for two reasons. The first related to the human figures and the second related to the required dimensions of the dwellings (Park 2018, 336). He used to the grid to obtain 8 different symmetry groupings based upon rotations and mirrorings about the primary and diagonal axes. Consequently, symmetries are achieved in multiple directions. This symmetry can be seen horizontally in his St. Marks tower, and vertically in the monolith homes or the Pueblo Ribera court. The groupings and rotations allow for private spaces and still allow the community to function as a cohesive whole (Park 2018, 339). In summary the interplay of the repeated units and housing symmetry allows for spatial opportunities and compositional relationships to emerge. This also provides architectural continuity and a cohesive community which is in contrast to the more eclectic alternatives.

Pueblo Ribera compositional relationships (Park 2018)

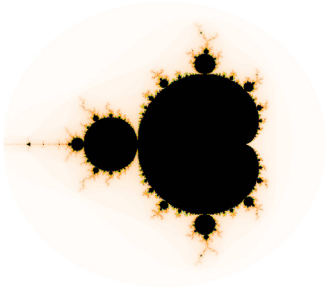
5.1.1 The Vancouver Special

The Vancouver Special is a repeated multifamily housing unit that establishes a strong sense of community amongst the families in urban neighbourhoods. Although each unit has an individual lot, it still manages to support interfamily relationships and is popular within multigenerational immigrant communities. The standard build and large size makes this design easy to finance, and it is consequently being used to provide affordable housing options (Labercane 2020). The layout is intended to house extended families or to use the extra lower floor for tenants that can help in offsetting a mortgage (Labercane 2020). These units are attractive to immigrant and working-class families as a way for them to achieve home ownership. The build allows the tenants to maintain proximity to important urban networks and remain close to the city core. The Vancouver Special exemplifies how a community centered modular design can support family values and aspirations.

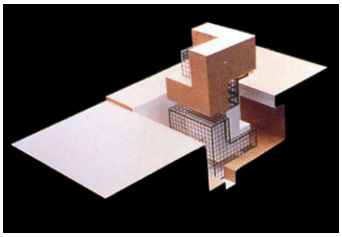
5.2 Fractals and Tessellation

Fractals are infinitely complex patterns that are self-similar across different scales. They are created by repeating a simple process over and over in an ongoing feedback loop

The Vancouver Special was an accessible multifamily typology in metro Vancouver. It was a counterpoint housing model as it was employed during the heightened nuclear family importance (Labercane 2020)



Mandelbrot set (Belma 2016)



11a house by Peter Eisenman (Belma 2016)

Both tessellations and fractals involve a combination of mathematics and art that relate to the distribution of shapes on a plane. Fractals are a specific tessellation that is scalable up and down where they typically have the same shapes no matter how enlarged they become (Belma 2016, 282). This is referred to as self similarity where one part resembles the whole (Belma 2016, 282). Tessellations and fractals that are self-similar have repeating geometric shapes. This is more famously seen in mathematical compositions such as the Sierpinski triangle or the Mandelbrot set. However, these concepts have been translated to architecture including façades, floorplans and masterplans. Fractals facilitate building plans or residential layouts that are easily scalable. This is exemplified on the interior of House 11a by Peter Eisenman and in the community organization of Ba-lla African villages.

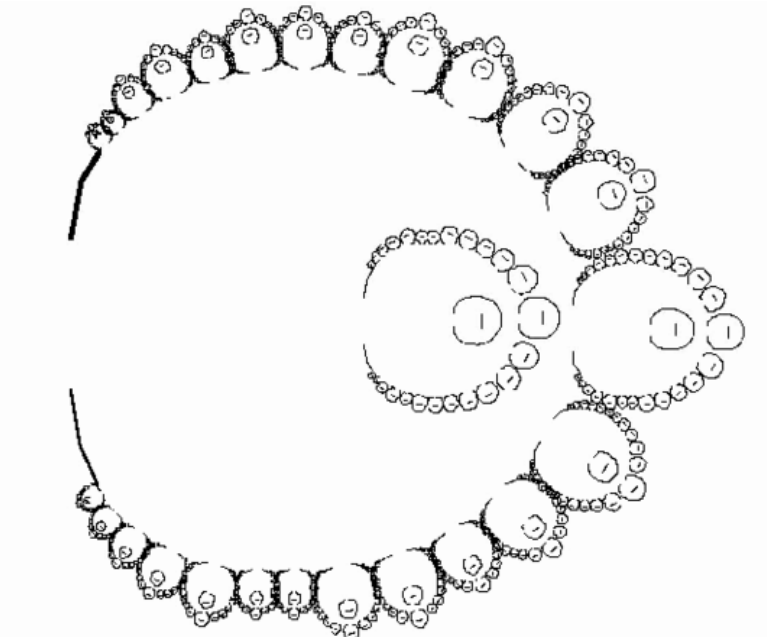
5.2.1 Ba–lla Settlement

In architecture, fractals and tessellations are most commonly seen in their two-dimensional form and mostly in the ground plans of buildings. Nonetheless, this concept is found in a wide range of architectural structures. These range from fortification plans to the organization of traditional Ba-lla villages. These settlements are structured around family rings, consisting of individual houses, which resemble the overall shape of the village (Belma 2016, 14). These ancient African settlements exhibit fractal characteristics. The European settlers found these complicated fractal arrangements as “primitive” when compared to their Euclidean geometry therefore rejecting the principles. (Belma 2016, 7). The fractal geometry of these villages exhibit several benefits in supporting communal living. The Ba-lla practiced an extended family system and the houses

were arranged around a ring-shaped livestock pen. The pen had a gate at the front and storage houses around it. The buildings became progressively bigger around the ring. A definite status gradient is thus established. The entire settlement is also a ring that constitutes of scaled housing units as described above. In order to understand its fractal characteristics, it is important to recognize that architects used a module as the main organizational element. In a sense, such an element can be understood as the metaphorical building block of the village. The method allows for an active and community centered design. By dividing a space into units, a subset of the space can be allocated to shared public interest. When these units are repeated, the combined shared spaces can grow and act as community activators.

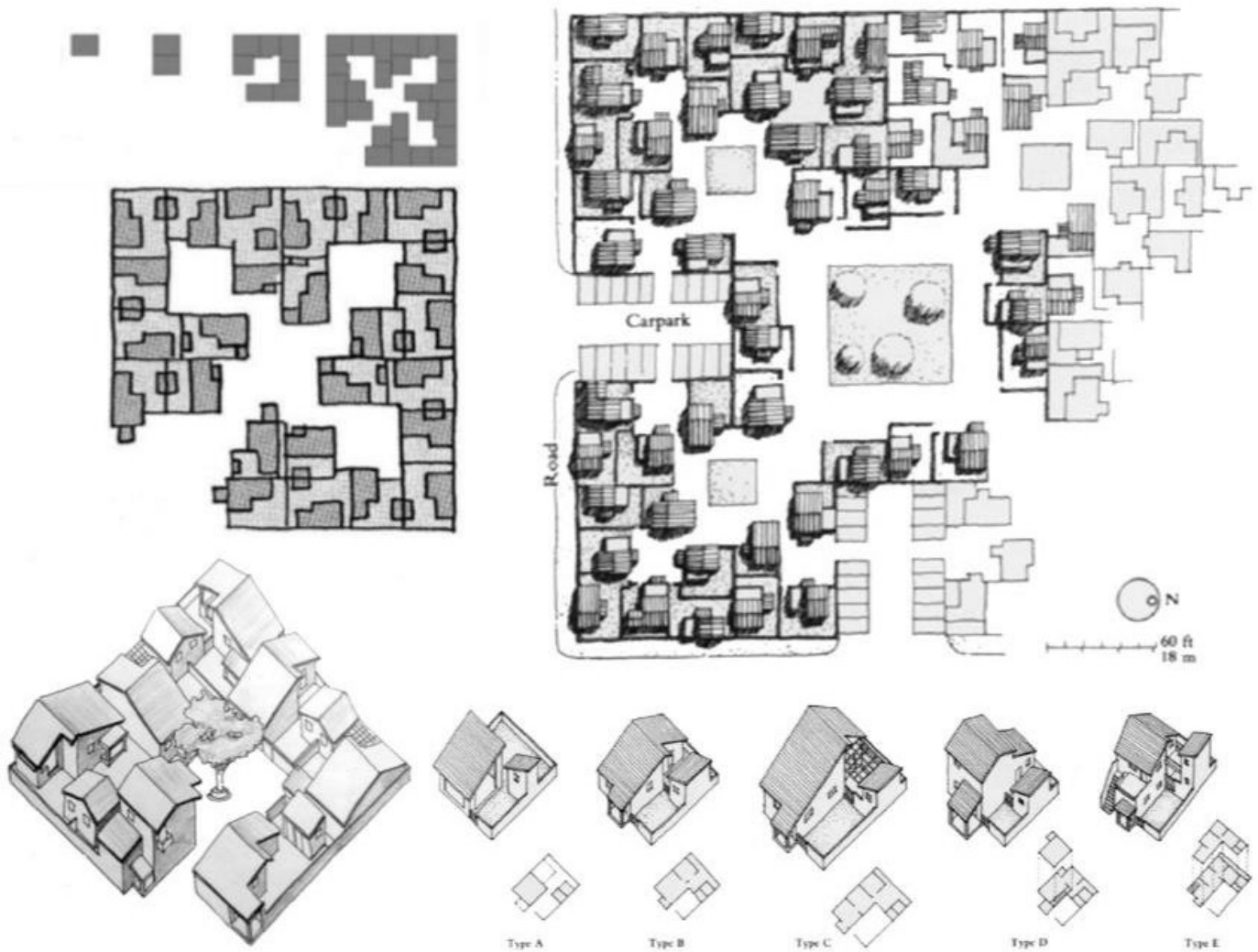
5.2.2 Incremental Belapur Housing: Charles Correa

Charles Correa was an Indian architect working in Mumbai, which had an ongoing problem of space shortage. As his



Using fractal based planning in Ba-lla settlement (Belma 2016)

work was focussed on unconventional solutions to density issues he designed a incremental system of housing focussed on individual plots for each dwelling that allowed for future expansion as necessary while accommodating a variety of income groups (RTF 2022). With this in mind he developed five types of dwellings that would occupy each plot according to lot size (RTF 2022). He used hierarchical open spaces to create a sense of scaled community. The smallest being the yard of each house, in which these were grouped in 7 and tessellated around a intimate courtyard of 8m x 8m (RTF 2022). With this 3 of these groups could cluster similarly creating a 12m x 12m space, then once again to make the ultimate community space of 21 x 21m (RTF 2022). Through book matching 2 of the 4 sides of each individual plot, this system could grow at an exponential rate as intended. The key takeaway from this project would scalable shared space and allowing the coming together of units permit more expansive shared spaces. The negatives would be that they still enforce the idea of a fence and individual principles on each lot. This is a great organizer for community space, however the design principles of what the infrastructure looks like on the individual lot and within the community spaces should be more thoroughly thought out to avoid infinite amounts of strict private space, and strict green space.



Cumulative community building scheme by Charles Correa. Through repeating a fractal unit, scalable community shared space can be created (RTF 2020)

Chapter 6: Designing for Community and Family

The prior analysis makes it clear that ongoing societal change has created a conflict between family structure and the modern housing paradigm. However, it remains unclear how this recognition can be incorporated into a new strategy for better designing for these communities. Wentling attempted to answer this question by identifying the key factors driving this societal change. The key factors that he identified were:

Household size: the average American household is shrinking. Instead of the need for a pure space, there is an emphasis on enhancing livability and comfort of the home.

Family structure: the traditional family is no longer the dominant family type. The percentage of single people, couples with no children, single parents, blended families, and unrelated people sharing a home has increased.

Employment: It has become more common for households to have both spouses working and sometimes extending their workplace into their homes.

Values: most families have two working spouses, resulting in a bigger emphasis on relationships with individuals and the family. Couples or parents spend at least half of the day working so the desire for connection with their household members becomes more important (Wentling 1995).

Trends suggest that the historical emphasis on maintaining privacy has resulted in a lack of community and an underutilization of landscape. There is a strong motivation to recreate a sense of community within suburban

neighbourhoods. This thesis proposes that this can be achieved by building repeating units for multigenerational living. These factors facilitate the pooling of resources which will improve the sense of community and provide more appropriate infrastructure at all stages of life. Over time, houses increasingly have blended internal and external spaces but only in a way that has remained entirely private. Consequently, a key challenge, related to improving community, is to design in a way that can blur public and private areas while still maintaining sufficient dwelling space.

Wentling divides the home into five components that are found in a typical American home and better meet the new needs of society:

Community

A comfortable and relaxed environment where members of the house can gather with one another in an informal setting. This is the space where families spend most of their time together such as the kitchen, breakfast area or family room.

Privacy

Although homes are usually shared with other members, each person needs their own space for alone time and privacy. A typical private space would be the bedrooms but can also be the office, den, or library. They are usually located away from community spaces.

Ceremonial

Entertainment is a large part of most American families, whether it is having friends and family over for holiday gatherings, a birthday party or sporting event. These spaces are usually the living and dining room.

Functional

The home must be operational and have room for all the behind-the-scenes functions such as the mechanical spaces, storage for household items and automobiles, clothing, tools, washer and dryer and other necessities.

Outdoor Component

The exterior of the home should reflect the members of the house. It should present friendliness towards the community and neighbourhood. Outdoor spaces are just as important as the interior spaces as they create a strong connection to nature and the surrounding community (Wentling 1995).

Cookie-cutter homes based on individualistic paradigms lead to feelings of isolation and are no longer practical. Lawns are an old tradition that no longer serve a purpose today, and we need to consider how we can use the landscape to its highest potential in a manner that benefits both the residents and surrounding community.

6.1 Planning for Multigenerational Lifestyle

Recent societal shifts have created more diverse family structures and incentivized multigenerational living. In considering multigenerational living, its useful to identify a discrete set of the stages of life. Peter Laslett breaks down the stages of life into four ages. The first age is childhood which is characterized by a period of “dependence, socialization, immaturity and education”. The second age is adulthood which is the “era of independence, maturity and responsibility, of earning and of saving”. The third is a time of “personal achievement and fulfillment”. Finally, the fourth age is “an era of final dependence” (Laslett 1991, 4). A housing module that supports all four stages of life is

needed as opposed to the past model primarily catering to the overlap of two. Through a housing model that supports all ages successful aging can be achieved for communal and individual wellbeing. From this model, communal needs can be dissected and addressed that can be shared amongst households in common spaces.

First Age

An infant, a toddler with a mother: Must include pediatric healthcare services, daily essentials, public transportation, daycare and social services, outdoor space for walking, social gathering, and playgrounds.

children pediatric healthcare services, activities outside school, sports facilities, babysitting, educational institutions, playing, studying, sports activities, and spending leisure time / hobby.

Second Age

Audults need convenient access to daily essentials, episodic services, like theater, library, public transportation between work and home, babysitting or pet sitting. Workspace, workplace at home, space for spending leisure time, sports activities and social gathering.

Third Age

Younger retirees need healthcare services, daily essentials, episodic services, public transportation, caregiving and housekeeping, space for walking, space to work at home, places of social interaction, places for a hobby, physical activity and space for family gathering.

Fourth Age

The dependant elderly need access to healthcare services, supporting activities of daily living and instrumental activities of daily living services, daily essentials, public transportation, caregiving and housekeeping, social gathering, hobby, physical activity, and family gathering.

Based on these four stages, the site needs to be in proximity to the city center as many of the goods and services needed are located here. Furthermore, the medium scale elements of communal necessities can be housed within the project. On the unit, a modular unit approach in configurable and adaptable to the family as it goes through changes.

6.1.1 Backyard Neighbourhood

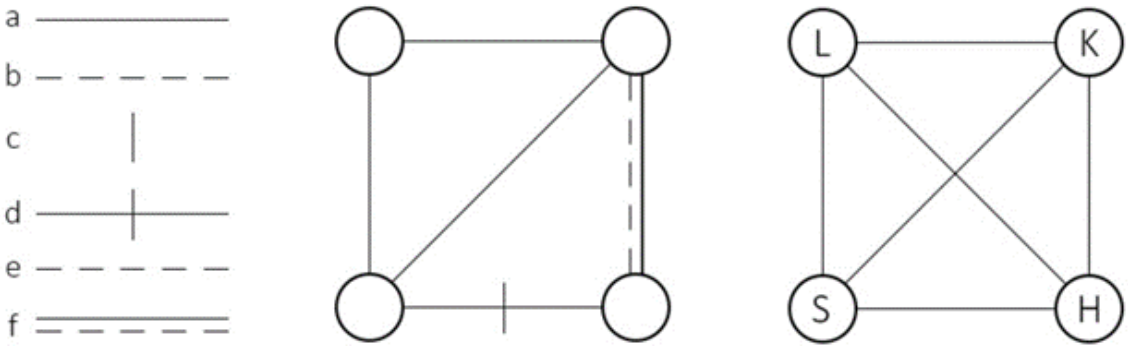
Linda Pruitt of the cottage company created pocket-neighbourhood communities which she termed the Backyard Neighbourhood approach. Whidbey island is an example of this design strategy where she incorporated three adjacent lots. In this space, she combined a compact single-family home and a detached backyard cottage. Two houses in one provides for multi-generational lifestyle choices. The design of these pocket neighbourhoods uniquely foster a sense of community amongst the residents. Rather than the typical “garage door” houses on a cul-de-sac of most suburban developments, the backyard neighbourhood was created by clustering two smaller dwellings on each separate lot and weaving them together with a shared alleyway. The 1200+ square-foot home on the front of each lot includes a light-filled main living space, two bedrooms, an office and covered outdoor space. The 425 square-foot “backyard cottage” offers significant lifestyle flexibility. Homeowners use this smaller space as an office, an art studio, a place for

an elderly parent, a starter house for an adult-child, a guest cottage, a rental or caretaker residence. Ultimately, it gives the residents flexibility and choice.

