FROM BACK-YARDS TO STACKED-YARDS

AN ALTERNATIVE HIGH-RISE HOUSING MODEL

BY

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ABSTRACT

Current intensified housing is not perceived by New Zealanders as desirable... Critiques are extensive and the loss of quality, private, outdoor space is decidedly felt. Densification is one of the solutions to our housing shortage and the needs of our increasingly diverse population. Densification has already been set in motion by local councils, but consumer uptake is too slow. Public perception is tarnished by stigma which is reinforced by the repeated failures of the developer-driven apartment market. This calls for new typologies of high-density housing to increase diversity and compatibility.

Back-yards to Stack-yards investigates how to improve the design of dense, urban housing typologies for the New Zealand context. This thesis aims to address the most common local critique of apartment living: the lack the failure to provide and support an inviting sense of the outdoors. Outdoor space of all ownership types contributes positively to the dwelling environment. The backyard is identified as a benchmark for enriching the dwelling, providing an array of beneficial affordances. Key are the notions of the quiet sanctuary and the outdoor room that can be completely personalised.

This thesis primarily follows a design-led, research method where major learnings are extracted through critical reflections. A strong understanding of resident experience is required and is deduced through an ongoing, in-depth literature review and critical case study analyses. Understanding the resident experience provides key insights into what is lacking from common apartments at a human scale, as well as strategies for improvement. The focus is on the relations, effects and affordances of the amenities and spaces, rather than the typical, simplistic itemisation, allowing for a better breakdown and reconfiguration of factors.

Possible solutions and strategies were tested on a central-city fringe site in Wellington. This is a zone where dense, residential development and re-development is already taking place due to population growth. The design outcome is a high-rise multi-unit development. It demonstrates the rich possibilities of a high-rise design with a range of outdoor and shared spaces as well as improved opportunities for personalisation and flexibility.

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INTRODUCTION

PROBLEM CONTEXT
PROJECT SCOPE
AIMS + OBJECTIVES
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RESEARCH QUESTION

01

INTRODUCTION

Intensified housing typologies are yet to be thought of as desirable homes by most New Zealanders (Dunbar et al., 2011; Haarhoff et al., 2016). However, denser housing is being built regardless of preference as space is limited and more housing is necessary (Central City Framework, n.d.; Dunbar et al., 2011; Marriage, 2010). The main issue reported with existing high-density housing is the lack of ability to support appropriate outdoor space (Carroll et al., 2009; Dunbar et al., 2011; Sowash et al., 2015). Therefore, this thesis looks to reimagine high-rise housing as a more desirable typology through literature and case study analysis, active research through the design process, and critical reflections. A series of strategies and a site-specific design, based in downtown Wellington will be presented to conclude the thesis.

PROBLEM CONTEXT

WHY DENSITY?

Figure 1:
Housing aspirations

AVERAGE HOUSEHOLD SIZE FOR NEW ZEALAND

Figure 2:
Graph of the average household size
in New Zealand for the last 100 years.
Summarised from Statistics NZ (2014)

URBANISED CENTRES GROWTH VS OVERALL GROWTH

Figure 3:
Graph of the growth in the urbanised
centres of New Zealand, compared
to overall. Summarised from Statistics
NZ (2014)

OUR CHANGING POPULATION AND PRIORITIES

The gap between the supply-and-demand of the housing market is ever increasing due to the growing centralising population, diversifying households, and limited space (Allen & Bryson, 2017; Wellington City Council, 2015, p. 12). Changing social patterns have resulted in greater popularity of urban living and new household formations, where smaller household types are becoming increasingly common (Ancell & Thompson-Fawcett, 2008, p. 431; Page, 2007, p. 16). New Zealand is already one of the most urbanised nations (Statistics New Zealand, 2006). In the 10 years between the 1996 and 2006 census, the populations of the inner-city centres almost doubled and has since grown steadily (see figures/graphs) (Stats NZ, 2014). In Wellington, the inner-city population has risen from around 1400 in 1996 to 13000 in 2013, and another 6000 are expected to be housed within this small, existing area by 2026 (see figures/graphs) (Sowash et al., 2015; Statistics New Zealand, 2006; Stats NZ, 2014). The population of the inner-city, Te Aro area specifically, is growing over three times faster than the rest of the city combined (Population growth, n.d.).

As our urban population grows, household types are becoming much more diverse with the average size of households shrinking, further increasing the demand for homes (see figures) (Ancell & Thompson-Fawcett, 2008, p. 431; Morrison & Schrader, 2010; Stats NZ, 2017). Single and two-person households are projected to be the fastest-growing household type (Dunbar et al., 2011, pp. 24, 26; Stats NZ, 2015). This change is largely driven by empty nesters, early or active retirees, and delayed or forgone parenthood (Dunbar et al., 2011, pp. 24, 26; Stats NZ, 2015). This has swayed the typical group of inner-city residents to include more than just young people and frequent movers with over a third of the residents of Wellingtons central city now being over 50

(Sowash et al., 2015, p. 8). Although, young people and frequent movers are still the majority of inner city residents (Dunbar et al., 2011). Throughout the age-groups the prominent reasons for choosing dense dwelling styles are convenience to services and entertainment, and decreased maintenance and travel times (Ancell & Thompson-Fawcett, 2008, p. 346; Chile et al., 2014, p. 152; Dunbar et al., 2011; Sowash et al., 2015, p. 7). Empty nesters and older adults are interested in nearby theatres and restaurants and are more likely to stay in the central city long term, whereas younger residents look to the proximity of study, workplaces, bars and parks (Ancell & Thompson-Fawcett, 2008, p. 346; Chile et al., 2014, p. 153; Sowash et al., 2015, p. 7). The range of households that can be considered inner-city residents is continually broadening in diversity of formation, but remain related by their housing motivations that draw them to this location.

The growing proportion of people who are seeing the city as a longer-term home demonstrates an improved attitude towards this style of living. In 2008 only 26% of residents had lived in central Wellington for over four years, rising to 34% by 2015 (Sowash et al., 2015, p. 8). Nevertheless, there has also been a general decrease in the ownership of homes for the whole of New Zealand, hence an inherent increase in mobility and transiency of residence nationwide (Dunbar et al., 2011, p. 23; Page, 2007, p. 4). This suggests the assumption of a typical, linear housing career that aligns with an individual's phases in life is disrupted and tending to be more alternative (Dunbar et al., 2011, p. 16). However, the ability to age in place and stay within a neighbourhood community are still commonly desired (Dunbar et al., 2011, p. 16). Housing needs to be adaptable enough for residents to comfortably stay for more than a few years.

Figure 5:
Graph of the number of households types in 2013 compared to projections for 2038. Summarised from Statistics NZ (2014)

Figure 6:
Diagrammatic representation of the
increase in population and shift in
household structure

URBAN HOUSING

The Wellington City Council is well aware of the increasing need for urban housing. In 2011 in their central city framework they estimated that at least 20,000 new dwellings are required to accommodate growth (Central City Framework, n.d., p. 20). For these new dwellings to be successful, it is vital that they can support a common notion of home as well as address the issues driving the housing crisis.

Apartments are key to urban living as their high spatial efficiency allows more people to live within proximity of amenities and each other. They also can seriously increase the amount of housing within existing city boundaries. It is a housing typology that is relatively new to New Zealand but is gaining popularity for both consumers and planners (Carroll et al., 2009, p. 354; Central City Framework, n.d., p. 12). There are significant benefits to high-density living.

Firstly, high-density living provides a convenient lifestyle with minimised travel time and maximum possibility of connection through spatial efficiency and mixed-use zoning (Carroll et al., 2009, p. 359; Sustainable Urban Development Unit, 2008, p. 4). This includes improved movement and accessibility as well as reduction of car dependency and pressures on transport infrastructure (Dunbar et al., 2011, p. 6). Secondly, high-density living has the potential to allow for more sustainable development through efficient land use. This could result in minimal sprawl and protection of rural land and natural reserves (Sustainable Urban Development Unit, 2008, p. 3). However, this is only effective if the apartments are designed to be both environmentally and socially sustainable (Ancell & Thompson-Fawcett, 2008, p. 426). Thirdly, high-density living gives rise to the possibility of greater housing choice. This would result in better wellbeing of residents and improved social sustainability (Ancell & Thompson-Fawcett, 2008, p. 426; Carroll et al., 2009, p. 354; Dunbar et al., 2011, p. 6; Sustainable Urban Development Unit, 2008, p. 3). Other crucial factors are decreased maintenance (Carroll et al., 2009, p. 359; Lauster, 2016, p. 175), increased flexibility and increased safety due to the secure 'lock and leave' nature and mixed-use zoning allowing use of the environment throughout different times of day (Carroll et al., 2009, p. 359).