6.2 Physical Control and Functional Frame: Designing for Frictionless Living

Backyard neighbourhood brings the public realm into the back yard of a subdivided lot through additional housing and circulation (Parolek 2020)

When a house contains multiple individuals in the same environment, it must permit individual success for each inhabitant in their individual tasks and communal interactions. According to Christian Norberg-Schulz, the purpose of architecture is to give order to certain aspects of our environment. As such, architecture controls and regulates the relationship between humans and their environment and creates a meaningful frame for human activities (Norberg-Schulz 1992, 112). These qualities are summarized as physical control and the functional frame. The physical control is the creation of an artificial climate. By



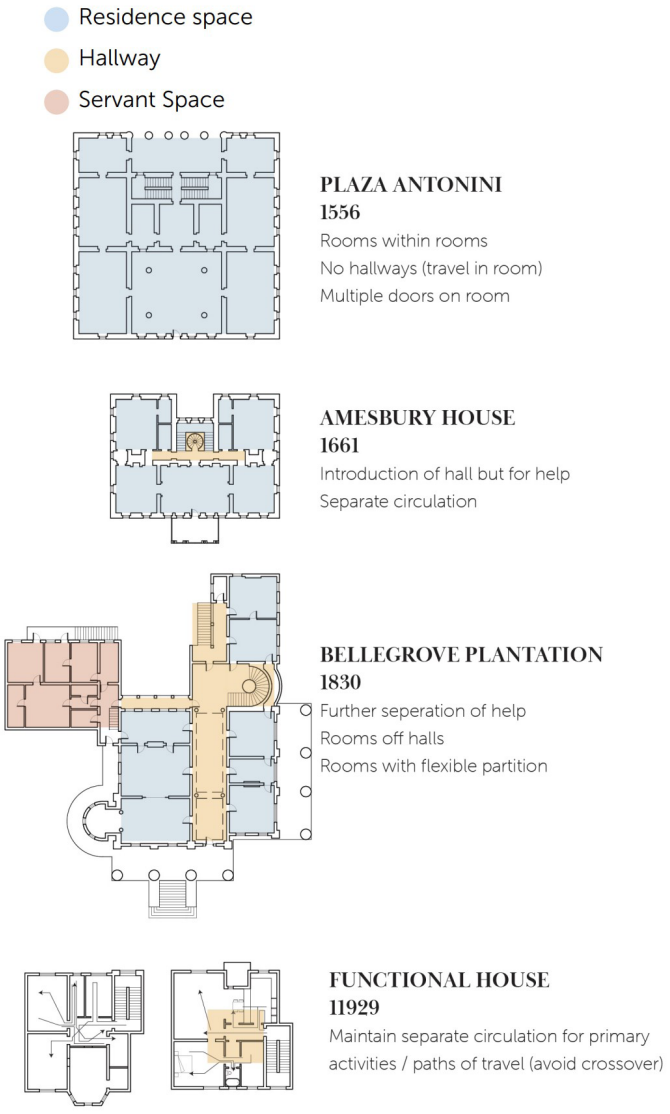
Diagrams of physical control and the functional frame. (A) Symbols designating (a) a connector, (b) filter, (c) barrier, and (d-f) switches. (B & C) Functional zones of a simple dwelling. L – Living, S – Sleeping, K – Kitchen and H – Hygiene. (Norberg-Schulz 1992)

using walls, doors and windows, architecture is protecting humans against environmental influences such as climate, light, sound, smell, etc. However, it also depends on the human activities and interaction with that building. Hence, the building itself is the functional frame for human activities (Norberg-Schulz 1992, 112). To explain these aspects further, Christian Norberg-Schulz coined the terms filter, connector, barrier and switch. A connector is a means to establish a direct physical connection. A filter is a means to make the connection indirect and controlled. A switch is a regulating connector, and a barrier is a separating element. For instance, an opaque wall is a filter to heat and cold and a barrier to light. Doors and windows can be characterized as switches because they can stop or connect at will (Norberg-Schulz 1992, 114). These functionalities allow humans to meaningfully pursue their desired activities.

6.3 Development of Floorplan

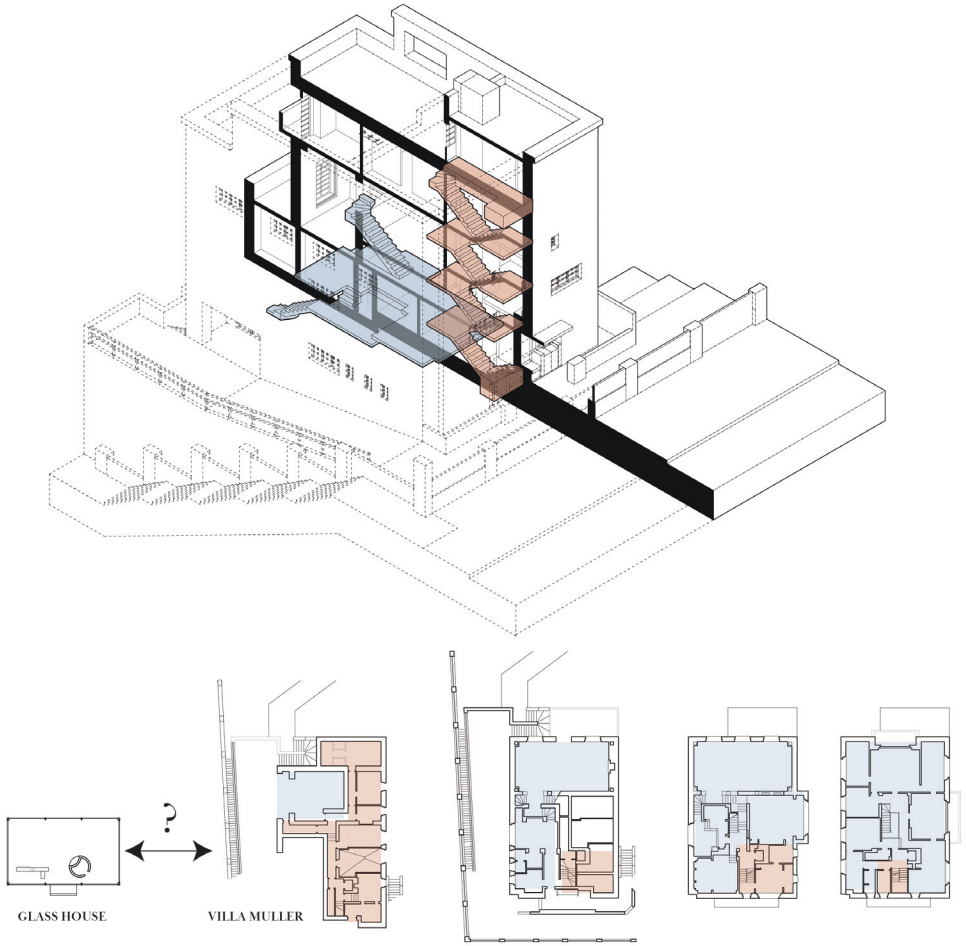
In his thesis figures, doors and passages, Robin Evans explains that an architectural plan describes the nature of human relationships through recording elements like walls, doors windows and stairs (Evans 1997, 56). Like the work of Norberg-Schulz, this concept is a useful design tool and

can help in tracking the historical development of floorplans. For instance, hallways used to not exist, and travel occurred directly between rooms as is seen in the Plaza Antonini constructed in 1556. Hence, there were multiple doors within each room for travel (Evans 1997, 62). Hallways were eventually introduced in order to keep staff and servants out of site in the Amesbury House. Eventually, these hallways became functional too all the inhabitants and became the key method of circulation.



Circulation as it relates to inhabitants and program (Evans 1997, 62)

Alexander Klein presents a related case study in the functional house. He describes that the circulatory paths are separated based upon function. Different inhabitants can simultaneously perform different tasks without overlap, and this helps them to achieve frictionless living (Evans 1997, 85). Combining this concept with the physical control and functional frame strategies can allow for frictionless living while maintaining a sense of community within the house. It's important to understand the degree to which the inhabitants need to be separated or connected. Extreme examples range from an open plan glass house to the organizational case study of the Villa Muller which was successful at maintaining ultimate separation between the inhabitants.



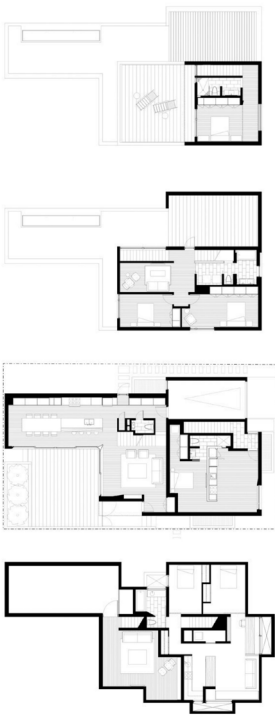
Circulation in the Villa Muller to separate individuals within the same dwelling (Evans 1997, 85)

6.4 Multigenerational Application Case Studies

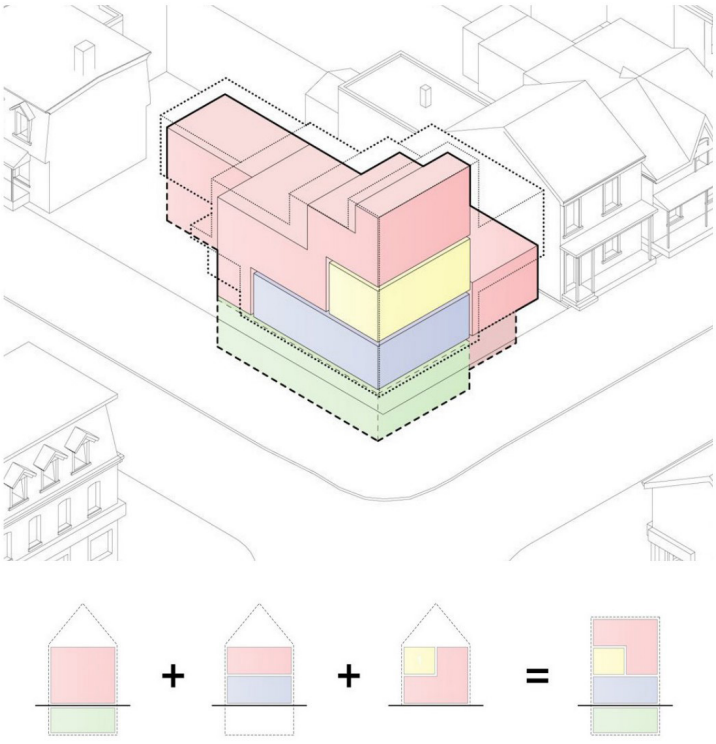
This thesis explores two case studies in modern multigenerational Canadian living. The first is the grange triple-double by Williamson-Williamson in Toronto, and the second is the full house by the Leckie Studio in Vancouver.

6.4.1 Grange Triple Double

Williamson-Williamson offer an important case study related to multigenerational living. Their Toronto homes merge typologies in order to reflect the financial realities of the inhabitants. In order to address a similar economic crisis as the one described in Vancouver, they “stack[ed] rental units, a bed sitting-rom, and a single-family home” (Williamson 2016). They formatted the design around a young family seeking home ownership in the city. The important advancement over standard single-family homes is that this design can evolve in tandem with the family dynamic. This



Combining unit typologies into one (Williamson 2016)

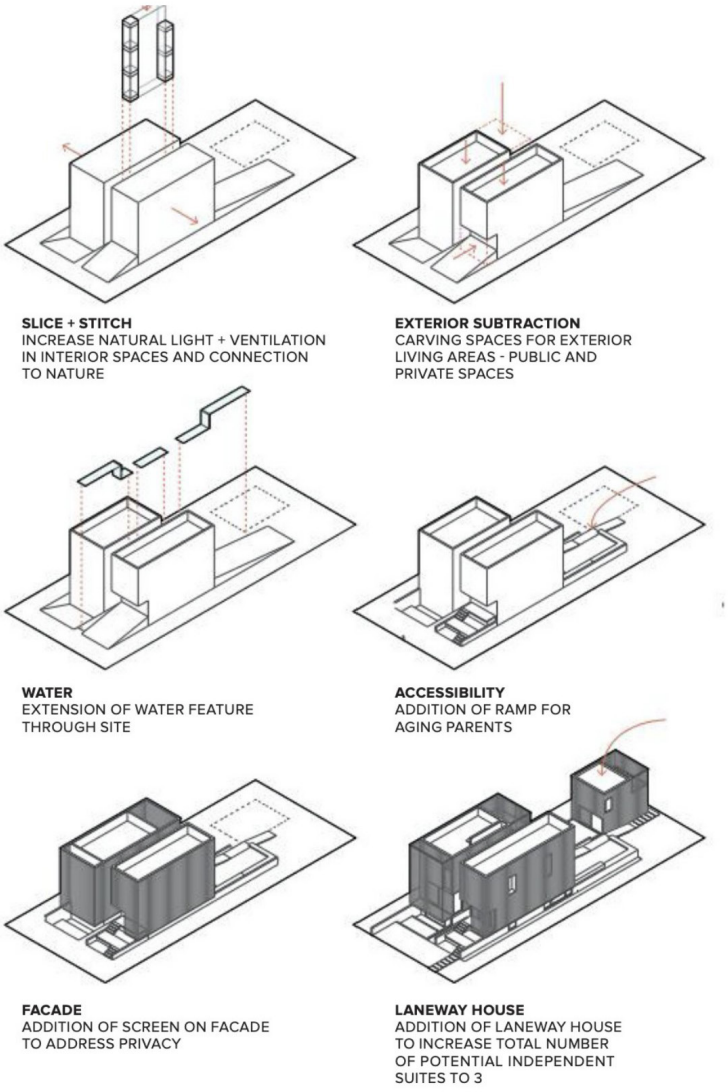


Combining unit typologies into one (Williamson 2016)

plan sacrifices the open floorplan in order to better support a dynamic family structure. The critical flaw of this iteration is how compartmentalized the plan structure gets, and how it remains frozen in the individual unitized state.

6.4.2 Full House

Another modern example of multigenerational living is provided by the Leckie Studio. Their Full House is a multigenerational housing typology developed for a family in Vancouver. How this group responded to the Vancouver



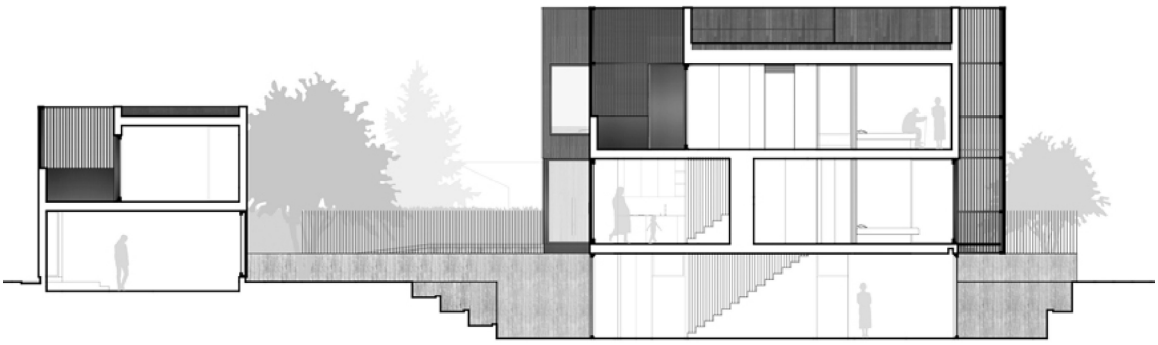
Providing a multigenerational framework in the urban core (Leckie 2021)

economic and social pressures is insightful for the goals of this thesis. The home caters to parent and adult child living arrangements. The home is comprised of five bedrooms with a one-bedroom laneway. The dwelling is reconfigurable to operate across a variety of traditional program scenarios through the orientation of a pivot door. They identify three different operational scenarios:

A. Two discrete dwelling units: one three-bedroom suite and one two-bedroom suite

B. Two discrete dwelling units: one four-bedroom suite and one one-bedroom suite

C. One large multi-generational home: one five-bedroom suite (with grandparents).



Cross section relating the home to the urban landscape (Leckie 2021)

Chapter 7: Site

7.1 History

The reality in most cities is that their planning and regulatory systems are barriers to delivering housing choices that communities need (Parolek 2020). Density- and use-based planning and zoning were established to separate uses and create suburban environments. This makes it difficult, or impossible, to mix forms, uses, and types that result in walkable, mixed-use neighbourhoods. These would be like the ones that formed organically before zoning was commonplace in the United States before the 1940s (Parolek 2020).

Zoning study in metro Vancouver (census data 2020)

Cities have attempted to address these issues over time but have often failed and sometimes made the problem worse. For example, in the 1970s many cities began to make changes in the zoning of single-family neighbourhoods that were adjacent to the downtown in order to allow for higher population densities. However, the ineffective regulations led to most new housing being out of scale, poorly designed, and poorly constructed. This in community frustration. In most cities, the backlash led to dramatic downzoning as well as the creation of historic districts to protect those neighborhoods. Most cities still have not recovered from that misstep in planning and zoning (Parolek 2020).

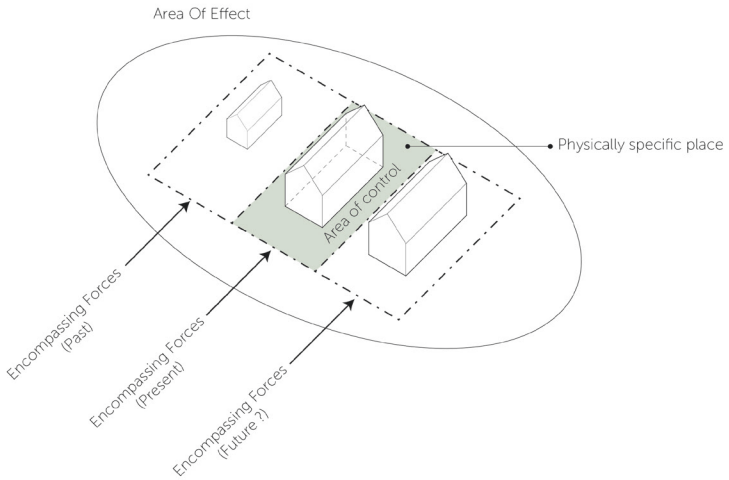
After mapping all of Vancouver, Shaughnessy was identified as an appropriate area to test this thesis because of its suburban qualities within city limits. This neighbourhood has excessively large lots and houses compared to surrounding neighbourhoods and has a low population density. Further,

most of the houses were primarily built between 1900 and 1970 so they will soon require intervention.

7.2 Single Family Residential Intervention

> It's important to consider how nostalgic elements of the past are replaced by, and can be incorporated within, contemporary design. Preservation is not simply the saving of old things, but the maintenance of a response to those things. (Lynch 1976, 53)

This response can be transmitted, lost, or modified… surviv[ing] beyond the real thing itself [and] we should expect to see conflicting views of the past, based on conflicting values of the present (Lynch [1973] 1976, 53). This recognition of the past, and the various ways that the past is perceived, is important to consider when planning a housing intervention. The city of Vancouver has recognized this conflict within their residential zoning despite the public calls to increase density. This is most clearly notable in the zoning for RS-1 (most dwellings) and that of historic Shaughnessy. Both zoning bylaws leave room to practice the previously discussed design concepts.



Understanding the area of effect beyond the property line (Burns 2005)

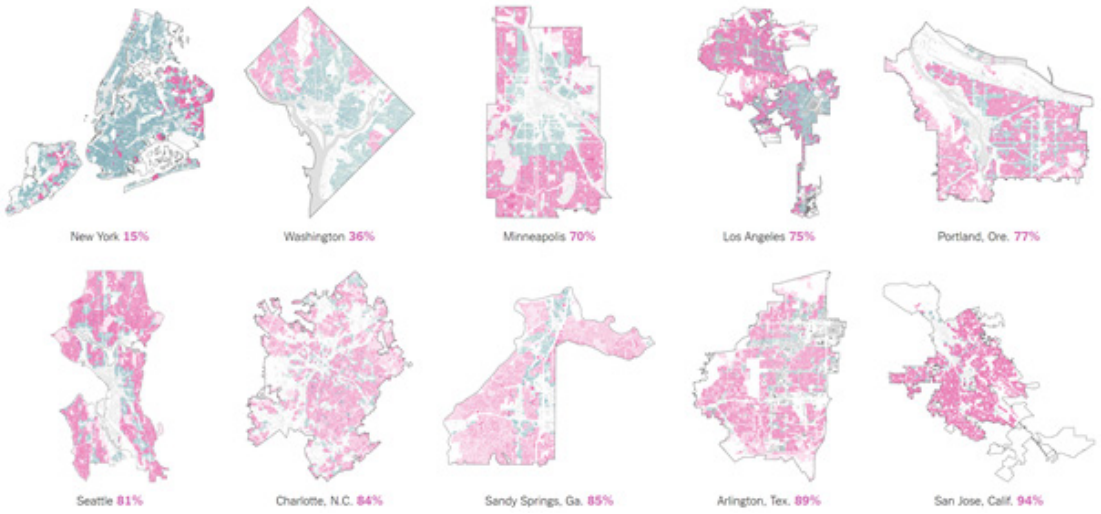
7.2.1 Comparative Zoning Study

There is a paradox going on in North America. People still fantasize about owning a detached house with a garage and a yard as a symbol of success, but urban areas are struggling to house a growing number of residents.