WHAT IS DENSITY?

The concept of density is derived from physics as a simple equation of quantity of mass per unit volume (Dovey & Pafka, 2014, p. 66). However, urban density is much more complex as it involves a range of interrelated quantities (Cheng, 2010, pp. 4–6; Churchman, 1999, p. 390; Dovey & Pafka, 2014, pp. 66–70; Rapoport, 1975, p. 136). There are many possible metrics, which are related but not with static relationships. It is also important to understand that the discussion is measured rather than perceived, density like this project, is concerned with physical housing capacity.

In New Zealand, density is typically classified as low, medium or high (Allen & Bryson, 2017, p. 4). Despite the current focus on residential intensification, there is no consensus of the definitions of the labels (Allen & Bryson, 2017, p. 4; Coxhead, 2017, p. 98; Sharpin, 2006, p. 9). An overview of the New Zealand definitions for high-density housing reveals that most are based on rigid housing typologies, unsuitable for the development of new housing models. Otherwise, dwellings per hectare is the dominant indicator of density. It is used in this thesis to generate a measurable, target housing capacity of the development (Allen & Bryson, 2017, p. 4).

The criteria defined in the 'Qualitative Benchmark' subsection of this thesis is also used to ensure individual housing capacity through qualitative means, instead of through arbitrary metrics. It is important to note the lack of relationship that this measure has to urban form, as demonstrated in the following massing section, or even population. (Allen & Bryson, 2017; Dovey & Pafka, 2014; Rapoport, 1975). Other measures such as floor area ratio (FAR), site coverage (GSI) and network density are indicative of urban form, and population density and occupancy rate are indicative of population (Dovey & Pafka, 2014; Pont & Haupt, 2010).

The definition of high-density housing as 125–250 dwellings per hectare, developed by the Sustainable Urban Development Unit (2008) was selected (p. 147). This was the highest density definition found, providing an extreme testing scenario to prove the effectiveness of design methods. This selection also takes into account New Zealand's comparatively low urban densities.

Figure 7:
Diagrammatic dwelling density comparison (right)

WHO DEFINED IT?	WHAT AS?	WHAT ARE THE MAIN VARIABLES?
Department of Internal Affairs New Zealand (2008)	"125-250 dwellings/HA (for an apartment block)"	Dwellings per hectare
Waitakere City Council (2003)	"Buildings for residential purposes which are greater than 11m or 3 storeys in height"	Building height
BRANZ (Allen & Bryson, 2017)	"Apartment buildings greater than 6 storeys, with individual dwelling unit sizes ranging from studio apartments to 3-4-bedroom apartments"	Building height, dwelling typology
Wellington City Council in the Urban Growth Plan (2015)	"Apartments which are greater than 3 storeys"	Building height, dwelling typology
Wellington City Council In the Johnsonville MDRA Design Guide (2013)	Minimum 65 dwellings/HA	Dwellings per hectare
OPUS for Wellington City Council (Selby & Opus International Consultants Limited, 2007)	Greater than 1.8 people per household	People per household
StatsNZ (.id, n.d.)	"High density includes all dwellings joined together in a four or more storey block"	Dwelling typology
Javier Mozas and Aurora Fernández (Mozas & Per, 2006, p. 6)	250 dwellings per hectare	Dwellings per hectare
This measure was established based on international cases, focusing on Europe and America		

WHY NOT DENSITY YET?

Figure 8:
Tower diagram

Uptake of intensified housing is slower than predicted (Dunbar et al., 2011, p. 9). Consistent with trends overseas, the preference for detached houses separated by lot ownership continues, reinforced by shortfalls within the developer-driven, retail investor, apartment market (Dunbar et al., 2011, p. 9; Haarhoff et al., 2012; Marriage, 2010, p. 4). Early urban housing in New Zealand was especially bad, promoting the association with illness, poverty and overcrowding (Marriage, 2010, pp. 3–5). Interestingly, many residents of intensified housing are content albeit it may not be what they aspire to own (Dunbar et al., 2011; Haarhoff et al., 2012, p. 2). This indicates that the public has a narrow view of what intensified housing is provides and means. These social values could shift if it was experienced by a wider market. There is a lengthy list of critiques and negative associations found within housing literature that influences this consumer mind-set and many will need to be addressed for the demand of dense housing to increase (Carroll et al., 2009, p. 354; Dunbar et al., 2011, p. 9).

A study carried out in 2011 by the Centre for Housing Research Aotearoa New Zealand investigated the consumer experience of denser housing (Dunbar et al., 2011). The study identified 29 key attributes of varying necessity to be addressed to increase attraction, providing the basis for general design and site selection criteria for the latter part of this research. Findings aligned with common housing design literature both within New Zealand and internationally. The study considered three spatial scales of sanctuary, involving the dwelling itself, domain, which includes the area or neighbourhood over which day-to-day social relations happen, and accessibility, which involves the connection and proximity of the home to other amenities and activities within the city (Dunbar et al., 2011). Accessibility itself is considered a must-have attribute. Location in relation to amenities and transport is pivotal to the provision of attractive housing (Dunbar et al., 2011, p. x). Sanctuary and domain involve several specific attributes, which have been condensed and are listed and discussed below as summarised principles.

Summarised principles for attractive, intensified housing, presented by the Centre for Housing Research (Dunbar et al., 2011):

Domain:

- Distribution and diversity: provide a diversity of housing types to cater for a variety of households.
- Neighbourhood amenities: provide a range of community and commercial amenities to be nearby by carefully siting the development.
- Urban landscape: design the development with a focus on the character and quality of residences, mitigating the impact of non-residential uses and including greenery and open space.

Sanctuary:

- Dwelling Site and Layout: design the layout of dwellings to allow for privacy, security, spaciousness, private outdoor space and some personalisation both indoors and outdoors. This relies heavily on the configuration of the dwelling's connection with the outside environment.
- Capacity: provide dwellings that are of a reasonable size to afford desired lifestyles, including ample storage space and allowing for flexibility. This may require rooms to be able to serve multiple purposes without visual intrusion.
- Comfort: design dwellings for adequate internal light and ventilation as well as good thermal and noise insulation. This included attributes such as separate laundry to contain noise, access to sunlight and natural light in all habitable rooms.

FLEXIBILITY

A prominent driver of the principles outlined above is the ability of dense housing to provide a reasonable level of flexibility (Dunbar et al., 2011, p. 40). This applies at both the domain and sanctuary levels, impacting negatively on residents' control over social interaction, connection to the surroundings, functional space use and housing choice. Schneider and Till (2005) assert that flexibility is vital for socially, economically and environmentally viable housing (p. 157). Research also indicates that flexibility minimises risk to developers and investors, and increases the range and diversity of market appeal in New Zealand (Dunbar et al., 2011, p. 40). Typical housing follows the traditional nLDK house, which is a layout of a variable number of bedrooms attached to a core of the living, dining and kitchen spaces, shown as a bubble diagram in figure 9 (Batchelor, 2014, p. 25). Yoshiharu Tsukamoto and Marriage (2010, p. 7) identify this housing structure as lacking flexibility for today's norms, especially at higher densities where dwellings are naturally smaller (as cited in Batchelor, 2014, p. 25). The result is a current system of mass housing that is unattractive to most. This rigid spatial structure is outdated for today's diversity of lifestyles and everyday routines, as any prescriptive, inflexible housing arrangement will likely become.

Apartments inherently obstruct their adaptability through expansion and serious renovation made even more difficult by ownership and regulatory issues (Marriage, 2010, p. 3). Currently, minimum apartment sizes are only enforced in central Auckland as 35m² for a studio, 45m² for a one-bedroom unit and 70m² for a two-bedroom unit (Marriage, 2010, p. 3). No other metric provisions are required apart from for accessible toilets, laundries and old persons' housing (Marriage, 2010, p. 3). These apartment minimums are less than half of the reported average size of housing in New Zealand in 2011 (QV, 2011). This lack of spaciousness and capacity is exacerbated by the disconnection of regular urban housing units from external areas that can become a significant and flexible

extension of living space. Therefore, a suitable level of capacity and spaciousness should be achieved proactively, through unit design that anticipates accommodating continually shifting norms and social values through either size, good design or both.

[This content is unavailable. Please consult the figure list for further details.]

*Figure 9:
Bubble diagram of Tsukamoto's identified nLDK system
layout (Batchelor, 2014, p.4)*

OUTDOOR SPACE

PRIVATE OUTDOOR SPACE

- Biggest critique of housing from the Survey of Central City Dwellers in Wellington, NZ
- Highly recommended for attractive dense housing by the Centre for Housing Research Aotearoa New Zealand

For the local context, the lack of private outdoor space was a particularly prominent issue (Gray, 2014, p. 83; Sowash et al., 2015, p. 14). Outdoor space and opportunities for outdoor living is bizarrely neglected both in New Zealand's housing literature and typical high-density housing, especially for a nation that boasts and affinity with nature and outdoor lifestyles (Marriage, 2014, p. 2; Sowash et al., 2015, p. 20). Literature tends to discuss dwellings as the internal space, disregarding the impact of attached outdoor spaces and the greater domain (Dunbar et al., 2011; Haarhoff et al., 2016, p. 13). Private outdoor space for apartments generally consists of balconies that are too exposed visually, unsafe for children, too small, inappropriate for the climate or

simply non-existent (Carroll et al., 2009, p. 360; Gray, 2014, p. 83; Sowash et al., 2015, p. 20). This drives away many residents as adequate outdoor space is often considered a "must-have" attribute of housing (Dunbar et al., 2011, p. 9; Gray, 2014, p. 83; Sowash et al., 2015, p. 14). In a 2015 survey of central city dwellers in Wellington, outdoor space was overwhelmingly the biggest critique and the most quoted reason for residents to move out of the central city (Sowash et al., 2015, p. 14). Hence, it is clear that this must be addressed to facilitate the transition to densification.

*Figure 10:
Diagram of no outdoor space in high density*

PROJECT SCOPE

This research contributes to the ongoing development of multi-unit, urban housing for New Zealand. It intends to provide a methodological precedent, through the development of a final architectural product. Hence, the contribution to the discipline will be strategies to improve high-rise housing that are discovered and developed throughout this thesis.

The design provides a hypothetical test case that is sited in central Wellington and responds to its specific contextual conditions. This allows a process and outcome from which lessons can be extracted. As directed by background literature, the focus is on possibilities for outdoor living space and the typical, associated affordances in high-rise housing. This cannot exclude the relationship between the interior dwelling space and exterior space, and the relationship between private dwelling space and other spaces. Other spaces, such as surrounding public space, are considered for their relationship and contributions to these only. Design at the human scale is key to relate spaces with human experience.

The scope of this research does not include specific construction detailing for consent and financial feasibility. Although these factors will be considered, they will not be at the forefront of design decisions.

AIMS + OBJECTIVES

The aim of this research is to investigate models and strategies for high-density housing that are more desirable by accommodating quality outdoor space and other sought-after housing amenities.

Informed by the literature, the proposed objectives to achieve this are to:

- develop and promote quality outdoor living opportunities for the residents of high-density housing that is comfortable, functional and has immediacy to indoor living spaces;
- develop strategies for balancing privacy and neighbourly interaction;
- develop flexible units that allow a demographic diversity of residents and the notion of the New Zealand home as the “hobby you inhabit”;
- reach what is classified as a high-density.

QUALITY OUTDOOR
LIVING

PRIVACY + NEIGHBOURLY
INTERACTION

FLEXIBLE UNITS

HIGH-DENSITY
HOUSING

Figure 11:
Diagram of objectives

METHOD

This research will follow a design-led, action research method that is supplemented and informed by ongoing critical analyses of case studies and literature. This involves working through the problem in a cyclical process of iterative design and extracting learnings through critical evaluation. The flexible and responsive nature of the method is vital for complex problems. The method allows appropriate reflections and adaptations for both introducing and revealing new learnings throughout (Crouch & Pearce, 2013, p. 144).

The outcome will be a site-specific design with key strategies, principles and other insights that are widely applicable within the architectural and planning disciplines. The latter will contribute to the continually evolving knowledge about the design of both high-density and residential environments.

Supporting images will be included in the addendum.

*Figure 12:
Methodology diagram*

Method specifics:

1. Literature and case study investigations to understand housing issues in the local context and inform a list of goals for design testing
2. Investigation of design theses and precedent, multi-unit housing to provide an array of spatial strategies as potential solutions for desirable high-density housing
3. Analysis of a test site to inform the hypothetical design test
4. Staged, cyclical development of a hypothetical design to test strategies
5. Final critical reflection to extract overall learnings and conclusions

Supporting images for the design outcome will be included in the addendum.

RESEARCH QUESTION

*How can the prioritisation of
quality outdoor living help
develop desirable high-density
housing models in Wellington?*

LITERATURE REVIEW

PUBLIC OUTDOOR SPACES
COMMON AND SHARED OUTDOOR SPACES
PRIVATE OUTDOOR SPACE
BALANCED OUTDOOR LIVING

02

OUTDOOR LIVING

Providing a token allocation of a balcony, or a shared patch of grass at the ground level of a building, has proven insufficient (Carroll et al., 2009, p. 354; Sowash et al., 2015, p. 10). Therefore, the following literature review intends to develop an adequately in-depth understanding of what successful outdoor space is, at both physical and psychological levels. The focus is on resident experience and qualitative value. The intention is to allow a better breakdown and consideration of spatial and perceived factors than the typical, itemised provision of space involves, as well as an understanding of why outdoor spaces are desired. It has been identified in the literature that well-designed space not only addresses physical comfort and privacy, but also personal social and cultural preferences and activities.

Residential outdoor space is a relatively limited, but growing area of interest. For this reason, New Zealand literature takes precedence when possible and is supplemented by international literature throughout. It is uncommon for outdoor space to be discussed as an integral part of the dwelling, instead the interior dwelling is considered as isolated, preventing true understanding of external dwelling spaces.

Outdoor space can be provided at varying levels of ownership, defined for this research as follows:

- *Private space* provided for an individual household
- *Shared space* provided for neighbouring households
- *Common space* provided for all residents of a development
- *Public space* provided for all and any

PRIVATE

SHARED

COMMON

PUBLIC

Figure 13:
Space ownership types

All four outdoor space types contribute to the perception of the identity of an area and quality of residence (Coolen & Meesters, 2012; Milanovic & Vasilevska, 2018, p. 295). However, the combinations of functions and meanings associated with open space of different ownership types are unique (Coolen & Meesters, 2012, p. 49). Thus, it is important to provide the range of outdoor space types, in terms of ownership levels, close to the internal space of dwellings. These spaces should also connect to each other with an easily comprehended hierarchy and flow of space to establish connectivity and clear ownership intentions (Gray, 2014; Milanovic & Vasilevska, 2018, p. 295). Disuse and safety are common concerns for outdoor areas, typically affected by maintenance, greenery, accessibility at a neighbourhood scale and the level of domestication that is encouraged.

PUBLIC OUTDOOR SPACES

Non-private open spaces are vital to a home's desirability as they are defining spatial features of the locality that provide necessary opportunities for social interaction and shared amenity.