To make cities more affordable and accessible, many government officials and urban planners have started rethinking the detached-home-only zones. Minneapolis ended single-family zoning in the whole city last year. The state of Oregon recently terminated single-family zoning in all municipalities which as the most radical strategy in the United States. (datalab 2019). The New York Times' data journalism column The Upshot quantified and visualized the single-family zonings in 10 United States cities in order to shed some lights on how zoning impact housing in the cities (datalab 2019). This is shown below in the figure below.

7.3 RS-1 Zoning

The downtown Vancouver core has been densifying for a while now and the city is actively aware of the inventory of single-family residential within the city limits. This tracking



Impact of zoning on single-family housing in 10 American cities (Datalab 2019)

has resulted in bylaw adjustments that advocate for increased density within RS-1 zoning. The goal is to address the middle-class housing gap and to supply appropriate housing for Vancouver needs. The previous regulations permitted secondary suites, laneway homes and character infill (City of Vancouver 2015). The new regulations are now permitting the addition of a duplex on the property with, or without, a secondary suite (City of Vancouver 2015). This would increase the density by a factor between 1.3 and 2 within the property lines. This is an attractive approach for increasing density, improving affordability and maintaining the individualistic demeanour within the property line. However, the approach does a poor job at addressing a lacking sense of community and it continues to waste space between the properties. This is evident on aerial views of areas that have already undergone this transformation. The images demonstrate an eclectic organization of the house, townhome, garage, laneway, etc. The lot space itself is constraining the effective use of other shared spaces in the neighbourhood and these ultimately become dead space.

7.4 FSD-1 Zoning

Now returning to Shaughnessy, it has become part of the heritage conservative plan. Although some people perceive this project to be a developmental hindrance, a closer examination of the site characteristics and zoning reveals certain key opportunities. These regulations primarily apply to homes built before 1940, and they aim to maintain the historic nature of the suburb. However, they also understand that there is an ongoing need for intervention, so they allow for building modifications and incentivize multiple conversion dwellings, coach houses and infill through increasing the

floor area ratio (FSR) allowance on site (City of Vancouver 2018).

Shaughnessy is the first Heritage Conservation Area (HCA) in Vancouver, and it is a trial for other HCA development plans in the future. These lots are categorized between small, medium and large and this zoning can facilitate multiple families on the same lot. They also exclude in the basement in the FSR calculation which allows that square footage to support the increasing population density (City of Vancouver 2018). For example, on a medium lot with a gross floor plan of 8030ft2, an extension could be built increasing that area to 11930ft2. This results in an increase in the allowable living area of 3900ft2 or 48.6% (City of Vancouver 2018). Because of the intriguing bylaw incentives

Shaughnessy new zoning opportunities for increasing density (City of Vancouver)

and suburban quality of this neighbourhood, Shaughnessy is a well-suited area for this thesis. It is a viable location for establishing a community nucleus that will support the transition to a denser and more cohesive community by blurring the private and public spaces.

7.5 Selected Site

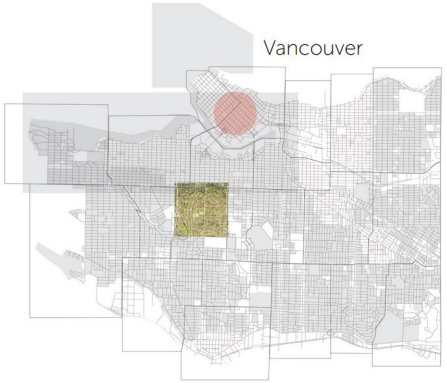
The organization of Shaughnessy ignores the typical urban grid and follows a more fluid circulation pattern. Consequently, it has many more suburban qualities than the adjacent neighbourhoods. Shaughnessy park is located at the heart of the community, and it creates spatial separation between the neighbours. The associated road intersects

Development of “suburban” Shaughnessy compared to a typical urban residential (Datalab 2019)

all the major neighbourhood arteries, and that makes this park an ideal location to test the idea of suburban nucleus housing.

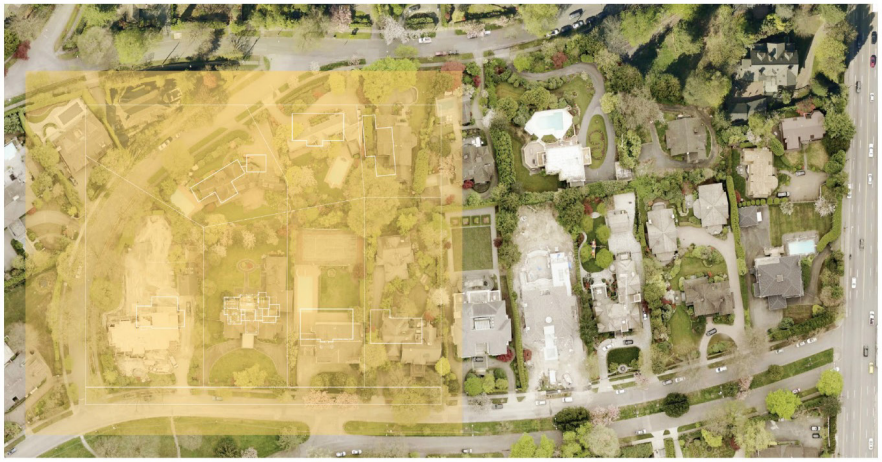
Despite its green space, this park is underutilized because it lacks any infrastructure that supports any sense of community. The yard it provides is redundant with the large private property yards in the neighbourhood. The space is comprised of dispersed trees, grass and a single footpath. Despite the lack of current utility, it could be transformed into an important community space through strategic architectural intervention. The resulting community nucleus will act as a catalyst for further transformations to nearby multiple conversion dwellings. A single lot will be transformed based upon the same principles used in the design of the community nucleus. Transformations will be done conscientiously between neighbouring lots in order to support community cohesion. Eventually, distinct property lines will blur and cease to exist. As the zoning bylaws continue to change, there’s a motivation to introduce a new design strategy that can grow and adapt alongside them.

Through mapping Shaugnessy is an appropriate area to test this theory for its suburban qualities within city limits. With excessively large lots and houses compared to surrounding neighborhoods and its lack of density. With the houses primarily built between 1900-1970 they are getting to an age that calls for intervention.



80% RS-1 Zoning In Metro Vancouver

Meandering roads and underutilized space



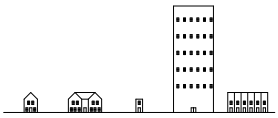
Site Two: Existing Block

Site One: Central Hub

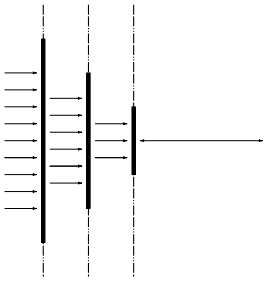
Shaughnessy is a good site to demonstrate our solution. Metro Vancouver is 80% single-family zoning. In particular, the old-wealth neighbourhood of Shaughnessy is a prototypical example of the traditional community that we've discussed previously. The homes are increasingly unaffordable to the new generation and there is a lost sense of community. The city struggling, through a patchwork of zoning laws, to accommodate the increasing population density. This outdated suburb is due for intervention. We'll examine two sites. First, a large undeveloped plot at the center of the community, and secondly, a block with existing infrastructure. Both being underutilized landscapes.

Chapter 8: Design Strategy

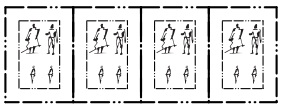
To provide an architectural model that realigns the single-family home with the needs of the modern family we must establish a design strategy that can be applied to all scales of inhabitation starting at the micro scale of the unit and scaled up to both the cluster and then the community.

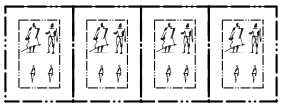


Individualistic

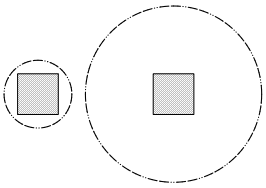


Inaccessible





Divisive



Non-Adaptable

The Current Principles: The existing single family housing model is based off of outdated principles that hinder community and family

8.1 Design Principles

This thesis will focus on four key design principles to provide an improved housing model for the multigenerational middle-class families. The four key design principles are adaptability, accessibility, communality and scalability. First, it must be adaptable to a diverse population and be flexible enough to remain adaptable throughout the family lifecycle. Secondly, the housing must be economically accessible and sustainable within contemporary suburbia. Thirdly, the project will employ a community centered design to cater to the complex dynamics of modern living. Finally, the resulting design should be scalable in a manner that can grow and be repeated.

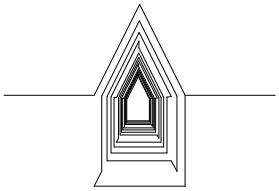
8.2 Cross Scale Application

8.2.1 The Unit

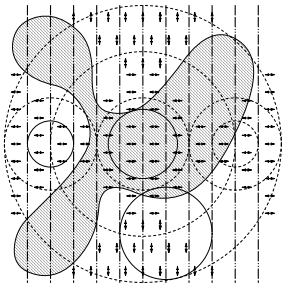
Adaptability

This project strives to provide an adaptable and seamless living module for multigenerational living, and each application starts at the scale of the unit. This is done by creating dynamic intimacy gradients that can be manipulated and adapted to meet the needs of the specific user. This ensures that people can remain throughout various life stages and different needs. It will also help their community

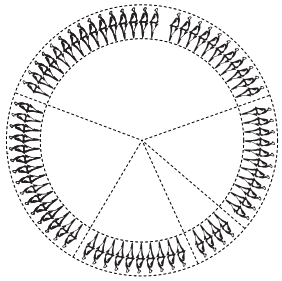
to grow greater bonds and social connection. By designing a single housing model with several typologies, the unit itself can be uniquely subdivided to meet the needs of a particular family.



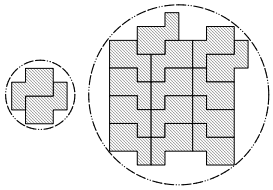
Adaptability



Accessible



Communality



Scalable

The New Principles: The proposed housing model is based off of principles that encourage community and family centered environments

Accessible

Accessibility refers to both fiscal and physical aspects. Financially, the unit itself can be composed in a way that is financially accessible to different users. This could involve facilitating multigenerational housing or by allocating space to renters in the areas underutilized by the owners. Physically, the units will be usable by various different family structures.

Communality

Community focused design is at the heart of these units. They invert the traditional housing model by placing the community at the center of the design process and this starts with the active public yard. The public-facing elements of the residence are positioned towards this central public yard. Shared elements like entries, circulation and leisure quarters also remain adjacent to this central node. As a result, the most intimate and private spaces are centered around the public spaces. This organization helps to correct the façade facing the street in contrast to the inauthentic façade of traditional single-family housing. Interaction with the external community is maintained through selective openings. Overall, the units allocate one-quarter of the space to the public realm which at this level is the public yard.

Scalable

Family composition inherently changes over time. The primary living unit should be able to scale proportionately with the family in order to provide adequate space. The organization of the different unit typologies allows for their strategic division or combination in order to meet these changes. The flexible unit scaling will support frictionless living for the inhabitants.

8.2.2 The Cluster

Adaptability

Each unit is designed to permit a form of tessellation because these units can be combined to create functional clusters. By creating symmetry groupings, different spatial transformations are applied which allow the clusters to perform context specific functions. Hence, each module can be adapted to meet and arrange of site-specific needs.

Accessible

Just as with each unit, resources can be pooled at the level of the cluster to facilitate improved financial accessibility. Fiscally, this provides a larger more meaningful space which can be noted in the larger yard and sharable amenities such as a rooftop deck, barbeque, community garden or a public entrance. Physical accessibility is also enhanced through shared public entry and circulation routes that create meaningful exposure to others.

Communality

This design that is focussed on communal activities. The clusters are internally facing in order to activate community. Social corridors are intentionally placed to provide meaningful

interactions amongst the users. The inward facing units allow for semiprivate spaces that safeguard sensitive areas by distancing them both horizontally and vertically. The units work together as a cohesive cluster which helps to defacade the individualistic nature of standard single-family homes. Because the system is based on a fractal pattern, this clustering is functional at multiple scales. This fractal provides increasingly larger opportunities for community and semipublic amenities. For instance, these amenities could include a shared co-workspace or a community café.

Scalable

The system is intended to continuously grow in response to the local demand and population density. The design of the clusters themselves is modular and intended to be repeated whenever possible in order to facilitate this continual growth.

8.2.3 The Community

Once the clusters are repeated enough, they then act as a cohesive community. This community will provide sufficient living space for all the inhabitants while also meeting the broad needs of a multigenerational community.

Adaptability

At the scale of the community, these building designs include spaces that are entirely public. Further, because of the modular nature of the housing, these public spaces can be adapted to various group sizes and local demand. Within a network of more rigidly programmed spaces, the public spaces will include flex rooms and spaces that can be adapted to a user specific task.

Accessible

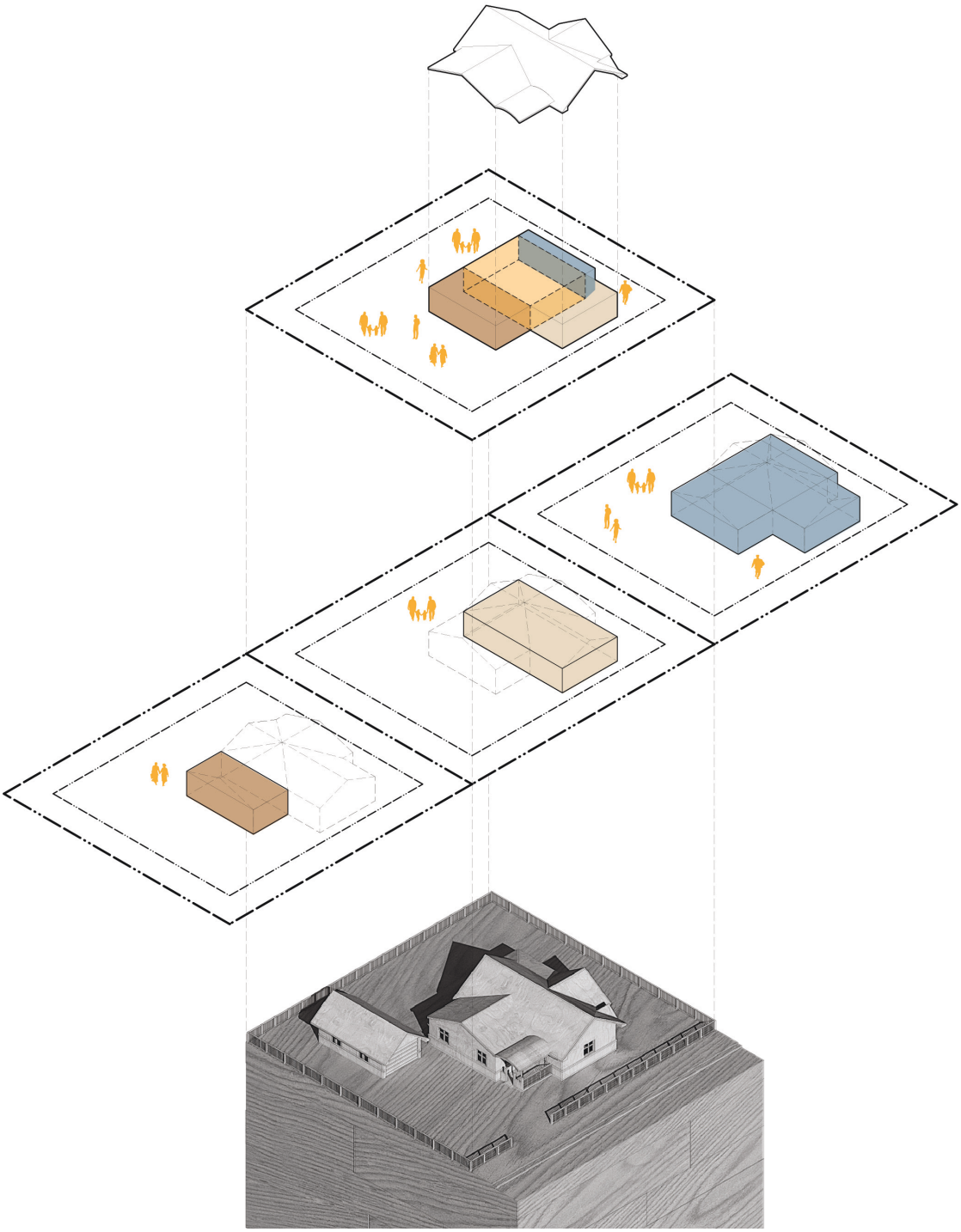
Accessibility throughout the community is achieved through a seamless circulation pattern between the individual units and clusters. This includes circulation between the shared elements like change rooms, stairs and entries. Further, residents now have easy access to significant community resources like gyms, pools and childcare. This is the level of the largest public interaction.

Communality

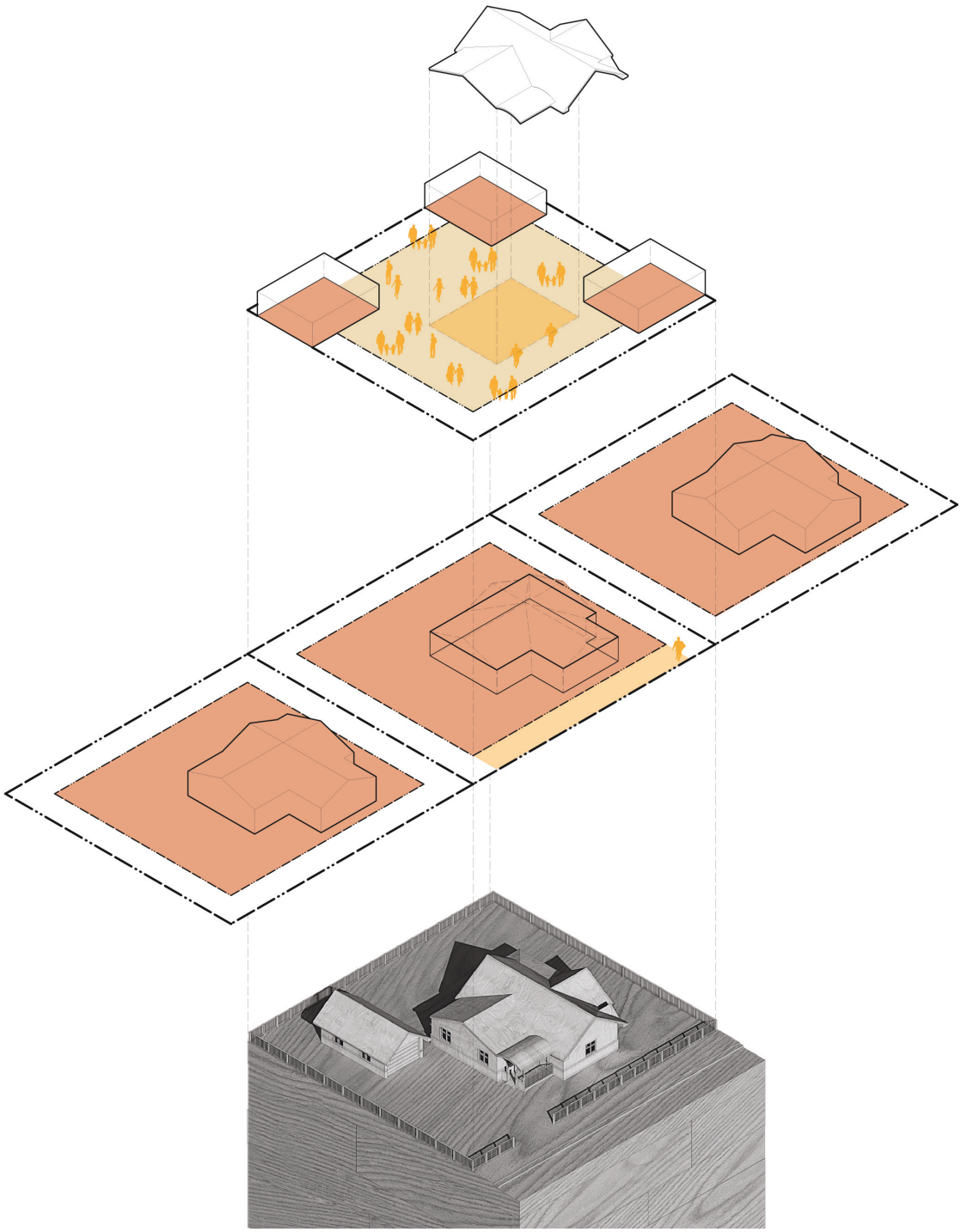
At the largest scale, this housing design provides spaces that act as community activators. These spaces encourage active environments and help to foster meaningful social connections. The semi-public and public spaces also provide the opportunity for social programming. Overall, these spaces help to encourage a sense of community. In contrast to the single-family home, these public centers provide a façade geared towards social cohesion as opposed to individualistic status.

Scalable

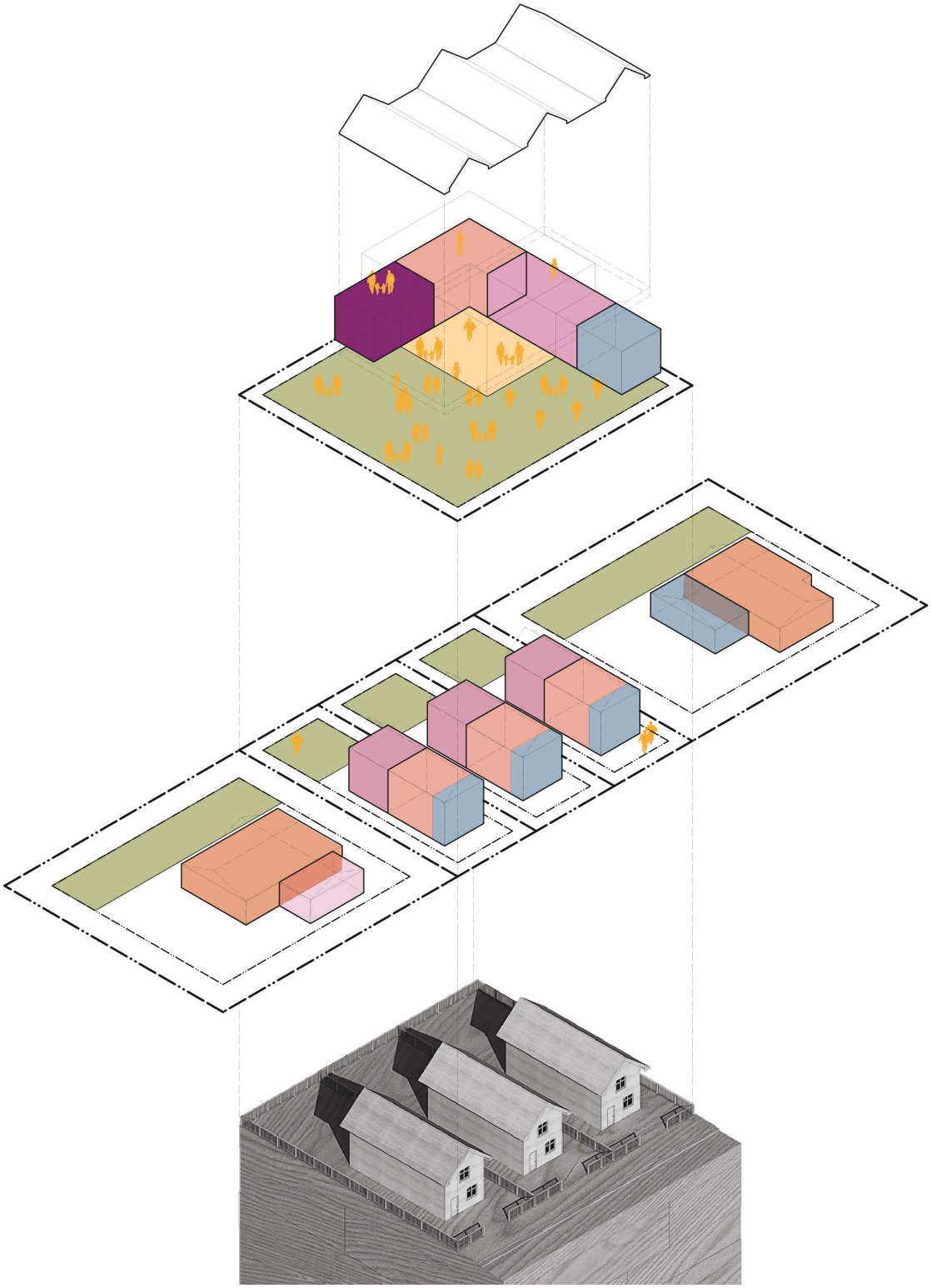
As the system continues to grow, it inherently creates larger spaces that can house unique programs and housing types. The scale at which the system grows is reflective of the surrounding environment and controlled by the social pressures. The fractal nature of the allows the strategy to remain responsive and scalable to these local social pressures.



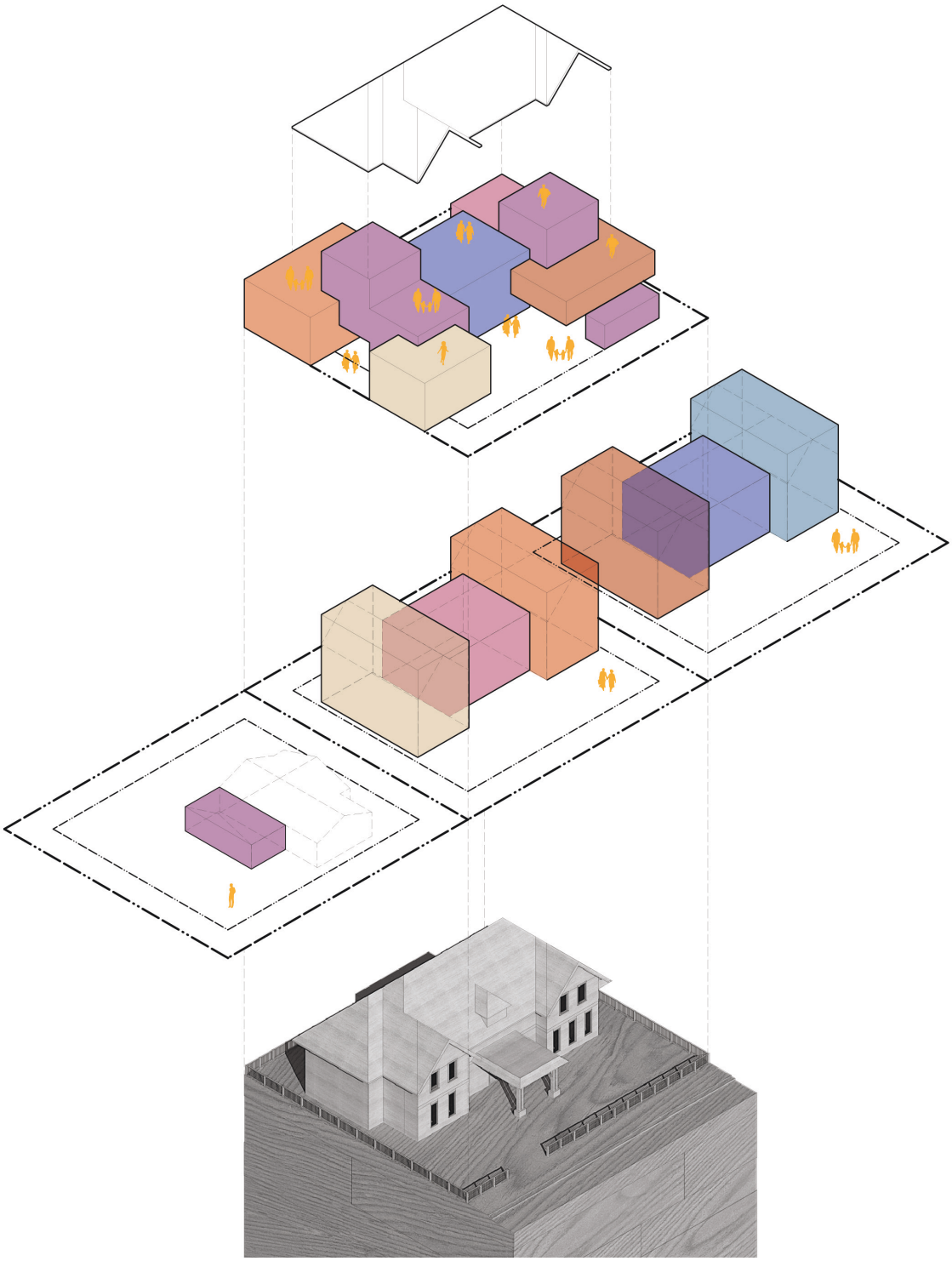
Adaptability: Currently, when a family goes through changes, the house is incapable of responding. This could involve elders moving in for support or young adults leaving the nest. People must move or live in an improper space. We need a model that can adapt with the family.



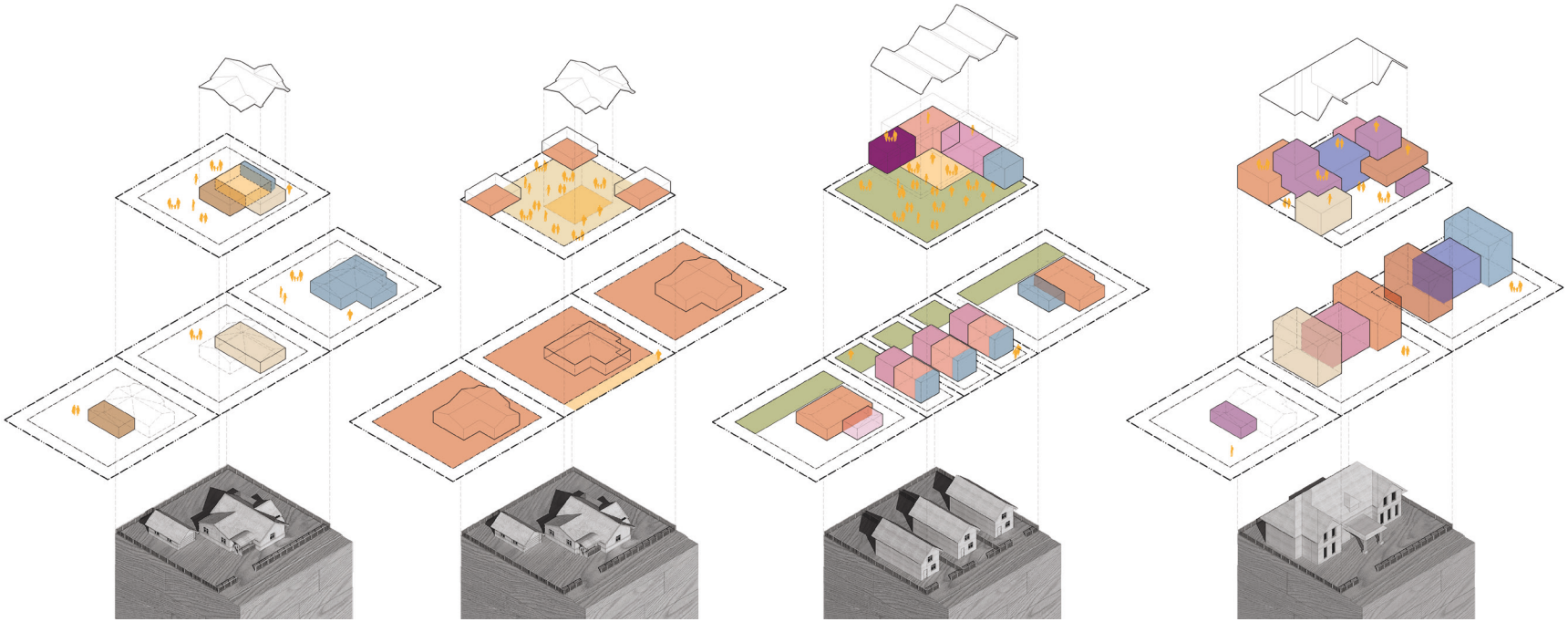
Communality: The traditional model privatizes the spaces and cuts families off from the greater community. However, community is an increasingly essential resource for modern living.



Scalability: The current model is divisive, and now even more so as population density increases. This limits people’s space and their quality of life. We need a new form of scalability that is additive and collaborative.



Accessibility: Under the current paradigm, these homes become increasingly valuable but are also more unaffordable for most middle-class families. A new model is needed that can offer home ownership to a new generation, meet the value of the land and provide high quality living.



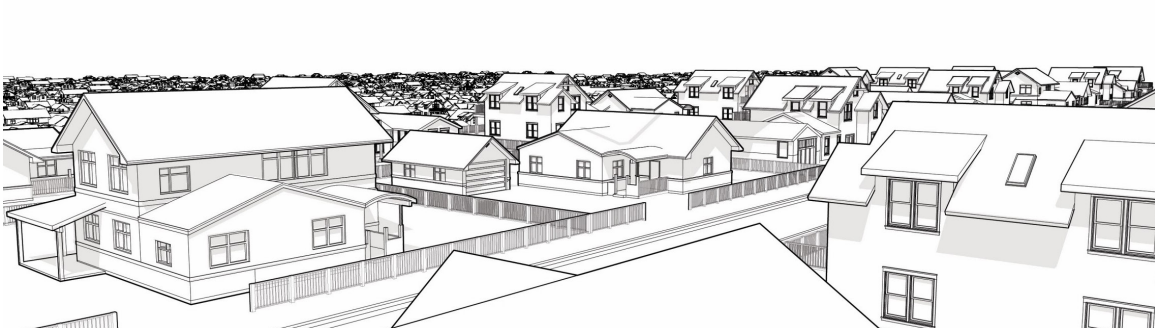
The design principles for the new housing model as derived from the inherent downfalls in the existing housing model. To accommodate the modern family, a new form of residential needs to be adaptable, community-centered, scalable, and accessible.

Chapter 9: Design

This chapter outlines the proposed design and details how the architectural choices are motivated by the design principle. In turn, the discussion explains how this new typology can act overcome the limitations of single-family housing and better meet the needs of contemporary families. First, the architecture of the single-family housing model will be discussed in terms of how it connects back to the social limitations that were previously mentioned. Next, the design principles outlined in chapter 8 will be applied in order to generate a new typology which better meets the social needs of modern living. First, an example of repeated horizontal housing is shown in order to demonstrate how this fractal design structure can facilitate community, scalability, accessibility and adaptability. Next, this same typology will be extended to retrofitting pre-existing homes in the neighbourhood through a unit termed the Latch. This application of the design principles exemplifies that this new typology can be integrated into existing neighbourhoods in order to support community. Finally, an alternative design of the same typology will be outlined where the repetition occurs in the vertical, as opposed to horizontal. This example will highlight the versatility of the typology and how it consistently meets the design principles even within different contexts. Overall, the design will show that an application of the four key design principles allows for a repeating typology solution that overcomes the limitations of the antecedent single-family housing model.

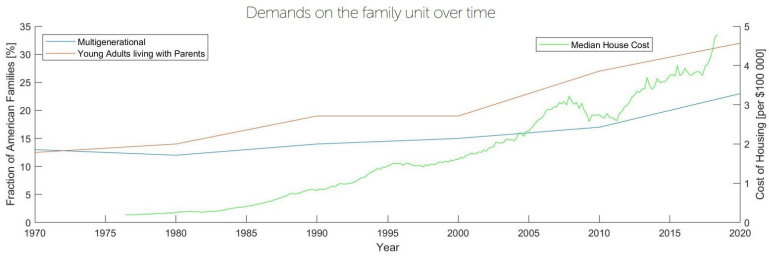
9.1 The Antecedent Model

Before addressing the solution, it’s worthwhile to take a closer look at the architecture of single-family housing



Sprawling suburban communities litter the urban core and continue to spread. The houses are familiar, designed for the ideal of a nuclear family. Despite the whole of the community, each house stands as a monolith and acts as a unit in isolation.

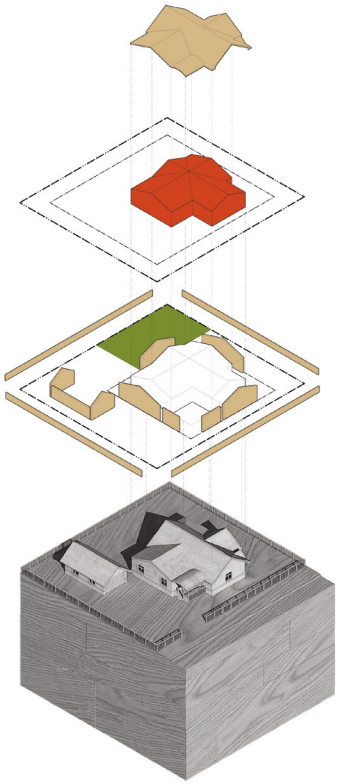
The problems of the suburb are only growing, but at the end of the day it comes down to the level of the house. This module is the unit at the root of the issues. We must ask ourselves if this accepted typology is meeting the needs of contemporary families and, if not, how can we rethink it to do better.