Public, common and shared open spaces are key to dwelling environments, influencing liveability, identity, sense of belonging through community interaction and sense of place, and the experience of nature (Coolen & Meesters, 2012, p. 49; Gray, 2014, p. 24; Milanovic & Vasilevska, 2018, p. 295). These outdoor areas can supplement limited private outdoor space whilst providing unique qualities, uses and meanings with great social and physical health benefits (Coolen & Meesters, 2012, p. 60; Griffin, 2012). Public open spaces are mostly used for exercise, children's play, walks, to enjoy nice weather and to just get out of the house in general (Coolen & Meesters, 2012, p. 53; Gray, 2014, p. 24). Urban space theorist Jan Gehl (2011) divides the activities that occur in public space as three types: 1) necessary activities such as waiting for the bus which happen in all conditions, regardless of environmental design; 2) optional activities such as sunbathing which only happen in favourable weather and environmental design; 3) social activities, which includes simply seeing and hearing other people, and only occur as a result of the first two categories (pp. 8-12). Facilitating optional activities and increasing the amount of time residents like to spend outside is crucial to promoting social interaction, which will lead to a better sense of belonging, community and safety (Gehl, 2011). The three key elements to this are visibility into public space, ease of route and the provision of excuses or reasons to enter the space (Gehl, 2011, p. 115).

Classifications of open space are increasingly complex. Carmona (2010) suggests that the defining factors are function, perception and ownership, describing space types as a 'patchwork' where these variables overlap, rather than being exclusive of one another (p. 172). Lack of consideration of these variables has the risk of leading to homogenous public space that disregards people's needs (Carmona,

2010, p. 172; Cattell et al., 2008, p. 556; Coolen & Meesters, 2012, p. 60). People require a variety of spaces that accommodate lingering, transiting, social interaction and retreat (Cattell et al., 2008, p. 556). Supporting this view, Coolen and Meesters (2012) indicate that people prefer a series of smaller open spaces to a single, larger space, perceived as allowing better accessibility of diversity in amenity and spatial character within a neighbourhood (p. 60). Typical functional types of open public spaces which can also be provided as shared or common spaces depending on access can be distinguished as follows:

- Parks
- Squares and plazas
- Memorials
- Markets
- Streets, laneways and other open access ways
- Promenades
- Waterfronts
- Nature reserves
- Playgrounds
- Sports grounds
- Skate and bike parks

Open space can be provided within built forms as park voids, rooftop parks, terraces and courtyards as demonstrated in figure 14

Figure 14:
Diagram of how open space can be
provided

COMMON AND SHARED OUTDOOR SPACES

Common and shared outdoor spaces are a common aspect of low-rise, high-density housing (LRHDH) (Milanovic & Vasilevska, 2018). These spaces are often used to supplement a loss of private outdoor space while retaining a degree of intimacy and privacy for residents (Gray, 2014; Griffin, 2012; Milanovic & Vasilevska, 2018, p. 295). Common or shared spaces are generally closer to the functions of private space, used more for sitting and relaxing, hanging out washing, talking to neighbours and eating outside (Gray, 2014, p. 23; Griffin, 2012, p. 276). Although, this distinction between public and semi-private use depends on the nature of the specific space, particularly the perceived levels of amenity, accessibility and control (Coolen & Meesters, 2012, p. 60; Lauster, 2016, p. 170; Newman, 1996, p. 17). Griffin (2012) asserts that these spaces are most important for providing: space between buildings, an attractive outlook, retreat spaces for sitting and relaxing, and space for talking to neighbours and space for children to play in (p. 284). However, it is important to understand that for all of the social benefits of communal space, not everyone wants to socialise so it is important to also include possibilities for seclusion and anonymity (Gray, 2014, p. 92; Milanovic & Vasilevska, 2018).

A serious issue with common and shared outdoor space is neglect. Inappropriately designed space can be uninviting and cause safety issues. Research indicates that shared spaces work better if residents also have a level of control over social interactions, activities afforded are compatible with individual residents needs and wishes, and shared spaces are aesthetically attractive and easy to access (both visually and physically) from private spaces (Griffin, 2012, p. 275). Essential is familiarity with neighbours, a sense of belonging and ownership in the space, and a clear understanding of what is allowed in the space, as the fear of upsetting neighbours is the most common barrier of use (Gray, 2014, p. 90; Griffin, 2012, p. 285). Griffin (2012) outlined the following nine characteristics to support the use of shared outdoor space (p. 285):

- 1) a maximum of 20 dwellings sharing any one outdoor space;
- 2) residents are required to enter shared outdoor space for other means, for example to use necessary access-ways or rubbish storage;
- 3) shared outdoor space has features that encourage lingering, such as seating, a water feature, or a barbeque;
- 4) space for gardening is included, preferably close to private dwellings;
- 5) private outdoor space that overlooks the shared space is provided for all residents, no matter how small (increasing the likelihood of residents going outside by increasing opportunities to become familiar with the shared space and neighbours from a place of security and comfort);
- 6) areas for different functions are clearly differentiated to decrease disturbance and improve clarity of spatial purpose;
- 7) transitions between individual and shared spaces are clear;
- 8) sufficient privacy between shared and private spaces to remove the sense of intruding; and
- 9) systems and arrangements regarding management and maintenance practices are clear.

ACCESS-WAYS

Access-ways within a housing development are a key type of shared or common space because the frequency of use by residents and convenience to private living spaces. Gallery access, both attached and detached, offers connection with the outdoors through its external building placement. Burgess et al. (as cited by Coolen & Meesters, 2012) found that outdoor spaces which are intimate, familiar and play a part in people's daily lives are often more valued by occupants (p. 52). There is also research that people think in terms of time as opposed to actual distance, so the more quickly that outdoor spaces can be accessed, the better. Access-ways are typically enclosed, monotonous, uninviting and solely functional spaces for transit between private units and

the public street (Coolen & Meesters, 2012 p. 52). However, they have the possibility to be reimagined as a pleasant spatial experience that also allows lingering, social interaction and sanctuary. This is something that the typical access to low density housing achieves more easily with streets, front yards and porches.

Figure 15:
Open air access-ways types

PRIVATE OUTDOOR SPACE

Private open space directly improves the perceived quality of homes through better spaciousness and flexibility (Milanovic & Vasilevska, 2018, p. 298). It is considered as an extension of the private living space into a zone that is qualitatively different, hence provides a whole different range of affordances (Coolen & Meesters, 2012; Gray, 2014; Milanovic & Vasilevska, 2018). Coolen and Meesters (2012) argue that it is equally as crucial as the rest of the dwelling for psychological wellbeing, yet it is often overlooked in both housing research and typical new housing (p. 51). Moore (2017) also opposes this tendency, stating that with increased popularity of dense living, larger houses and the continued “system of development that promotes an inefficient use of available private land on a macro level” outdoor living has become jeopardised (p. 1). It is especially neglected in high-rise, high-density developments where floor area is often exploited to its maximum and space is scarce. Our typical housing models and systems to need to be redeveloped if we are to provide both density and good outdoor living space (Marriage, 2014, p. 3; Moore, 2017).

Private outdoor space is typically provided as the types shown in figure 16.

Figure 16:
Diagram of typical built form to open
space relationship types

INSECT AND BIRD LIFE
LARGER TREES
STORM-WATER RUN-OFF
AESTHETICS AND VISUAL ATTRACTION
PERCEPTION OF NEIGHBOURHOOD,
ESPECIALLY IN TERMS OF SUSTAINABILITY

SOFTLY DELINEATE PUBLIC AND PRIVATE
SPACE

PRIVACY FOR THE HOUSEHOLD AND INDIVIDUALS

PLEASANT C

AN OUTDOOR ROOM WITH QUIET AMBIENCE
NOISY OR MESSY PASS TIMES

CONTROL OF NEIGHBOURLY INTI

FEELING OF SPACIOUS

CONTROLLED
PRIVATE
CONVENIENT
SUNNY
SAFE

SPACE FOR ST

THE BACKYARD

The domestic backyard provides the quintessential example of desired, outdoor, living space due to its complete privacy, control and flexibility for the occupant (Lauster, 2016; Moore, 2017, p. 4). It is typically referred to as a garden in literature, inherently including the natural setting and activity of gardening in discussions. As a commonly identified ideal, the private backyard provides a benchmark for enriching the dwelling,. Hence why it contributes to the design criteria in the latter part of this thesis.

Gardens are expected to be sunny, safe, private, controlled and convenient (Lauster, 2016; Milanovic & Vasilevska, 2018, p. 300). Gardens provide a whole host of qualities for the home itself, largely concerning the visual division and control of public and private boundaries as well as the spaciousness of the home (Gray, 2014; Lauster, 2016; Milanovic & Vasilevska, 2018, p. 300). There are also ecological benefits for the wider environment when hardscaping is kept to a minimum (Lauster, 2016; Moore, 2017, p. 4).

*Figure 17:
Beneficial backyard qualities
according to Gray (2014), Hall
(2010), Lauster (2016) and Moore
(2017).*

BACKYARD TYPES

Private outdoor spaces have diverse uses and meanings for different residents, but there are clear themes. This multifaceted nature has prompted studies from a wide range of perspectives (Bhatti & Church, 2004; Coolen & Meesters, 2012; Gross & Lane, 2007; Loram et al., 2011). Related empirical studies are largely based in Australia, the Netherlands and England causing complications for translating the findings to the local context (Coolen & Meesters, 2012, p. 58; Hall, 2010, p. 15). However, their findings maintain importance as they provide a range of significant uses and meanings, illustrating why private outdoor spaces are desired. The studies also highlight the multi-functionality of private outdoor space (Coolen & Meesters, 2012; Gray, 2014; Hall, 2010). Grampp (as cited in Coolen & Meesters, 2012) determined three types of garden based on common uses and meanings as follows (p. 52):

1. the living garden, which is an outdoor extension of the dwelling for domestic activity improving the spaciousness and flexibility of the dwelling;
2. the well-tempered garden, which is formal, tidily maintained and essentially for aesthetic purposes, supporting a sense of identity and a pleasant view for the resident; and
3. the expressionist garden, which is for the hobby of gardening which allows escapism, learning and sensual connections to nature, as well as supporting sense of identity and attachment to place.

All three types support well-being and homemaking. The surveyed literature suggests that the living garden is the most prominent and desired outdoor space type for residents, across cultural backgrounds (Coolen & Meesters, 2012; Gray, 2014; Hall, 2010, pp. 16–19; Milanovic

THE LIVING GARDEN
FUNCTIONAL

THE WELL-TEMPERED GARDEN
IDENTITY DISPLAY + OUTLOOK

THE EXPRESSIONIST GARDEN
FULFILMENT THROUGH WORK

Figure 17:
Backyard types as defined by
Grampp (as cited in Coolen &
Meesters, 2012)

& Vasilevska, 2018). There is also a defined set of activities that outdoor space is expected to provide for that supports this notion, as they are predominantly functional day-to-day, leisurely or social activities (Gray, 2014, p. 22; Hall, 2010, p. 23; Loram et al., 2011, p. 808; Moore, 2017, p. 5). For example, Mead (as cited in Hall, 2010) found that in suburban Australia clothes drying is by far the most prominent use of private outdoor space, followed closely by sitting out, gardening and entertaining (p. 16). Yet, the well-tempered and expressionist gardens tend to receive more attention in literature, often focused on the therapeutic potential of nature and gardening, related to Kaplan's (1995) Attention Restoration Theory (ART) (Coolen & Meesters, 2012; Gross & Lane, 2007, p. 226; Hall, 2010; Longhurst, 2006; Loram et al., 2011, p. 808). ART posits that interaction with natural environments allows better focused concentration by prompting effortless attention and allowing recovery time and restoration from directed attention fatigue (Kaplan, 1995). It is not possible to adequately provide all garden types in singular private spaces for occupants of high-rise housing. Therefore, it is essential to re-think the way these affordances are included.

BACKYARD ACTIVITIES

Figure 18:
Expected backyard activities
described in literature

ESCAPISM

IDENTITY + OWNERSHIP

RELATIONSHIPS

A GARDEN IS A PLACE...

BACKYARD MEANINGS

In the Netherlands, Coolen and Meesters (2012) found that the most important meanings of private outdoor space describe an 'outdoor room' and relate strongly to the meanings of the living room (pp. 52, 58 & 59). Both the living room and the backyard are commonly seen as places to enjoy life and for leisure activities, where they differ is to do with their inherent traits of inside and outside (Coolen & Hoekstra, 2001; Coolen & Meesters, 2012; Gross & Lane, 2007). This reinforces the prominence of 'the living garden' (Grampp, as cited in Coolen & Meesters, 2012, p. 52) and of outdoor space as an essential part of the

dwelling (Hall, 2010, p. 60).

The wide range of possible meanings for backyards arises due to flexibility that "generates a significant opportunity to individualise structures, order nature and fashion private histories and generally pursue this symbol of self" (Hall, 2010, p. 35). This process of control, also known as territoriality, has psychological benefits through place attachment, identity claims and improved person-environment fit, which enhance personal identity and reduce environmental stressors (Bhatti & Church, 2004; Fleury-Bahi et al., 2016; Gilbert et al., 1998; Gross & Lane, 2007, p. 234). Place attachment is the emotional bond between a person and a place based on personal meanings, experiences and behaviour (Fleury-Bahi et al., 2016, p. 87). Identity claims are symbolic statements that a person uses to communicate their preferred identity to themselves and others, either consciously or subconsciously (Gilbert et al., 1998). Person-Environment fit is the compatibility between the user and the environment (Fleury-Bahi et al., 2016, p. 459).

Figure 19:
Francis's (as cited in Coolen & Meesters, 2012, p. 52) survey results in California and Norway outlined ten meanings of gardens, listed on the left and Coolen and Meesters' (2012) meanings of private outdoor space, listed in order of importance according to their survey in the Netherlands

PRIVATE OUTDOOR SPACE MEANS...

Francis (as cited in Coolen & Meesters, 2012) clarified ten meanings of gardens based on surveys with Norwegian and Californian gardeners (p. 52). As these are based on the garden, rather than general outdoor space, the results focus on 'the well-tempered garden' and 'the living garden'.

Gross and Lane (2007) subsume most of these under the themes of escapism, identity and ownership, and relationships, which were the major themes that arose in their own study of the meanings of gardens across age groups (pp. 238–240). These themes are consistent with other discussions of gardens and outdoor space. Particularly notable are the related concepts of escapism, retreat and freedom (Coolen & Meesters, 2012, p. 52; Gross & Lane, 2007, p. 231). The garden is often desired for its ability to provide these through a rewarding ritual and distraction from everyday concerns and pressures (Coolen & Meesters, 2012, p. 52; Gross & Lane, 2007, p. 231). It encourages "sensual connections with nature" (Bhatti & Church, 2004, p. 49), connection with a different concept of time and deep reflection, in line with the ART concept of 'being away' (Coolen & Meesters, 2012, p. 52; Gross & Lane, 2007, p. 231).

BALANCED OUTDOOR LIVING

A common thought is that private outdoor spaces can be simply substituted for public, common or shared spaces (Hall, 2010; Milanovic & Vasilevska, 2018). In New Zealand's typical high-density housing, this substitution has been unsuccessful (Gray, 2014). Gray (2014) states in her thesis about outdoor space in New Zealand, that the provision of privacy is the key factor in this. However, to provide functional and comfortable outdoor spaces with this level of privacy for all residents in high-rise, high-density will likely detrimentally jeopardise the liveability through other sacrifices. Bhatti (2009) argues it is more to do with the personal, place attachment, developed through control of a private garden as a sacred yet ordinary place of practice, than the privacy itself. Coolen and Meesters (2012) investigate this gap in substitution further in the Netherlands, discovering that the combination of affordances and meanings offered by a private garden is what makes these spaces so unique and desirable (p. 56). There is scope to investigate spaces with similar opportunities and qualities to support the development of the same affordances and meanings, potentially through exploiting control systems, intimate space design and similar place attachment development.

Gray (2014) also found that the size of private outdoor space was easily compensated for, and that residents were beginning to place equally high-value on common outdoor spaces (p 161). Common spaces provided previously unattainable amenities and social and aesthetic benefits (Gray, 2014), which is how many international models have become successful (Griffin, 2012; Marcus, 2003; Milanovic & Vasilevska, 2018). As household sizes shrink, the need to seek support networks and community outside of the household unit also grows (Ancell & Thompson-Fawcett, 2008; Chile et al., 2014; Marcus, 2003, p. 36). This indicates an emerging desirable space that has rich potential to supplement limited to no private

space, when executed to an adequate quality and able to accommodate a range of uses and wishes (Griffin, 2012, p. 284; Marcus, 2003, p. 36).