Since the 1970s, the proportion of multigenerational families and young adults living at home have been steadily increasing. The capitalistic reality of these traditional single-family homes means that their value has only increased exponentially. The house design has stagnated creating an increasingly divergent model.

along with its associated limitations. Single-family housing is the antecedent design style that this thesis is proposing to replace. Architecturally, it is designed on the principles of individualism, consumerism, inauthenticity and stasis. These qualities have insufficiently adapted to the needs of modern living and can be shown to be a direct result of the building design. Further, the design creates a sense of isolation and prevents establishing a sense of community for the inhabitants. The case example of a generic single-family home is discussed in order to highlight these limitations. An example of a single-family house with the front lawn and the side lawn highlighted. This yard structure is common within this housing typology but it poorly serves community. The front yard is a private space that works to distance the house from the street. In doing so, the house lacks public access and becomes entirely private. The isolation of the house is worsened by a series of thresholds which could include gates, a driveway or the front door. Even the internal rooms become increasingly private and guarded spaces. Ultimately, this contributes to the isolation and lack of community seen in this design. Further, the side yards highlight the poor cooperation between adjacent lots. They are entirely private spaces but are too small to engage in meaningful living. These spaces are often dead and underutilized. Also, this dead space acts to divide neighbours which further contributes to solitary living. A more community-oriented approach that allows these dead spaces to work collaboratively could help to activate community and provide more resources to all homeowners. Single-family housing is designed to include a front-facing façade which projects a message to the community. This message is based in a consumeristic culture which values

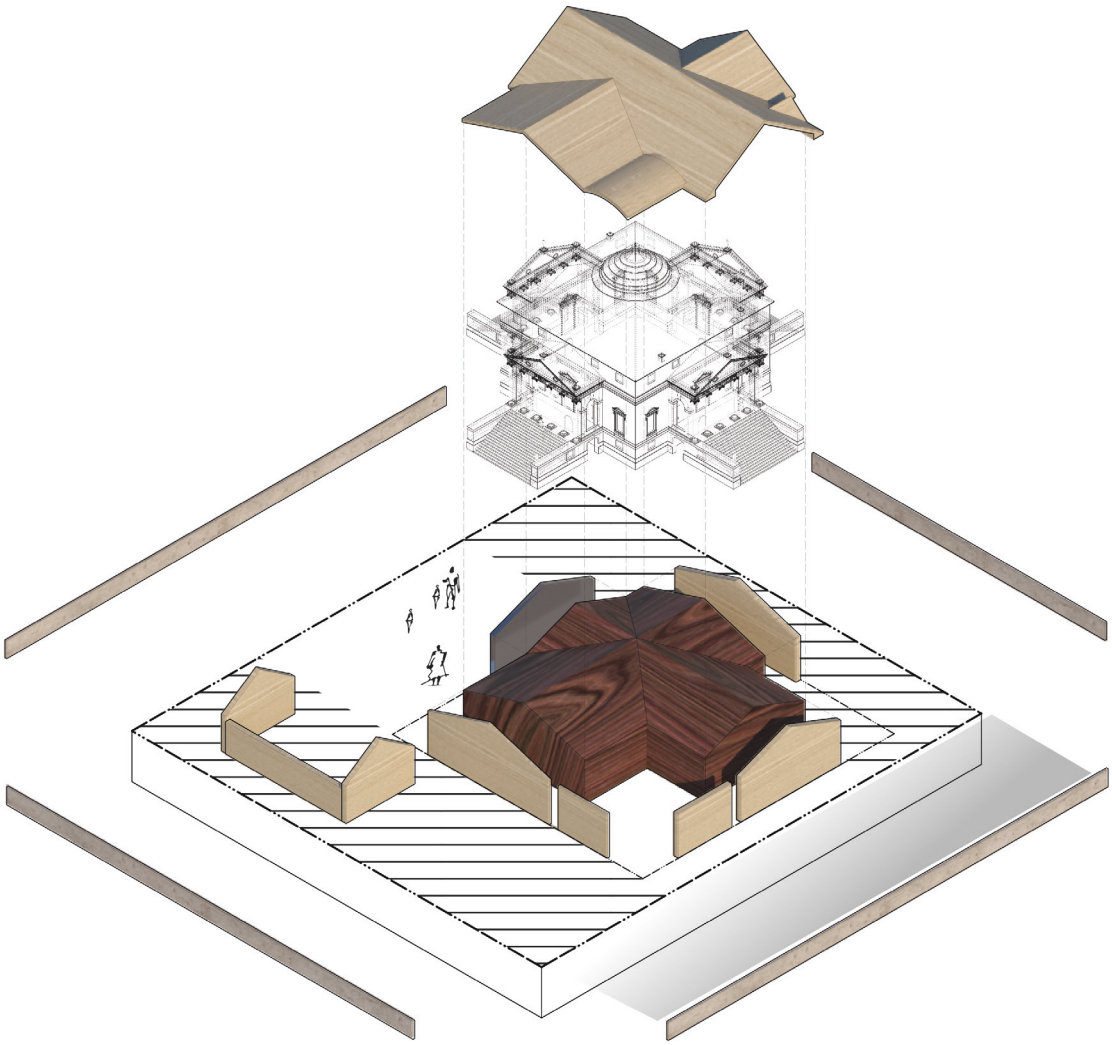
indications of status and wealth. This makes the design of this façade a fundamentally individualistic inclusion. Even the oversized roof acts to mark an exclusively private space. This messaging hinders the sense of community and creates an inauthentic representation of the family that lives there. The front-facing façade becomes a way to demonstrate ownership over the land which further makes it a private space. Ultimately, the neighbourhood becomes a form of competition as opposed to an opportunity for community. Similarly, the rear facing community is also signalling an anti-community message. It privatizes the space of the backyard and further limits integration of the family into the surrounding community. Overall, a new typology will need to refaçade the family building in order to promote, as opposed to stifle, a sense of community. The traditional style of single-family housing offers a poor balance of private and public space. This imbalance ultimately limits community and impedes the quality of life of the inhabitants. This disparity is both in terms of the abundant outdoor private space and in terms of the contrast with the public space. In this model, the backyard is fully private. The space that is meant to be used for socialization is ironically one of the most private. This design limits community integration by placing the space as far as possible from the street. It is also worth noting that the house itself if a fundamentally private object in the center of this space which only further isolates the family. There is disproportionate amount of private space relative to the public in a community. The sidewalk is often the only public space in contrast to the large plot of land. Under this paradigm, each house exists as an independent structure. These homes are working against each other as opposed to cooperatively. A clear opportunity exists to develop a more



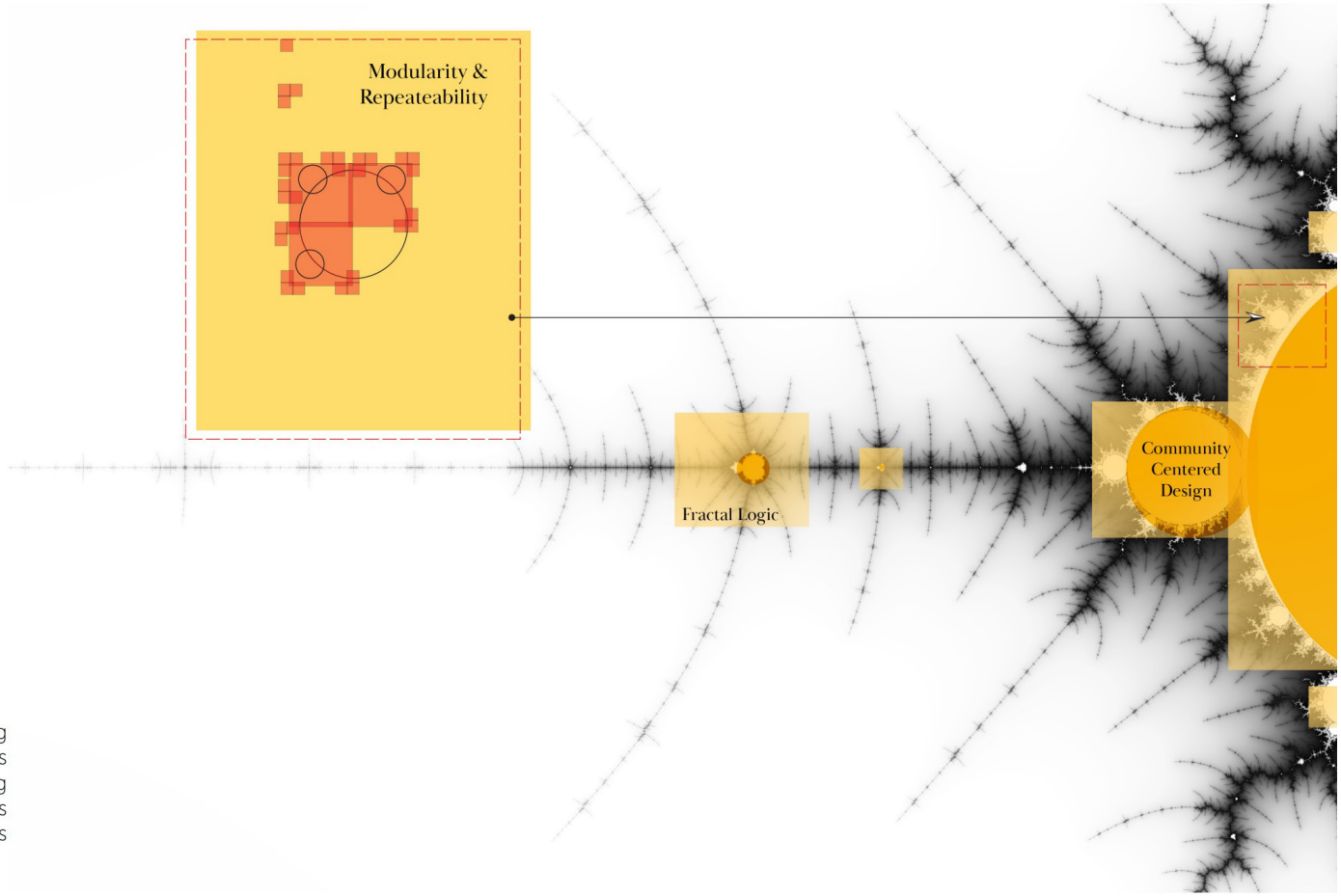
The inherent qualities of the single-family home can be seen by pulling apart the key elements of the house. Starting at the first layer in beige, walls and fences physically separate the family from the surrounding community. Potential spaces of community gathering like the backyard, shown in green, are placed at the most protected position. At the next layer, the home itself, shown in red, is an entirely private space. It centers a lot which indicates a design style meant for privacy and individualism. An oversized gable roof marks that private space.

collaborative and communal lifestyle by addressing the deficits of single-family housing.

A review of single-family housing architecture illustrates that this housing model is not working for the benefit of the families living within. The individualistic nature hinders a sense of community, and the consumeristic bases makes this lifestyle inaccessible to many families. The static nature of these homes make them inflexible to change, and the dead space on the lot designs prevent growth. The established

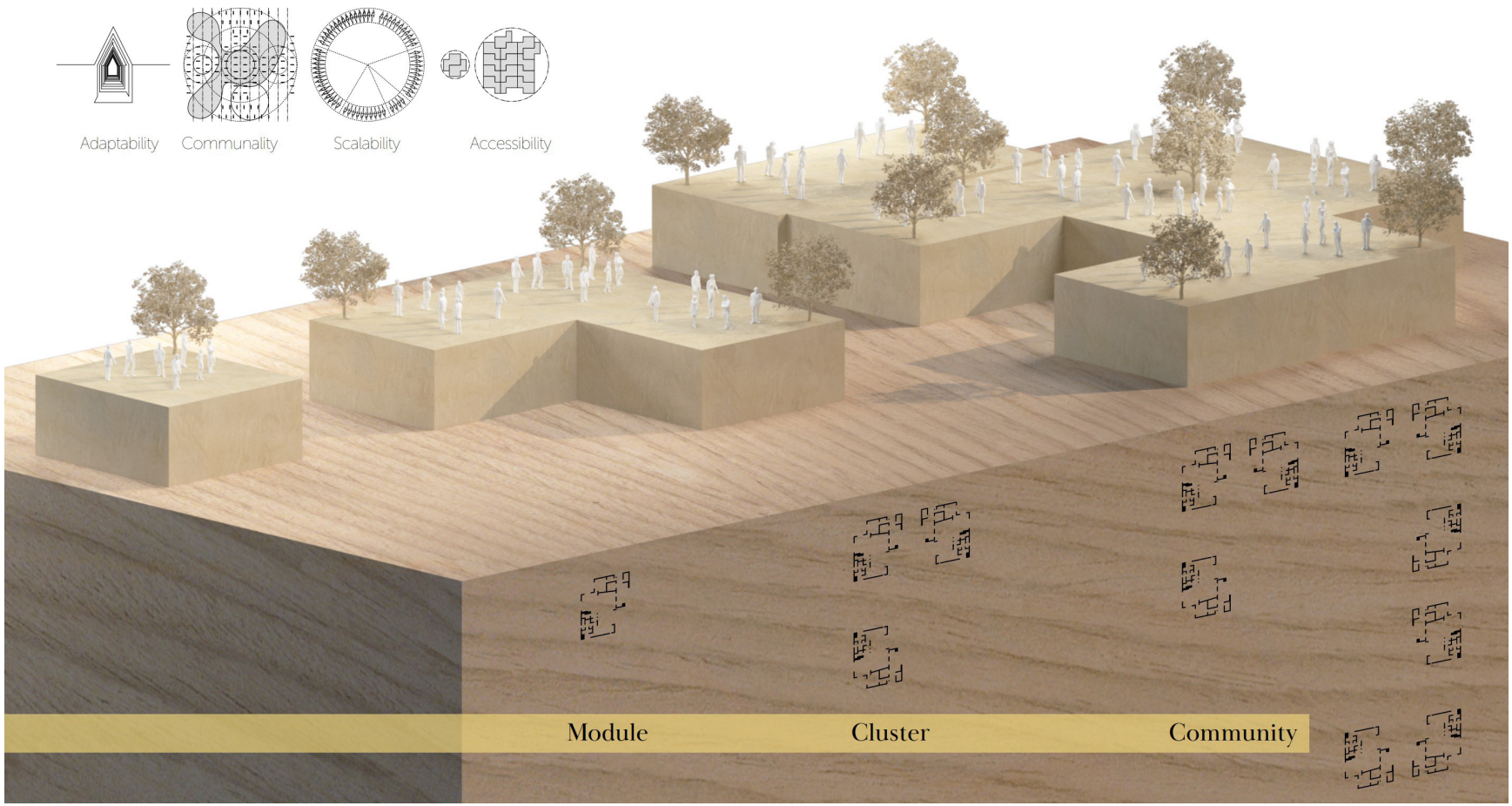


The front lawn acts as a symbolic barrier cutting the house off from the street. The side yards have potential, but in the current layout are typically dead space. Overall, these homes are built on privacy, individualism, and ownership. These same features exist at all scales of single-family housing, right up to the extreme of the Villa Rotonda. A better solution is needed that will allow for a community, and its homes, to work collaboratively.



A fractal is a strategic, never ending pattern, that is self similar across different scales. Through repeating a well defined, yet simple process an ongoing feedback loop is created.

In order to integrate our design principles, we must apply a fractal logic. A fractal is a strategically repeating pattern that is self-similar and can continue to grow at different scales. In community design, fractals allow for scalable space and shared accessible resources. I will employ a repeating module that will be iterated around community centers. The modules allow the design to be adaptable to specific needs, and centering the public space activates the community.



Our design principles are to be applied at three different scales of inhabitation: The module, the cluster and the community. Each scale accommodates a proportional population group. You can see here that the same pattern is repeated to generate the next scale.

Latch Horizontal Vertical

Our base-case will focus on a horizontal fractal pattern on the circular and central lot. We also want to consider how to integrate this new typology with the larger community. One-option is to consider the fractal as part of the retrofit of a pre-existing single-family house. I've termed this approach the latch because it latches the repetition into the existing house and acts as a seed to spread the pattern within the community. For empty single-family lots, we can also consider the repetition in the vertical direction.

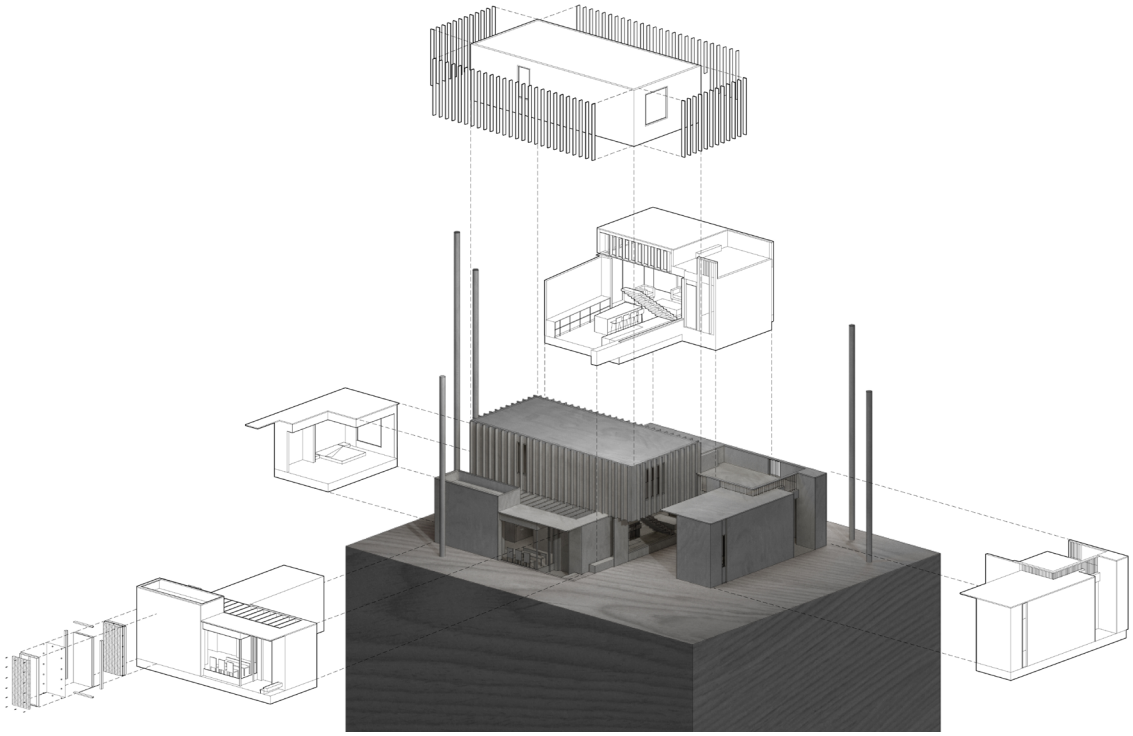
design principles are a direct answer to these limitations. Based on this review, a new typology can be developed by focusing on community, accessibility, adaptability and scalability.

9.2 A New Typology of Horizontal Repetition

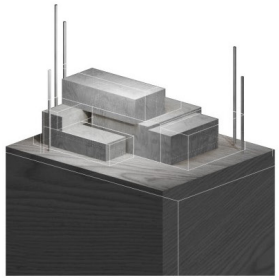
As we now understand the limitations of the current housing model, we can examine a new housing model better suited to the demands of model living. We will apply our four key design principles: Commonality, Adaptability, Accessibility, Scalability

9.2.1 The Unit

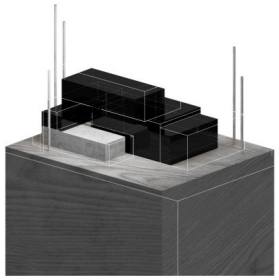
A review of the design begins on the level of the unit which can illustrates all the core design principles. An exploded view is shown below. In this unit design, four different apartment



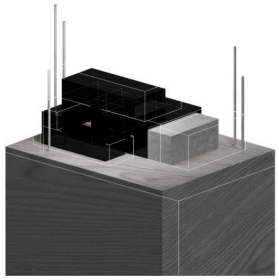
The module design of the horizontal base-case. It strategically blends several apartment typologies in order to provide flexibility. This allows the module to function cohesively or as three independent units.