Current high-density housing lacks in providing for a variety of living styles and is very restrictive, resulting in limited market appeal. There is sufficient research that new typologies of high-density housing will broaden the market that this density appeals to, and that private space desired within the sanctuary can be successfully traded for other desirable attributes (Dunbar et al., 2011; Haarhoff et al., 2012). This is a trade-off process that occurs when households are choosing housing, constrained by price and location (Dunbar et al., 2011). The limited availability of housing has led to many people living in a density they did not originally desire, as other factors such as local amenities and quality of housing may take precedence (Dunbar et al., 2011). However, despite the strong stigma of densified housing, those who live there are actually satisfied and are more likely to keep living in denser housing (Dunbar et al., 2011; Haarhoff et al., 2016; Page, 2007; Sowash et al., 2015).

The following guiding questions are raised:

- What amenity can common space in high-rise housing offer and what does a network of desirable common spaces in high-rise housing look like?
- Where is the appropriate balance between public and private for common spaces in high-rise housing and how said common spaces provide the meanings and affordances of traditional backyards?
- What are appropriate spatial proximities of common and shared space to promote use and neighbourly interaction?
- What can reimagined spaces of calmness, sanctuary and escapism in urban housing look like, influenced by learnings of the backyard?
- How can common and shared spaces be sacred, yet ordinary spaces of practices, as well as supporting self-expression?
- How much broader can the target market for high density housing become with the generation of new typologies?

A TARGETED SUB-MARKET
SPATIAL AFFORDANCES AND OPPORTUNITIES

03

A CRITERIA

A QUALITATIVE BENCHMARK

The following provides a series of goals for the design investigation of this thesis. These goals emerged from the literature discussed above. The authors discussed above directly influenced the criteria below. However, the authors alone do not reflect the extent of research undertaken and are just a glimpse of the research. Authors such as Rebecca Chan, Kim Dovey and writings by the Ministry for the Environment were important for providing general insight into the nature of intensification in New Zealand. Additionally, that literature provided insights into housing design tools and urban design tools applicable both nationally and internationally.

A TARGETED SUB-MARKET EXAMPLE

Inner-city housing is typically desired by a very specific and targeted submarket, which over the last few years has begun rapid expansion and diversification (Dunbar et al., 2011; Sowash et al., 2015). For the scope of the later design research, a list of likely households have been described below with the intention that they are the minimum range of occupants to be provided for. This is based off the local work done by Dunbar (2011), Page (2007), Sowash (2015) and Statistics New Zealand (2014, 2015, 2017).

THE PROFESSIONAL ROOM-MATES

- Well separated spaces to provide privacy
- A space where all residents can enjoy the dwelling together
- Easy maintenance
- Convenience to places of study

THE YOUNG, INTERNATIONAL PROFESSIONAL

- Easy maintenance
- Convenience to places of work
- Only have a small number of belongings

THE EMPTY NESTER COUPLE

- Easy maintenance
- Pleasant living space
- Hobby space
- Plenty of storage because they have a decent number of belongings after down-sizing
- Space for entertaining

THE SEMI-RETIRED COUPLE WHO TRAVEL

- Easy maintenance
- Space and reasons to 'potter'
- Pleasant living space
- Space for entertaining

THE SINGLE GRANDPARENT WITH REGULARLY VISITING FAMILY AND FRIENDS

- Easy maintenance
- Space and reasons to 'potter'
- Pleasant living space
- Spaces that can become private, or be included into the bigger living space as needed
- Space for entertaining
- Single level unit for accessibility

SPATIAL AFFORDANCES AND OPPORTUNITIES

The following possibilities are derived from the literature above to frame assessment of designs and case studies ahead.

GENERAL HOUSING WISHES

- Maximised accessibility to amenities and destinations desired near housing
- Mixed use zoning
- Diversity of housing types to suit a range of living patterns and households
- Interesting and pleasant housing design through features such as high ceiling heights
- Low maintenance design
- Ample storage space
- Spacious design
- Natural light and ventilation in all habitable rooms
- Access to sunshine

BACKYARD CASE STUDIES

The qualitative literature on outdoor space was more concerned with abstract concepts and general affordances than spatial or architectural features. The following case studies provide a grounding in spatial structure. Five houses from Churton Park, Wellington, were chosen to provide an example of local, contemporary, private outdoor space use, as they are new, detached houses.

*Figure 19:
Reference plan for backyard case
studies.*

3 SANDYBROW, CHURTON PARK

Built: 2004

Land area: 606m²

Figure 20:
3 Sandybrow, Churton Park
case study analysis

5 SANDYBROW, CHURTON PARK

Built: 2004

Land area: 568m²

Figure 21:
3 Sandybrow, Churton Park
case study analysis

7 SANDYBROW, CHURTON PARK

Built: 2004

Land area: 580m²

Figure 22:
3 Sandybrow, Churton Park
case study analysis

9 SANDYBROW, CHURTON PARK

Built: 2005

Land area: 623m²

Figure 23:
3 Sandybrow, Churton Park
case study analysis

11 SANDYBROW, CHURTON PARK

Built: 2005

Land area: 542m²

Figure 24:
3 Sandybrow, Churton Park
case study analysis

BACKYARD CASE STUDY SUMMARY

The living garden is the most common garden type in these cases, followed by the well-tempered garden. The expressionist garden also made an appearance but was much less common than literature indicated. All cases and yard types were found to be distinctly different, demonstrating the diversity of individual preferences and the importance of total control and flexibility. There is a big range in spatial configurations, privacy levels and affordances. However, all gardens included a sunny private area which the residents could retreat to with convenience from the back or side of the house. That space tends to be the largest and is where the widest range of activity based affordances and garden types occurred, providing an extension of the living space into a qualitatively different zone. The side-yards with awkward proportions are basically wasted space. Side-yards do allow for the physical separation of houses, access to the back and provide a decorative outlook. The front-yard is a display of identity and a semi-private transition zone to the home, providing a largely psychological and decorative function. This is where privacy levels varied the most. The literature demonstrated the similarities of private outdoor space in New Zealand to the Netherlands, Australia and England (Coolen & Meesters, 2012; Hall, 2010, p. 40).

Figure 25:
Churton Park case study
analysis summary

DESIRABLE HOUSING QUALITIES

The most desirable housing qualities, derived from the literature review of outdoor space and the above case studies are listed below.

SPACES THROUGHOUT THE DEVELOPMENT SHOULD BE:

- A rich journey between the public street and private home that invites lingering, social interaction and a sense of sanctuary when desired;
- A clear hierarchy and flow of spaces that communicates ownership and activities permitted
- Thermally comfortable for the majority of the year i.e. have sunlight access and sun and wind shelter, and are convenient to access (preferably directly accessible);
- Spaces which support retreat, sanctuary and quiet ambience;
- A design that allows residents to comfortably undertake the range of expected outdoor activities; and
- Clear opportunities to exercise territoriality through control and potentially individualisation or ritual processes, promoting the development of positive place attachment.

SHARED SPACES SHOULD BE:

- Inviting both in terms of amenity and environment to support use and the development of community.

AT THE THRESHOLD OF THE PRIVATE DWELLING IS:

- The possibility to visibly and creatively personalise the dwelling for semi-public displays of identity;
- The possibility to exercise control over the degree of privacy and interaction in both private and shared spaces;
- The possibility to comfortably extend living patterns outside of the individual private dwelling, focused at the threshold;
- A transition between the private dwelling and the public space to invite neighbourly interaction;
- Good visibility and ease of access into non-private spaces from individual dwellings; and
- A pleasant outlook from most living spaces.

THE PRIVATE DWELLING SHOULD INCLUDE:

- A series of qualitatively diverse, private, living spaces, likely through the use of different lighting, volumes and views; and
- Internally flexible housing units allowing a range floor plans.

DESIGN BASED THESES
OUTDOOR SPACE AND DENSITY IN PRACTICE
ADDITIONAL PRECEDENTS

04

CASE STUDIES _ STRATEGIES

CASE STUDIES

The following are three series of case studies that influenced the design contained in the latter part of the thesis. The intention for both of the first two groups was to provide a series of strategies that allow residential outside space in dense or multi-unit housing. The first demonstrates the existing body of knowledge in a theoretical setting, for a deep understanding of the strategies and process. The second then demonstrates the use and success of these methods in practice. It shows the role that urban form plays in resulting spatial qualities. The third group provides more specific strategies that responded to issues raised throughout the design process, and are not strictly selected for outdoor space.

DESIGN-BASED THESES

Existing design-based theses provide a series of spatial strategies which can be used as a starting point for design explorations. The key techniques found were: interlocking apartment units, voided building masses, shared multi-use gallery access, mat-building and spatial looseness. The discovery of the series of techniques used by interlocking apartments to provide a phenomenological dimension to design, are highly valuable.

This literature frames the scope to be a high-density project that is focused on human scale. Previous investigation have focused either on outdoor space and density, density and the human scale or outdoor space and the human scale, but never all three.

MAT-BUILDING

VOIDED BUILDING MASSES

MULTI-USE GALLERY ACCESS

INTERLOCKING APARTMENT UNITS

SPATIAL LOOSENESS

Figure 26:
Diagrammatic representations
of Spatial Strategies common
to relevant design-based
theses

MAT-BUILDING

Figure 27:
Diagrammatic representation
of Mat-building

Mat building is a design strategy coined by Alison Smithson, that organises the structure and spaces of a building following a modulated grid (Batchelor, 2014, p. 138; Gomez et al., 2013). It focuses on relational, rather than formal, systems with possibility for growth, erosion and change. In other words, it focuses on “[d]ismantling and reframing programme and composition, mat-building envisaged architecture as a dynamic, flexible armature” (Gomez et al., 2013). Batchelor (2014) found that a privacy based mat that leaves programme open, was highly successful for integrating a

variety of flexible living spaces and dwellings (109). All units were inherently multi-aspect and were able to have vehicle access and a variety of private, shared and common, indoor and outdoor spaces, without becoming isolated from one another (Batchelor, 2014, p. 139). However, it is difficult to predict whether the ambiguity of spaces will result in appreciated flexibility that promotes use or neglected interstitial zones. The design process was labour intensive due to the lack of repeating units, which may not be feasible for a larger project.

This content is unavailable. Please consult the figure list for further details.

Figure 28:
Bachelors (2014, p. 130) mat-building
method as a model (right)

Figure 29:
Bachelors (2014, p. 139) specific mat
developed for steppedness and some
of the resulting dwellings (below)

This content is unavailable. Please consult the figure list for further details.

VOIDED BUILDING MASSES

Figure 30:
Diagrammatic representation
of a voided building mass

Voids within buildings may seem counter-productive due to the loss of floor space. However, cavities in a building mass provide the opportunity for greater natural light, ventilation, range of external spaces, planting and sense of spaciousness (Coxhead, 2017; Fraser, 2014; Shepherd, 2014).

Coxhead (2017) simply used a void in the floor of a raised, urban park to allow sightlines and natural light to the public entry space below, intended to increase pleasantness of the entry space, perceived access to the space above and community interaction. Frasers (2014) project involved a much more comprehensive investigation of building voids, through exploring the possibility of vegetated, high-rise housing,

and the development of a verdant access network (p. 68). Both vertical and horizontal voids were used to increase solar access for central courtyards and units. Horizontal voids also aided public permeability and increased open space to provide many garden terraces and courtyards. The difficulty with void spaces is ensuring that their created sightlines and spaces are not only appropriate for the climate and adjacent interior spaces, but also pleasant and desirable.

COMMON OPEN-AIR ACCESS-WAYS

Figure 31:
Diagrammatic representation
of common, open-air access-
ways

Providing open space as part of gallery or single-loaded corridor access to private apartment units was the most common strategy. The threshold nature and proximity to all units makes that open space valuable, especially to those above the 4th story which lack connection with the ground where common space is typically found (Gehl, 2011, p. 98). Frequenting access-ways is routine for residents. Thus, that space has the potential to become part of the network of most valued outdoor spaces

(Coolen & Hoekstra, 2001, p. 52). These open-air access-ways are inherently well-connected to the outside, the individual dwelling and other residents. The British architects Alison and Peter Smithson were prominent influences for their work developing galleries as “streets in the air” to improve community interaction in denser mass housing (Ashworth, 2018, p. 36; Coxhead, 2017, p. 53; Fraser, 2014, p. 115). Fraser (2014) used open air access methods to provide common planting and greenery that would be

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Figure 32:
Linking Landscapes
exploded isometric
of the Frasers (2014,
p. 162) designed
high-rise building
with a common green
network (right)

experienced by all residents. However, maintaining that type of space is questionable due to the limited functionality, scale and seclusion.

Figure 33:
Render of Frasers (2014, p. 197) green, open-air gallery design (below)

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Read (2015) used open-air access to enhance both private and shared amenity of medium-density housing. Circulation for the tallest dwelling named the 'Cloud Buster' was added around the exterior of the building. The idea was to create a continuous yard accessed from all levels to increase connectivity to the larger rooftop space. However, considerable areas are narrow, exposed and shaded. Hence, it is not ideal for the climate, functional use and maintenance necessary for the planting shown. The recreation loop created using additional common access-ways is much more successful. It links underutilised roof spaces, some individual outdoor spaces and shared, backyard-inspired amenities in a spatially interesting and diverse manner. This increased permeability of site promotes neighbourly interaction and use of shared amenities in a relaxed by lively setting. The nature of this space supports the creation of meanings similar as those typical for backyards in literature. The only criticism is the erosion of privacy for adjoining private outdoor spaces and nearby windows.

Figure 35:
Render of Reads (2015, p. 100) Recreation Loop with the Cloud Buster house and continuous yard in the background
[This content is unavailable. Please consult the figure list for further details.]

Figure 34:
Programmatic diagram of Reads (2015, p. 100) Recreation Loop
[This content is unavailable. Please consult the figure list for further details.]

Figure 37:
Isometric of Coxhead (2017, p. 108) elevated urban park and extended gallery access
[This content is unavailable. Please consult the figure list for further details.]

Figure 36:
Render of Currans (2017, p. 127) shared gallery balcony
[This content is unavailable. Please consult the figure list for further details.]

Similarly, Ashworth (2018), Coxhead (2017) and Curran (2017) all used gallery access to increase outdoor space, for mid to high-rise housing. All use increased access-ways to provide supplementary common space. This was typically adjacent to private units for a space reminiscent of a suburban front yard, “to coax residents out of anonymity and provide copious opportunities to meet when coming and going” (Coxhead, 2017, p. 145). The opportunity for lingering, neighbourly interaction and a richer passage home is beneficial. Circulation tended to be sandwiched between these spaces and the private units, increasing sun-exposure for the urban yards and activating the façade, but also increasing general disturbance and disruption of privacy for both interior and exterior spaces. The yard spaces were also completely open and flexible in program allowing for residents to personalise the space. However, the lack of security and ambiguous ownership is likely to discourage this leaving spaces neglected. As these spaces are not private, they cannot be treated as such during design.

Ashworth (2018) developed access models that provide more private outdoor spaces adjacent to the common access. The first involved an entire floor of private, urban yards, separated by partitions and screens as preferred by residents. These create a buffer between the common circulation and individual units located above or below yards, as opposed to level with them. Ambiguity of ownership is resolved and desirable neighbourly conditions are created, but perceived proximity to interior space is

inhibited through the change in level and lack of visibility. The second involved dual, point-access and the third gallery access. These allowed private outdoor spaces at apartment level that can either be closed off or opened up to access-ways. The point-access is particularly successful as the space is relatively private and only shared with one other unit, minimising disruption and privacy erosion without completely isolating units.

Figure 40:
Floor plan example of Ashworths (2018, p.148) apartment unit above urban yards

This content is unavailable. Please consult the figure list for further details.

Figure 41:
Sectional view of Ashworths (2018, p.133) dual, point access tower

This content is unavailable. Please consult the figure list for further details.

Figure 39:
Render of Ashworths (2018, p.149) urban yard design

This content is unavailable. Please consult the figure list for further details.

Figure 42:
Render of Ashworths (2018, p.155) dual, point access tower

This content is unavailable. Please consult the figure list for further details.