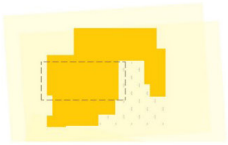
Full House

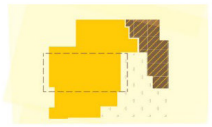


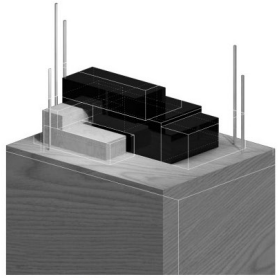
2 Bed + Studio



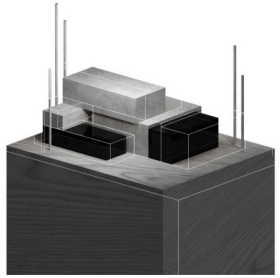
2 Bed + Bachelor



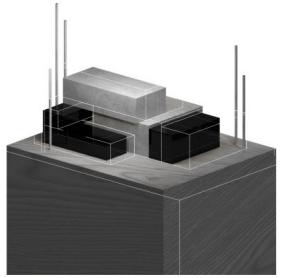




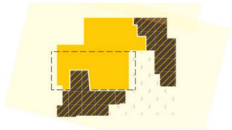
2 Bed + 1 Bed

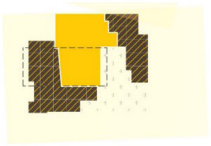


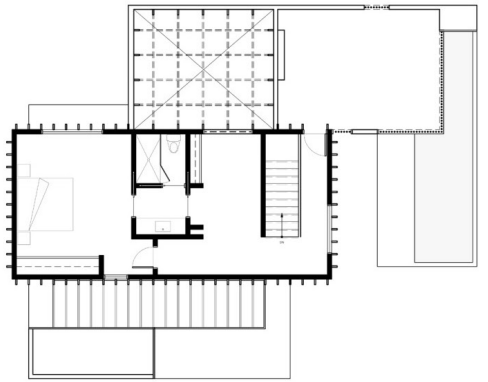
2 Bed + studio + Bachelor

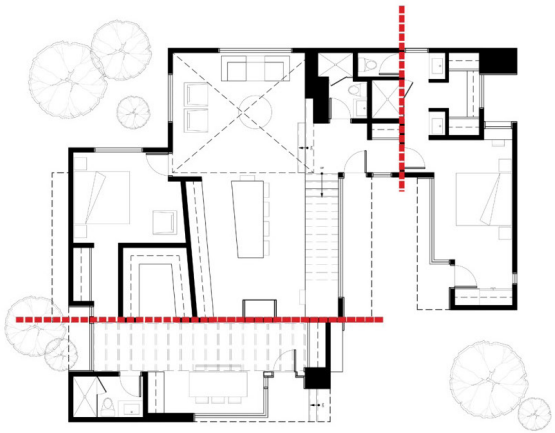


1 Bed + 1 Bed + Studio

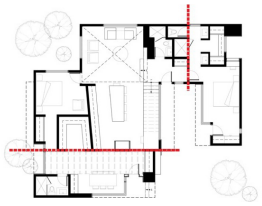






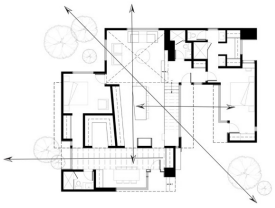


Six different configurations are possible by centering the common spaces and rearranging the private. The apartments can be combined or separated based on two principle dividing lines. This allows the apartment to be adaptable to the needs of the residents. The central common space is visible from all directions in order to provide a sense of community. Different economic models make the housing affordable, and the modular nature allows it to scale organically.

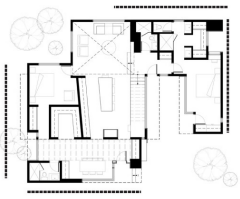


Two principal dividing and connecting lines of the horizontal unit design

Centralized common space



Visual connections to all coordinate directions of the horizontal unit design



Connection planes/ axis of symmetry to allow the module to repeat and grow

styles are centered around a central public space which can be shared amongst the residents. The connections between the apartments are modifiable thresholds which can be adapted for specific user needs. For instance, the thresholds can be opened or closed in order to create smaller or larger living spaces depending on the context.

The design of this unit provides living accommodations that focus on family and community. One unit involves the overlaying of four existing typologies that are specifically a single-family home, townhouse, two-bedroom, one bedroom and studio. Consequently, this structuring generates areas of programmatic overlap. By examining the common features between these distinct typologies, they can be strategically combined into a single functional module. This allows them to act both as individual dwellings and as members of a greater whole. This design achieves all four of the core design principles which will be described in following.

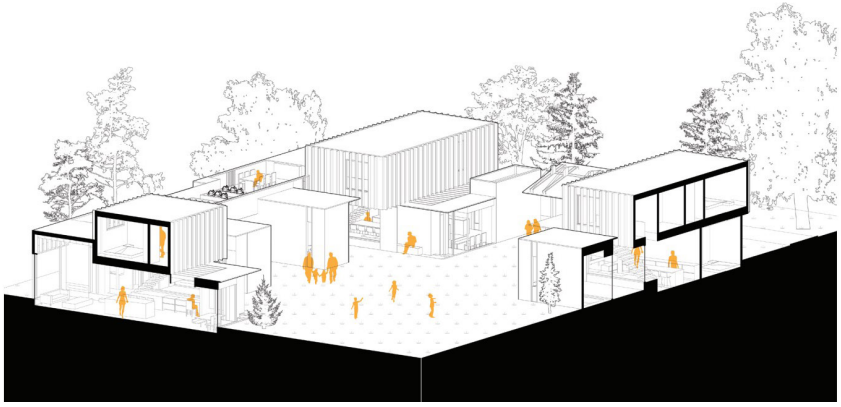
This integrated unit design is intended to generate a sense of community amongst the residents. The unique elements (such as the apartments) are tessellated around centers of the public shared space. In doing so, the method places community at the center of the design. The internal circulation is veered towards the central public yard, and this is paralleled by the orientation of the windows and sources of external lighting. Private spaces are minimized but, where required, a slat system is used to provide a level of privacy.

Thresholds of control are a key element of the unit design that help to facilitate the adaptability of the units. The module is internally organized around two primary axes which act as the control thresholds. They can be manipulated by

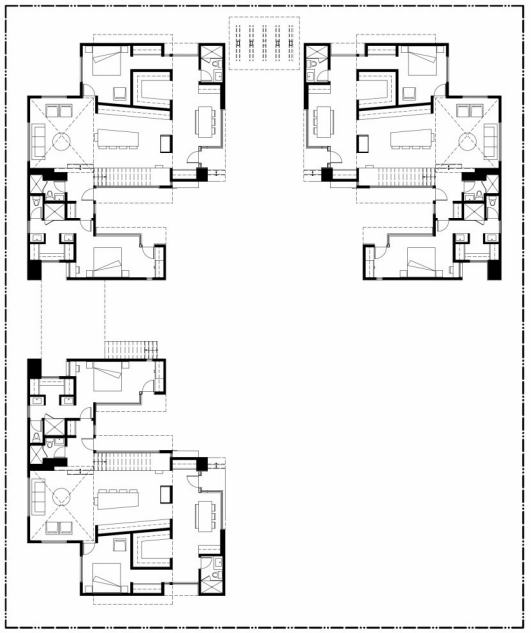
the owner to create eight distinct module configurations. Therefore, the selected module is responsive to the needs of the family and is adaptable as the family goes through changes. Individual apartments within the units can also be as expansive as multigenerational living, or as small as an individual, depending on the context. This allows for a unit that can be fully used and inhabited by the residents.

The unit design is also accessible to most family types and this is particularly true in regards to financial considerations. The multiple and modifiable apartments mean that the unit provides an array of housing options that can meet the needs of diverse family structures. Therefore, the units could support a multigenerational family where elders or young adults might struggle to find a similar space. Similarly, the unit could support multiple families where the sense of community helps to improve affordability for all. Finally, certain units could be extended to a renting framework which can help to offset the costs for permanent residents. Overall, the unit design is accessible to the social and financial needs of modern families.

Lastly, the unit is scalable both in terms of housing different family sizes and for its ability to be repeated and grow as a system. The unit can work individually in order to fit with existing bylaws. However, in opposition to traditional laneways, the yard is placed so that multiple units can be combined into a cluster. By combining multiple units that are reflections of one another, the public spaces can work together at a larger scale. Further, these units are build using modular brick panels on their sidewalls. Therefore, adjacent units can be directly combined into a greater whole by overlapping their core infrastructure.



Axes of symmetry within the unit allow it to be repeated and generate clusters. Three modules form a semipublic courtyard which is shared amongst the residents and activate community. This courtyard is always visible from the central facing windows and communal patios of the cluster. By repeating these units, communal spaces grow and collaborate for the benefit of all of the residents. Partitioning these private and public spaces makes the building dynamic and adapting.



A shared garden is accessible to all residents and the greater community. The external gate is welcoming in order to connect the cluster with the larger neighbourhood. This encourages an active and engaged community. The cluster itself also bears a modular nature making it scalable.

9.2.2 The Cluster

As discussed, the inherent repeatability of the units creates the opportunity to form clusters. Consequently, neighbourly structures can work collaboratively as opposed to in opposition to one another. For a cluster, a set of units are centered around a public yard. By combining the individual yards of each unit, the cluster yard can grow proportionately to the number of residents that it's accommodating. A semi-public space is established by this center which can be shared by all the individual unit communities. The yard will also incorporate the primary access points to the individual units. Therefore, the circulation intentionally encourages public interaction. Combing the units into clusters creates more meaningful community activators which can also be noted in the rooftop deck, community garden and the public entry.

Community is encouraged at the level of the cluster through the creation of public gathering spots. The semi-public central courtyard is the primary tool for encouraging a sense of community. The building themselves work together to create this area and, in turn, this promotes collaboration amongst the residents. The units are internally facing in order to encourage the residents to capitalize on the public space. The communal workspaces, the rooftop deck and the community garden also generate opportunities for organizing community gatherings.

The cluster promotes accessibility in two different ways. First, it allows families to access amenities and improved resources that would not be available within the traditional housing structure. This might include larger decks, barbeques or the community flex spaces. Secondly, an

element of the cluster is also accessible to the external public and the nearby community. Two entrances lead to the public garden with one being for all the public and the other being exclusive to residents. As such, the accessibility of these shared resources can be adapted to the aspirations of the residents.

Like the organization of the apartments within the unit, the units can be arranged in different ways in order to generate different structures for a cluster. These different structures are possible by applying different rotations, reflections and translation to each unit. As such, the exact site layout is adaptable to the specific needs of the context where it's being built. Further, there is a possibility to add different units throughout the lifecycle of the cluster which means that it can better adapt to changing family size.

Finally, the clusters can grow in order to fill a site of interest, and therefore the clusters are also scalable. The extent to which they can grow is ultimately limited by the size and restrictions of the specific site. Either the clusters or the units can be multiplied and combined in order to scale the housing to the contextual demands. Further, a cluster might initially be designed for an individual lot, but then extend to adjacent lots as the need and demand arises. As such, the cluster design incorporates multiple elements of scalability in order to create an overall community.

9.2.3 The Community

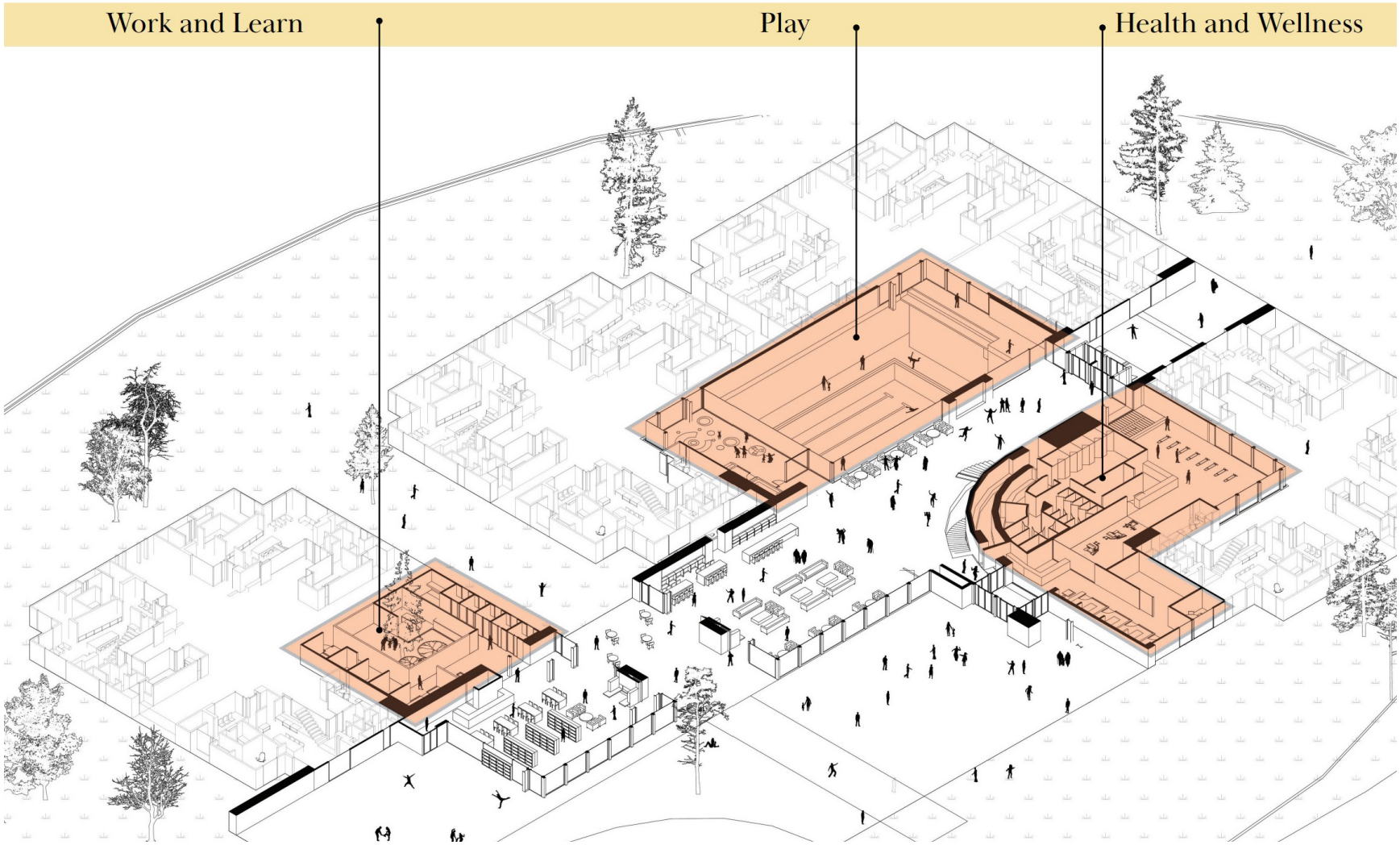
The repetition of the cluster scales the implementation to the level of a larger public space that can be called a community. By applying the principle of community to the design, an infrastructure is created that includes shared public spaces, facilitates multigenerational living and

promotes sharing amongst the residents. This is the largest grouping of the infrastructure, and it is intended to serve an entire neighbourhood. This community is centered around a public nucleus which is exemplified by the example of the selected Shaughnessy site. At this center, all the main arteries of the residential circulation intersect.

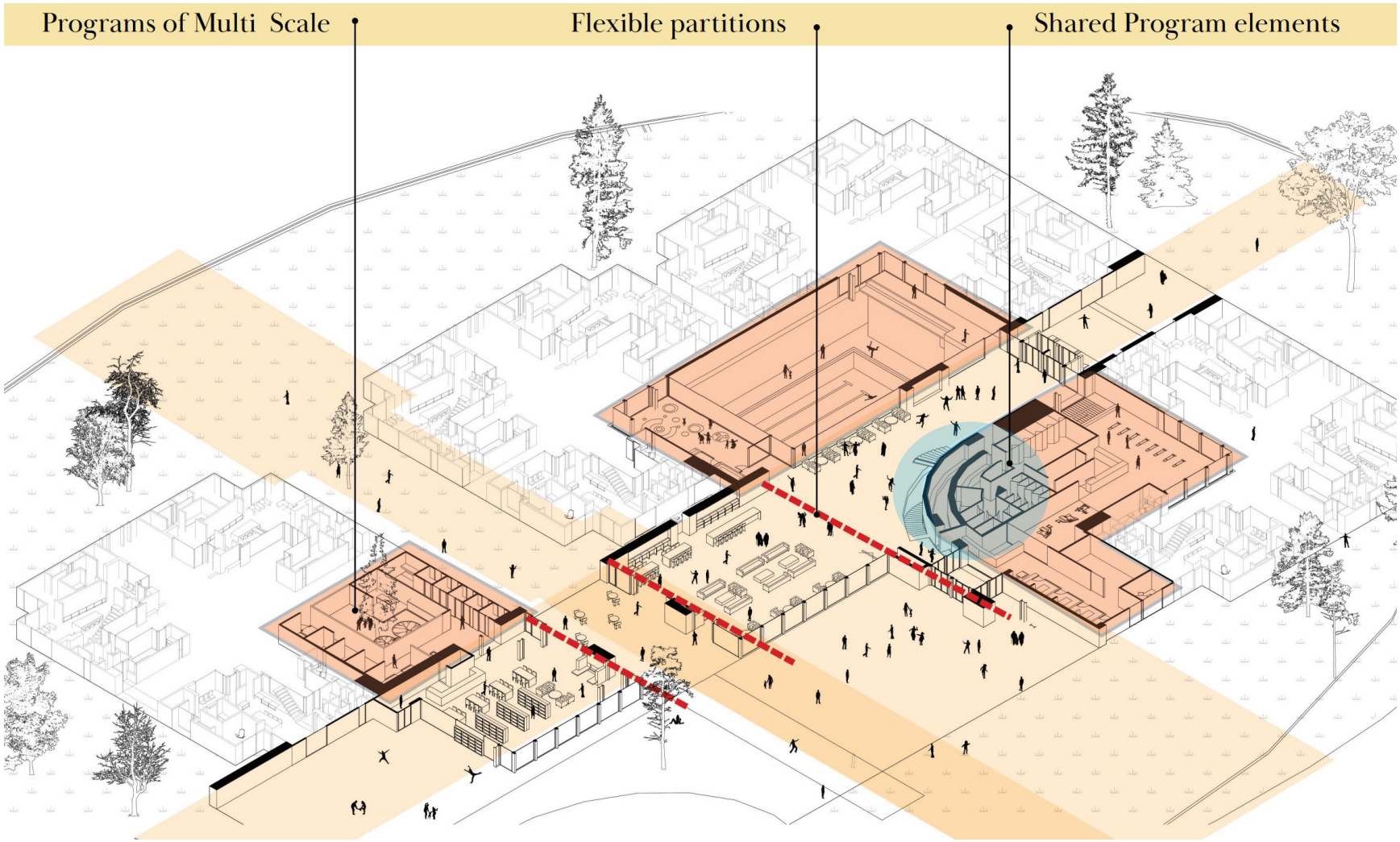
This integrated community design allows for the inclusion of community hubs that can offer different programming to the residents. There are three important hubs that should be included in one of these communities: (1) The work and learn hub, (2) the play hub, and (3) the health and wellness hub. The work and learn hub are a flexible workspace for study, pet projects and work-from-home residents. The play hub will offer child programming and daycare services. Finally, the health and wellness hub will include features such as a sports court and gym. Combining the common spaces of individual clusters is what allows for the creation of these hubs. Living and private spaces are then tessellated around these public areas. Communal spaces are placed at the center of the site which helps them to be accessible and adaptable to everyone in the community. Two public streets span the entire community structure, and they can accommodate a variety of social needs.

Like at the level of the cluster, two different types of entrance to the public space help to promote accessibility for the residents. Public entrances to the community will open spaces to visitors, but more private entrances will also be provided at the level of the clusters. Residents maintain their accessibility to all sites, have the option to include external friends and family, and can control this balance. As such, a relationship with the street and external world is maintained

The community is created by repeating cluster several times again. This repetition naturally forms two primary through-paths in the site. Several smaller paths, which had previously existed within the clusters, are also maintained. These routes link the courtyards and centralize community.



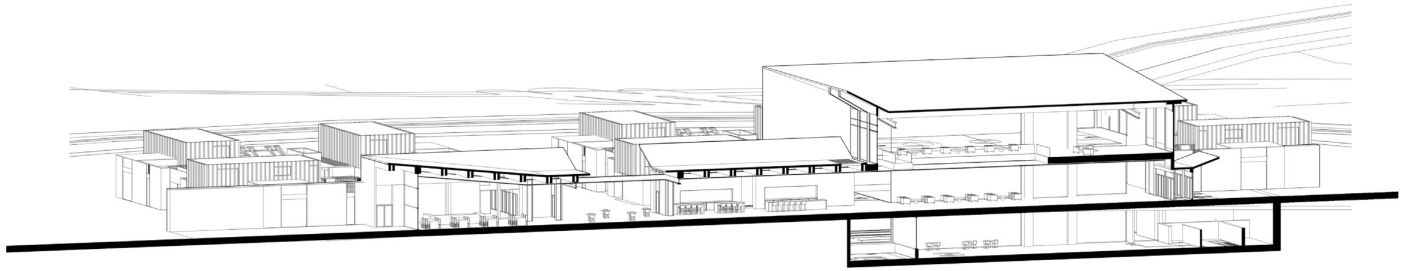
The community contains three hubs: the work and learn hub, the play hub and the health and wellness hub. A community network is created by sharing and stacking these programs. The play group includes the daycare, the gym and pool. The wellness center provides fitness facilities, shared health care services and a yoga deck. Finally, the learning space has a winter reading garden, work pods, and library.



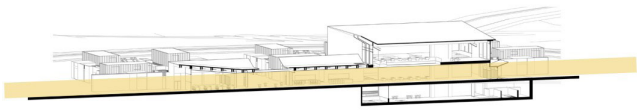
More rigid programs are placed on the periphery of more flexible community spaces such as the public central street. Versatile spaces like change rooms are also strategically placed between hubs. These large shared-community spaces can be subdivided for intimate events or opened for large community gatherings.

At the intersection of the primary circulation, the community also introduces the community hearth. It is the epicenter that connects different programs both internally and externally. It acts as a threshold between the most public and private spaces (such as between the road and the apartments). These hearths house sliding partitions in order to allow for seamless integration of the internal space with the external environment.

The library is an important part of the work and learn hub. It supports work-from-home and remote learning which are important features in the modern world. By separating this space from the central community center, it caters towards more intimate events. In contrast to the prior example, a more intimate hub like this could function as a community space for when a fewer number of clusters are repeating.



The public face of the building offers a welcoming façade to connect with the larger neighbourhood. The public courtyard is created by the repeating clusters and offers a larger space for events and bonding. This central space facilitates programming and community activating amenities that would otherwise be inaccessible to the residents.



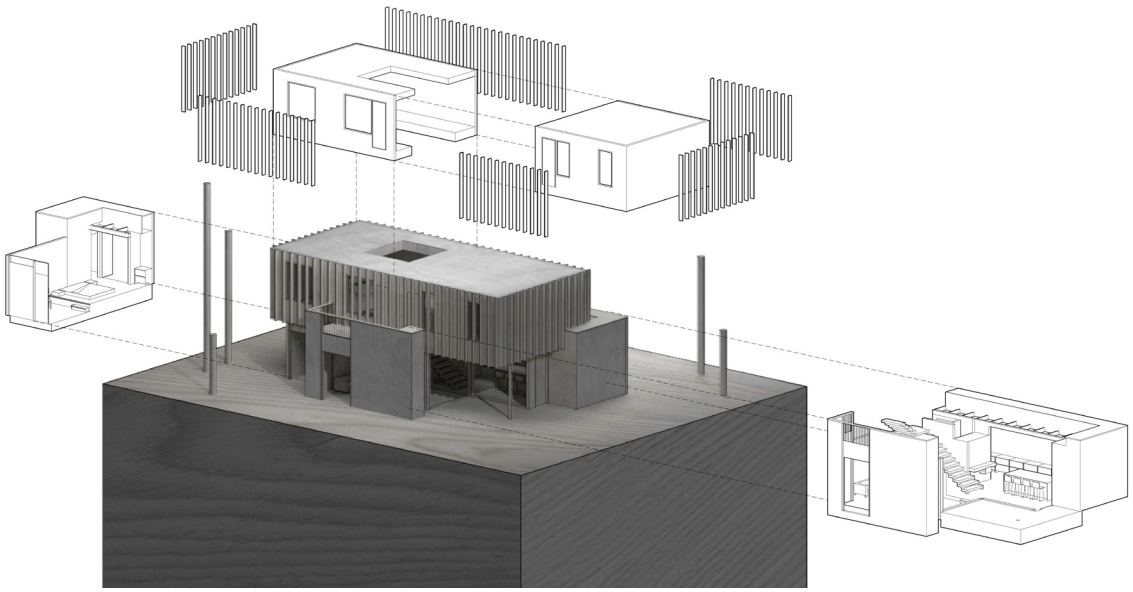
There is also an interior public street. What you can see if visual connections between programs and tiers, with large openings to allow light into the center of the building. Community is again centralized, and resources like daycare (on the right) or a community kitchen are offered to residents who otherwise couldn't afford them. The main flex space is shown in the background. This room can expand or contract based on specific resident needs which ensures that the space is used with maximum efficiency.

that was limited within the traditional single-family housing model.

Adaptability, at the level of the community, is most noteworthy at the level of the public hubs. These central spaces include sliding walls which allow for the spaces to be blended or separated according to the specific resident needs. The spaces can be enlarged for communal events or separated for more intimate occasions. Therefore, the programming itself is scalable and the space can be fully used. Further, just as with the clusters, the community itself is scalable and can incorporate adjacent lots to fit the housing needs of the residents.

9.3 The Latch

The latch is a unit design which allows for pre-existing housing to be retrofit with the new typology. This process begins by considering the existing infrastructure of the single-family home. We will use a case study analysis of



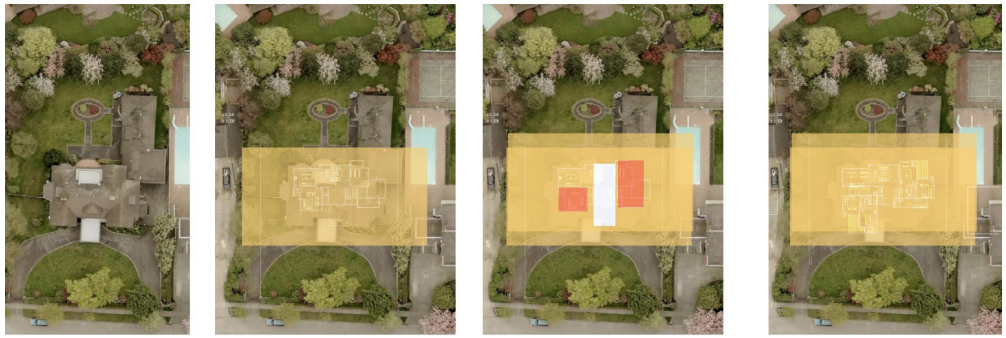
The latch module is very similar to the design and therefore qualities of the horizontal unit, but it is now intended to latch onto a pre-existing house.

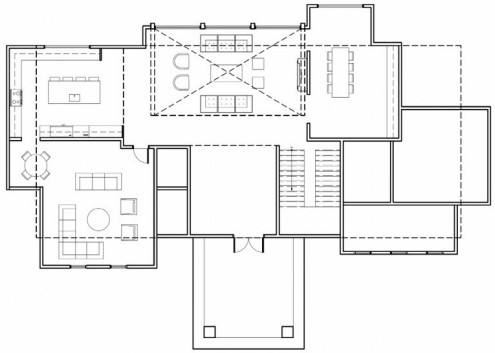
a home in Shaughnessy. This is a textbook example of the antecedent design style in a suburban context.

By analysing the existing floorplans of the home, we can note an axial layout with central circulation that is double height space. Internal places of social gathering are shielded from the public realm. The most public space is the most distant from the community. The same design principles considered previously need to be applied to this central node. In adjacent single heigh spaces, a modular framework can be applied to increase community. This method works on all the axes and fronts of the lot, and it can adapt to the existing extrusion and gable sizes. The first step is to defaçade the home by removing individualistic features that were included for a pre-existing idea of family. Hard thresholds should be replaced by social corridors and social impediments, like the fence, can be replaced by communal courtyards.

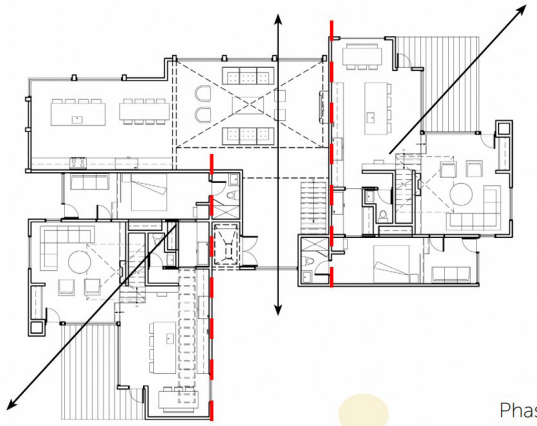
9.3.1 The Unit

In this unit design, three different apartment types are centered around a central public space. Secondary spaces are created which can be shared amongst the unit or divided for specific needs. As before, the connections between the units act as adaptable thresholds. The allow the space to become smaller or larger in response to the changing family needs. By integrating three apartments into one unit, certain resources and facilities can be shared. These units work in tandem with existing infrastructure and capitalize on the resources of the existing house. For instance, the stairs of the original house can support the access to secondary levels. Like the horizontal implementation, the social spaces are centralized in the retrofit and the private spaces are placed on the periphery.



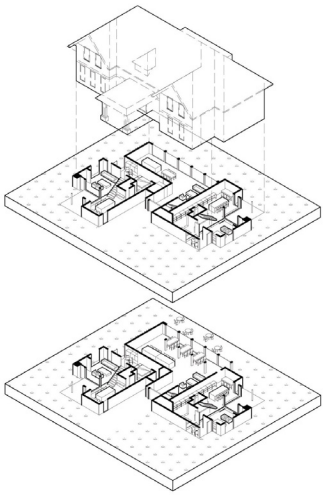


Existing Plan



Phase One

At the level of the cluster, two latch units are attached to the side arms of a pre-existing large Shaughnessy home. These units are oriented outwards and towards opposite corners in order to activate the full yard.

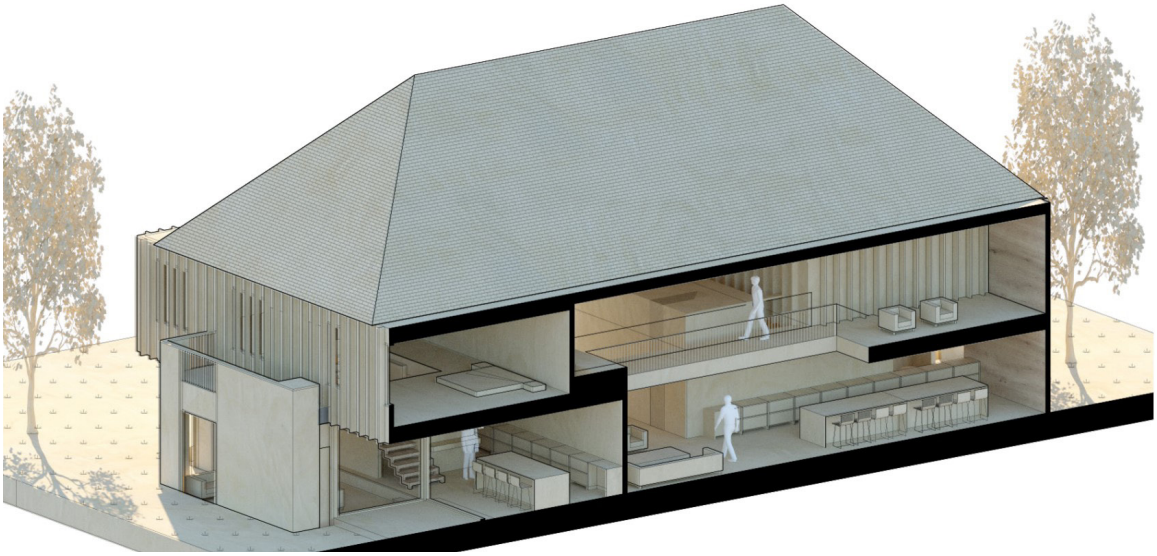


In the first phase, the cluster acts as a triplex. Afterwards, the latches can connect to other horizontal modules in order to join into a larger network.

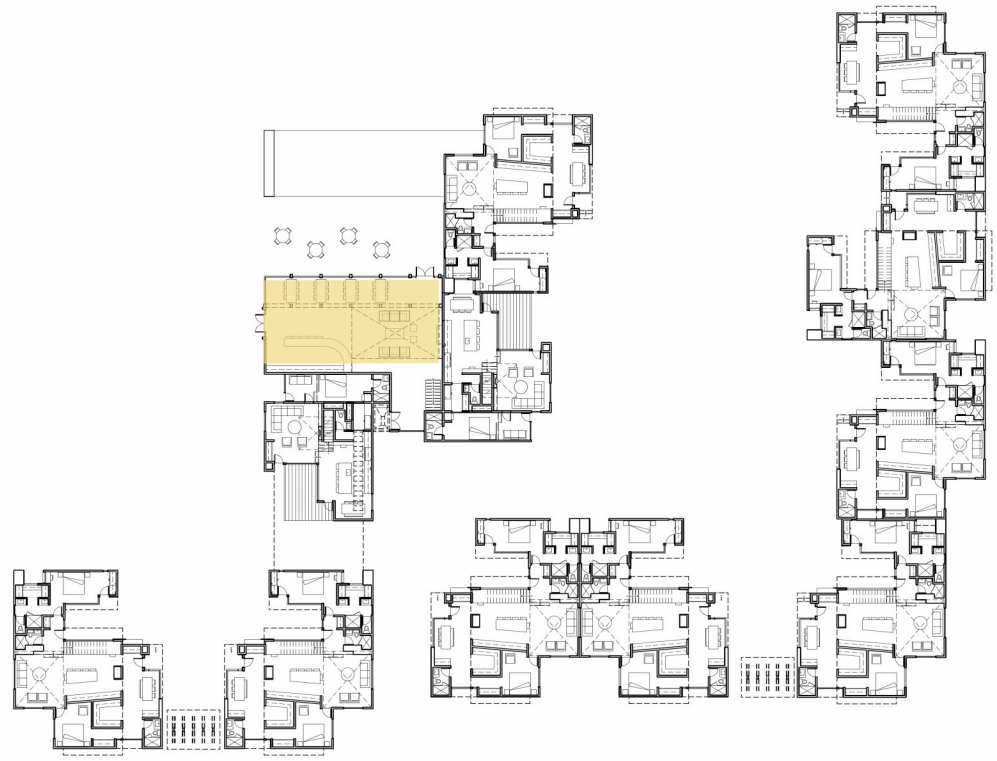
This retrofit unit design accomplishes all four of the core design principles. The units are adaptable to diverse family structures through the combination or separation of individual apartments. Community is promoted through the inclusion of shared spaces that are centrally located. The units are scalable and responsive to the number of residents living in the space. Finally, the home is more accessible financially than the traditional housing structure through the pooling of resources amongst the residents.

9.3.2 The Cluster

By tessellating three units around one piece of existing infrastructure, all four corners of the site can be actively used by the residents. A path ribbons through the cluster and connects the private and central public space. The building core is converted into a shared social hub which could be a café or workspace. This centralization of the public space promotes community amongst the residents. The pre-existing circulation of the building is now shared



As the growth continues, semi-private spaces like the original courtyard become fully public which again centralizes community. Therefore, the structure is scalable to increasing population and adaptable to community changes.



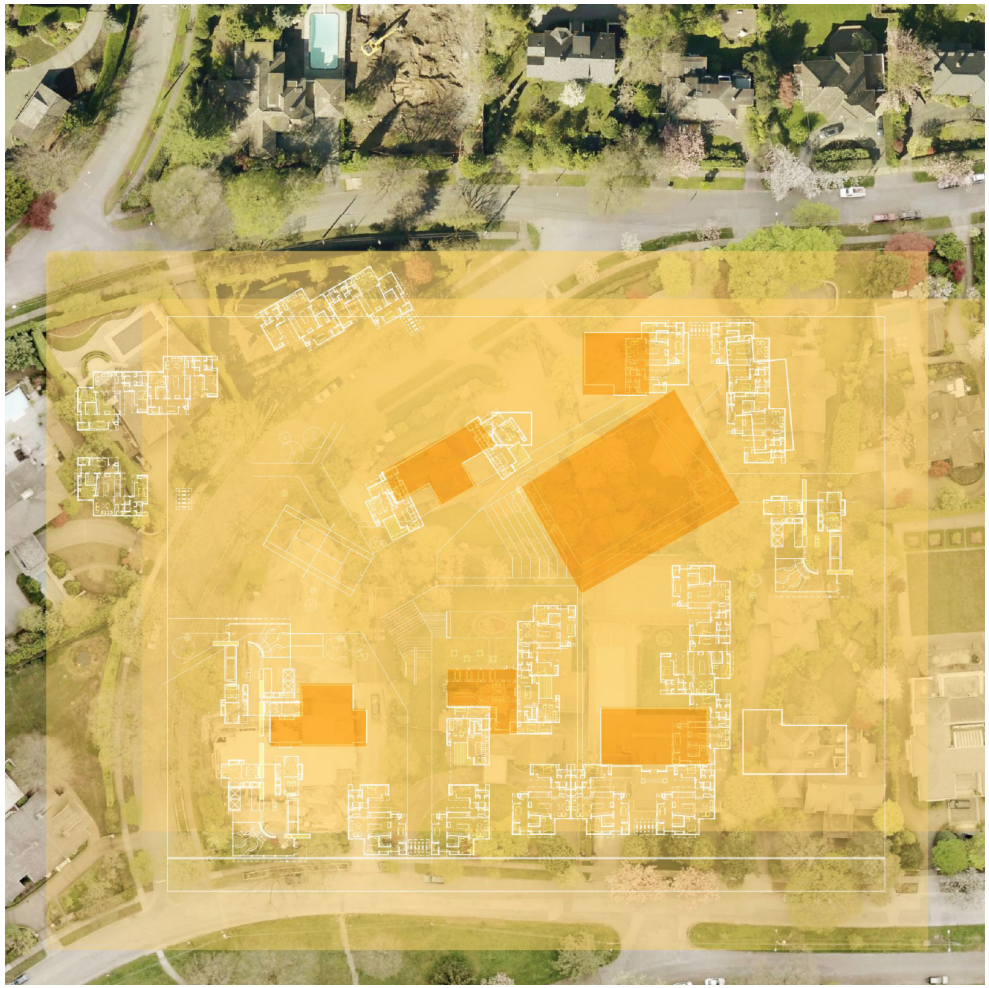
The best part of the latch is when it can interconnect adjacent houses and new cluster networks. This community design creates an even larger central courtyard that maintains its central position. Spaces that would otherwise be dead and underutilized between the lots can now be capitalized on and enjoyed by the larger community. By extending to adjacent homes, the fractal can continue to spread and is scalable within the neighbourhood.

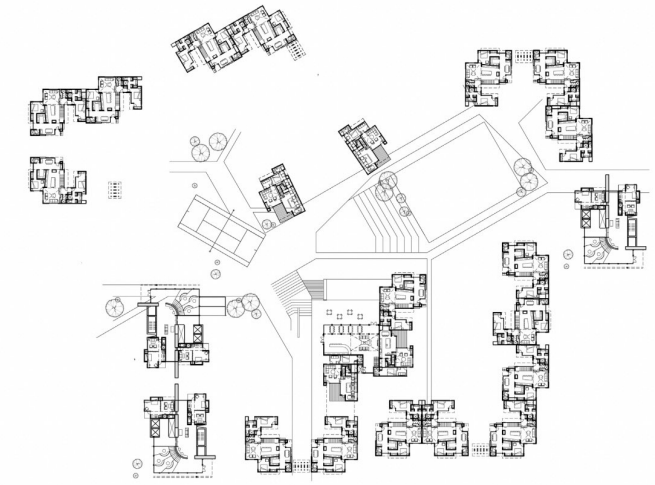
amongst all the residents and visitors. Flexible and adaptive space is maintained through sliding doors, and partitions. A large window is added to the front to create engagement with the street.

9.3.3 The Community

As opposed to previously marking a private space, the roof of the community now marks a public hub. A dormer act to welcome the street and encourage social gatherings. This modern dormer allows light to flood into the public space. This design is scalable because multiple neighbours of pre-existing housing can become interconnected. Property lines are broken down and resources are shared in order to make diverse amenities more accessible to the residents. The connection between the lots also creates a public garden entrance which further promotes community. Finally, as with the horizontal implementation, the public hubs are adaptable through partitions and community programming.

From the rear-view of the latch community, a coffee shop shared by the residents can be seen on the ground floor. This is but one example of how this flexible space might be programmed and enjoyed by the residents.





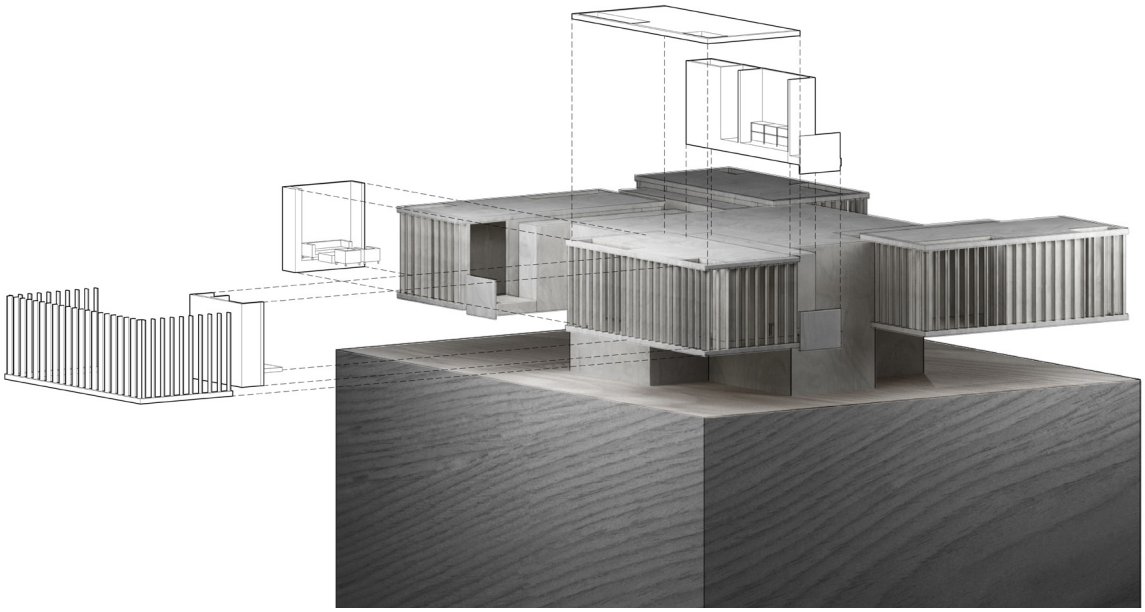
Ultimately the growth can continue to spread and tie the entire neighbourhood into the same network

9.4 A Vertical Alternative

The concept of fractal housing is also feasible with repetition in the vertical direction. Because the design is better suited for a smaller lot, the apartments of this implementation cater to one or two individuals. There is an option to expand to a family of four in rare cases. This section will consider applying the same design principles discussed previously, but with a structure that is repeating vertically.

9.4.1 The Unit

The unit of the vertical implementation illustrates the core design principles, and an exploded view of such a unit is detailed below. In this unit design, three different service pods are centered around the central core living space. The pod inserts have one larger standard pod which is composed of a kitchen, washroom and the utilities. The other two in the apartment are modifiable which can be adapted for specific user needs. Designed off a modular concept, user specific



The module of a vertical installation. The module is one of four wings on a floor that will eventually become a growing tower. Despite repeating in a new dimension, many of the qualities offered by this implementation are similar to the horizontal base-case.

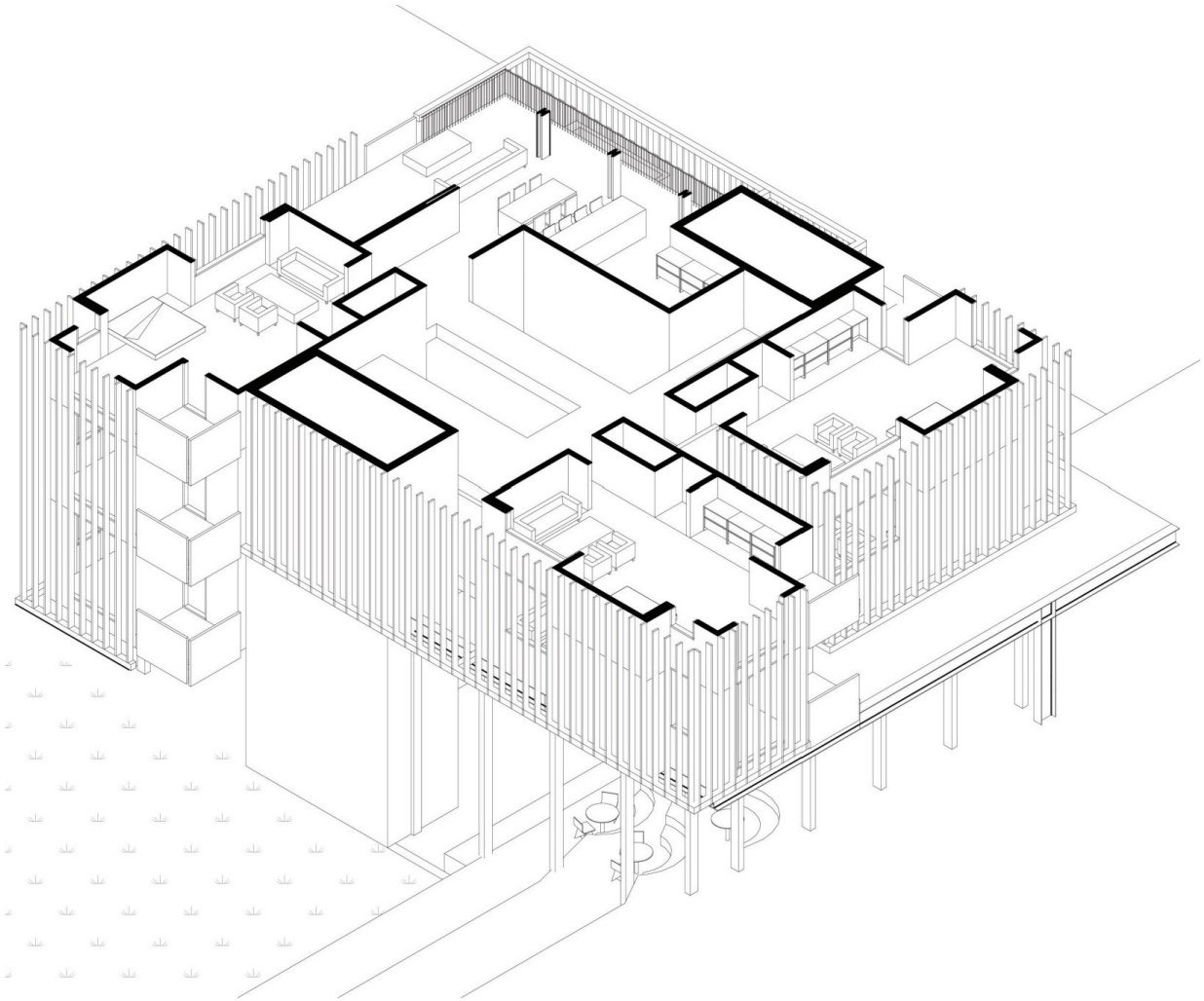
elements can be placed within each pod. These can take the form of beds, dining spaces, partitions, seating, or office spaces. These custom-elements will be pre-designed to be included in the unit. The design of this unit provides living accommodations that focus on family and community. It achieves all four of the core design principles in a similar manner to the horizontally designed unit.

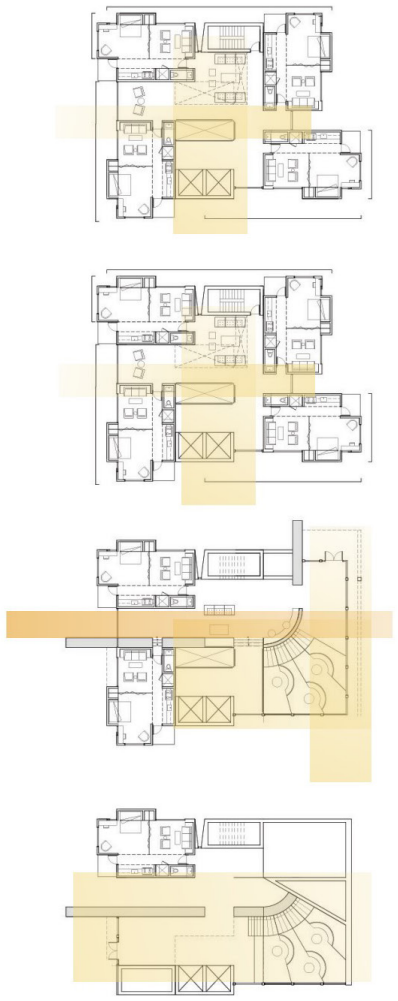
9.4.2 The Cluster

As discussed, the inherent repeatability of the units creates the opportunity to form clusters. Because these accommodations are smaller in scale, the clusters become very important in providing flexible space that can adapt to the resident needs. As families host or gather for events, the clusters must accommodate these dynamic situations. Consequently, neighbourly structures can work collaboratively as opposed to in opposition to one another. For a cluster, a set of units are centered around a public shared space which can be used by all residents to ensure the larger spaces are fully utilized. This center creates a semi-public space that is shared amongst all the individual units. The circulation, or social corridors, is centralized through the public gathering spaces which intentionally encourages community interaction. These spaces are further activated through vertical connection of floors, bridges and light wells. Combining the units into clusters creates more meaningful community activators and this can be noted in the rooftop deck and community kitchen. In order to make these social spaces adaptable or scalable to specific needs, they also include modifiable partitions.

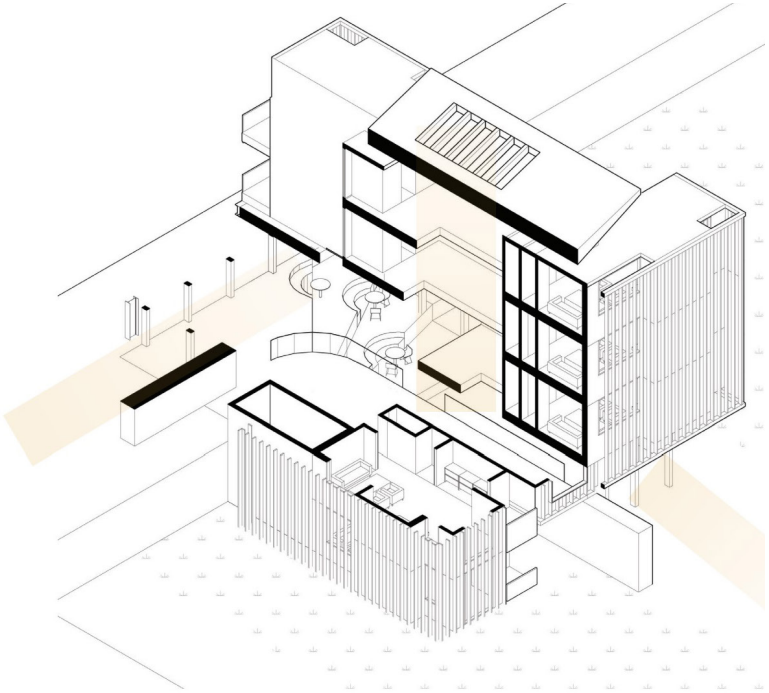
9.4.3 The Community

Just as in the horizontal implementation, clusters can be adapted and combined to create a community space. This is possible by creating slight variations in the underlying fractal pattern. The shifting of the units to accommodate collective community spaces starts with the relationship between the tower and the street. It is through this connection that the vertical community can interact with the external world and activate the internal public spaces. The tower is connected through a set of stairs that encourage socialization. Garden terraces and a public path, that ribbons through the building, also help to encourage the sense of community. The garden terraces are adjacent the central social stairs so that they can act as a gathering place. A lightwell connects the upper and lower spaces. These lightwells and the inverted roofs help to mark the spaces of public gathering. Work pods on the ground floor are accessible to the entire community. This area also serves as a public entrance to the site. These social spaces not only promote community but are adaptable to the specific resident needs. Further, the tower structure of the building can continue to grow in order to be accessible to diverse family structures or to be scalable to increasingly demand.

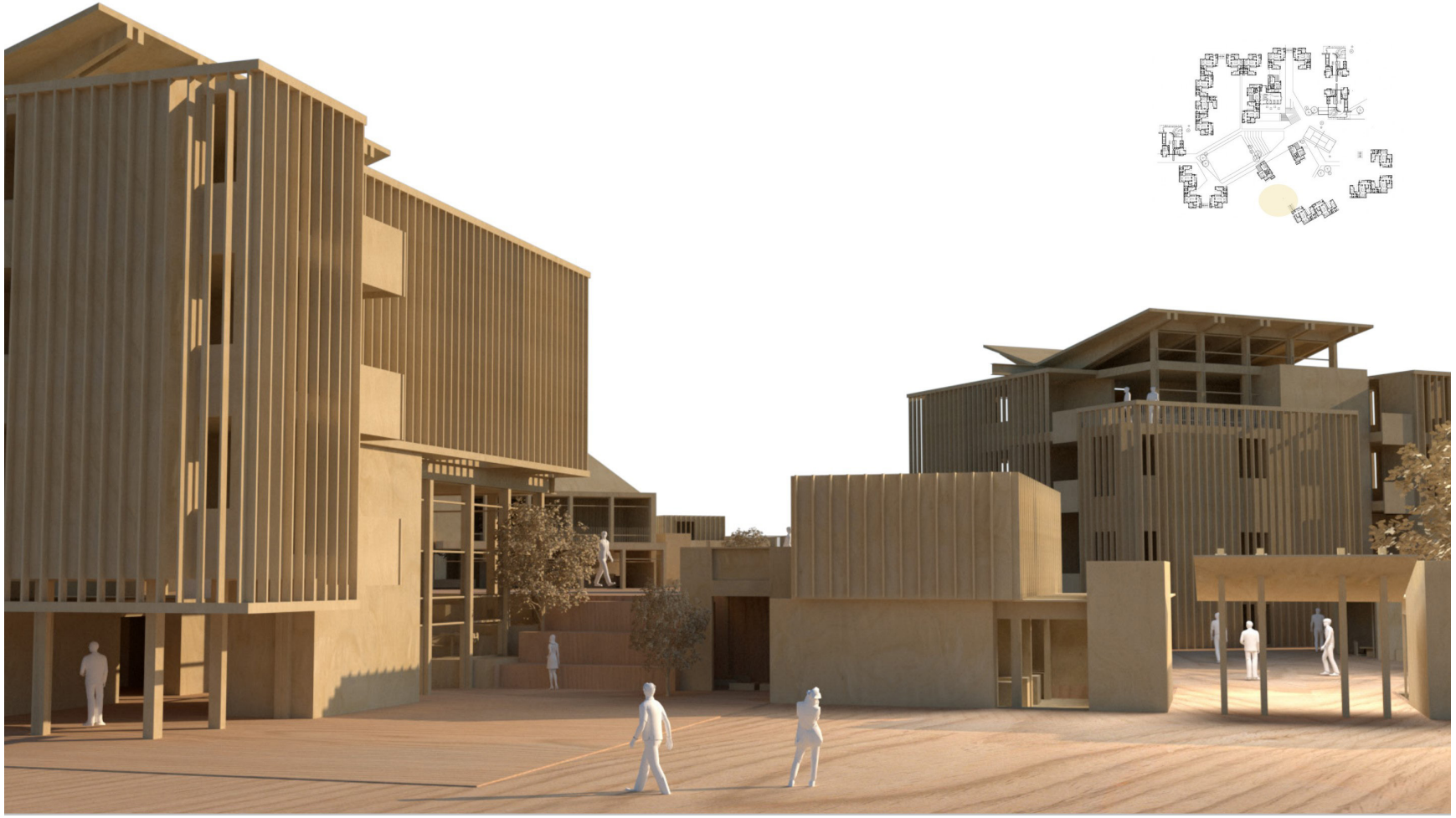




Within the cluster, units can be adapted with modifiable partitions in order to accommodate families of two to four. I chose a design for smaller families because vertical apartment buildings with less lawn space are often more accommodating to younger and smaller families. Sharing of common spaces help to accommodate larger social gatherings when needed.



At the community scale, a completely public atrium is maintained on the ground floor in order to centralize community. Social stairs then connect the ascending floors so that all residents remain connected to this social hub. Bridges within the lower space help to keep the space open while not impeding the circulation. Public gardens on higher levels of the building help to distribute the public space throughout. A public corridor ribbons through the building connecting all of the residents. The community spaces are adaptable to specific functions like in prior designs, and provide hosting, athletic and gardening amenities that would otherwise be challenging to access in the city.



Notably, all three of the implementation styles can work collaboratively. They all play a unique role in renovating the existing Shaughnessy neighbourhood. The horizontal implementation acts to create a central hub that can support both its internal and the external community. The latch design allows the network to integrate with the existing infrastructure. Finally, the vertical implementation can suit smaller sized lots. The figure of the community offers an example layout of all three implementations working synergistically.

Comparative section of the existing model and its inherent isolating properties versus the proposed housing model that encourages community engagement.

Chapter 10: Conclusion

This thesis illustrates that the limitations of the standard single-family home can be overcome through repeating multigenerational units that pool resources in order to provide accessibility to an improved sense of community, flexibility and scalability for the modern family. Traditional single-family homes create unnecessary financial pressures, are ill-suited to transcultural norms of multigenerational living and fair at fostering a sense of community. By employing a fractal-based modular design with community and flexibility at the forefront, we successfully can reconcile the housing model with the family lifecycle. Multigenerational living has seen several successes both historically and internationally. Western Canadians are transitioning their housing ideology, but they lack viable housing options that meet these new goals. This conflict is due to a set of outdates social constructs that are too narrow at understanding the modern family. June Williamson notes that “we spent fifty years building and living in these suburban landscapes, and we must spend the next 50 retrofitting them for the new needs of this century.” By revaluating the design principles of single-family housing, family and community are better addressed and an entirely new housing model has been proposed. Through fractal repetition, the collective community is grander and more obtainable than the individualistic homes of the past. This will re-establish a sense of community for the tenants and improve their collective quality of life. This cumulative approach is exciting because of its adaptability and scalability. Sets of fractal units could eventually help the suburbs of the past to become the cities of the future.

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