Figure 38:
Floor plan of Ashworths (, p.147) of urban yards

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INTERLOCKING APARTMENT UNITS

Figure 43:
Diagrammatic representation of
interlocking apartment units

Interlocking apartment envelopes are intended to create dwellings with improved spatial interest and perceived spaciousness to negate the perception of repeated 'shoe-box' apartments (Batchelor, 2014; Shepherd, 2014). These incorporate spaces that have greater diversity and better spatial relationships (Batchelor, 2014; Shepherd, 2014). In support, Shepherd (2014) developed a list of spatial techniques of interlocking apartments: split levels, a range of ceiling and floor heights, increased length of internal sight lines, shared views to spaces between apartments, building voids, multiple

aspects for individual units, a wide range of external sightlines, a range of external spaces, integrated circulation, multi-use space and softer thresholds between both inside and outside, and private and public. Interlocking apartments do not necessarily result in improved outdoor space. However, these do improve dwellings through supporting similarly beneficial qualities, namely visual connection to the outside, privacy, individuality and perceived spaciousness. These spaces provide the opportunity for a variety and quality of outdoor spaces, with proximity to indoor living spaces,

through the creation of nooks, gaps and less regular spaces.

Ashworth (2018) used this strategy to limit access to every second level, simultaneously increasing rentable floor space and intensity of use of the remaining access-ways. The intention was to promote interaction and use of access spaces. In a high-rise situation interlocking apartments are best designed within pre-defined structural bays to limit the complexity of their envelope, allowing for sensible structural systems and services. Alas, this style of apartment inhibits accessibility due to their split level nature, so can only support housing choice and home as the hobby you inhabit for a limited group.

Design testing is necessary to prove the worth of this form based strategy. However, the spatial techniques discovered by Shepherd (2014) (see figure 44 on the following page) that are relevant to the success of interlocking apartment units will be invaluable regardless.

INTERLOCKING APARTMENT UNITS

Figure 44:
Shepherds (2014) spatial techniques
of interlocking apartments

PRIVATE AND PUBLIC

MULTIPLE ASPECTS

EXTERNAL SIGHTLINES

RANGE OF EXTERNAL SPACES

BUILDING VOIDS

SHARED VIEWS

RANGE OF CEILING AND FLOOR HEIGHTS

MULTI-USE SPACE

?

SPATIAL LOOSENESS

Figure 45:
Diagrammatic representation of
spatial looseness

Spatial looseness opposes the lack of flexibility that has already been identified as a critique of high-rise housing that reduces housing choice and compatibility (Dunbar et al., 2011; Marriage, 2010; Schneider & Till, 2005). Like interlocking apartment units, spatial looseness does not result in outdoor space, however, it has the potential to improve both the internal and external dwelling through similar means. It is one of the most desirable qualities both of and facilitated by the backyard. Batchelor (2014) and Coxhead (2017) both oppose the regular and restrictive nLDK format of housing,

promoting programmatic freedom, spontaneity, overlapping functions and choice. They instead focus on hard and soft architectural elements or performances, provisions of volumes and privacy levels. Hard architectural elements define how space must be used. Whereas soft architectural elements, such as furniture, allow users to adapt spaces to their needs and are typically only found within private units due to security (Coxhead, 2017, p. 152).

There is scope for some of these opportunities in adaptability to be in-built, especially for

common, shared and public spaces where personal possessions are not likely to be used. Shepherd (2014) investigated this in private space through the concepts of hinged space and double duty. Hinged space involves movable elements to allow a space to have a range of spatial conditions which likely correlate to specific possible functions (Shepherd, 2014, p. 238). Folding, pivoting or sliding screens, walls and storage were common solutions and successfully improve the degree of control and personalisation for residents. Double duty involves exploiting spaces to be multi-use, typically enabled through careful attention to detail. Typical solutions included study spaces in pockets of circulation and stairs as spatial dividers. These two concepts are deeply related. These strategies were successful, but have the potential to fail structurally or cause greater inconvenience if elements are not well-designed and are cumbersome to use.

Coxhead (2017) created common, lobby spaces between small clusters of apartments which are socially flexible for activities which are shared or need larger floor areas. The clustering promotes use through intimacy and familiarity. Conversely, the positioning of entrances to individual dwellings directly off this space may be intrusive, to both the occupied lobby and individual to resident coming and going. The space also lacks visual connection and pleasant spatial qualities that would promote use. Balancing positive adaptability and negative ambiguity requires careful consideration.

PRACTICE EXAMPLES OF DENSITY, MULTI-UNIT HOUSING AND OUTDOOR SPACE

The following are a series of housing projects with inspirational outdoor space provision, especially in denser housing. These are analysed in terms of their ability to meet the criteria generated through literature and whether any of the strategies above are used.

This content is unavailable. Please consult the figure list for further details.

*Figure 46:
Case studies overview*

SKY VILLAS

Figure 49:
Penda Sky Villas analysis sketches

Architect: Penda AKA Chris Precht
Location: Hyderabad, India
Date: In process
Dwelling sizes: 3 bedroom (240-370m²)
Other Programmes: Car parking underneath the dwellings, public park

This development also envisaged a hybrid of high-rise living with the suburban detached house. All dwellings are two storeys with a private 45m² grassy garden, edged with modular planters. This supports individualisation, sense of sanctuary, qualitative diversity of living spaces, extension of living patterns into outdoor space and privacy, while still allowing visibility into the public space below. Qualitative diversity of spaces is mostly created by spatial volume, planting and degree of exterior exposure. Planting was also employed as a strategy to soften the building's exterior appearance and perception of density. The provided outdoor space lacks the sense of ultimate expanse that the Mountain Dwellings (below) achieve through horizontality and large unobstructed views. However, it is not completely without this quality and it has the capacity to provide more housing for its tower typology allowing stacked units.

Figure 48:
Penda Sky Villas image courtesy of Penda (Lynch, 2016)

This content is unavailable. Please consult the figure list for further details.

Figure 47:
Penda Sky Villas image courtesy of Penda (Lynch, 2016)

This content is unavailable. Please consult the figure list for further details.

Units are completely private from each other due to the setback placement of neighbouring units and strategic partitioning. This also contributes to privacy from the street. There is no visibility between the common access and private space, leaving no margin for extending living patterns or neighbourly interaction. No shared seems to have been included other than a public park at ground level. Due to the building being a maximum of 6 storeys, it retains a level of connection with this space, although the length of journey is likely to discourage use.

Strategies from theses used:

Voided building mass (double height outdoor gardens and ventilation shafts)

Spatial looseness (possibility for extra room and super flexible outdoor space)

Figure 50:

Penda Sky Villas apartment floor plan example, image courtesy of Penda (Lynch, 2016)

This content is unavailable. Please consult the figure list for further details.

8 HOUSE

Figure 52:
8House image of cycling promenade courtesy of Ty Stange
(Minner, 2010)

This content is unavailable. Please consult the figure list for further details.

Architect: BIG

Location: Copenhagen, Denmark

Date: 2010

Dwelling sizes: Terraced housing (51-100m²), apartments (46-152m²), penthouses (73-171m²)

Other Programmes: Retail, offices, public park and natural reserves

Described as a three-dimensional neighbourhood (8 House by BIG, 2010), 8 House reimagines provision of traditional programmes and housing typologies. Building programmes are stacked to optimise the building form and site. Retail interacts with the street, offices are northern facing and dwellings have sunshine and views into the open spaces. The ground level also has public parks and a large passage through the site, improving liveliness and intensity. The communal facilities including meeting rooms, canteen for parties and outdoor spaces for barbeques are located at the centre of the building.

The range of housing allows for housing choice. It allows for a good range of the housing opportunities derived from the literature but only

Figure 51:
8House image courtesy of Julien Lanoo (Divisare, n.d.)

This content is unavailable. Please consult the figure list for further details.

for the row housing typology. These row houses do provide opportunity for personal gardening, limited individualisation, extended living patterns, neighbourly interaction, some privacy and visibility into public spaces. A difficulty of this layout is lack of opportunity to undertake completely private or more functional outdoor activities, such as sunbathing or clothes drying, away from the public access. Although this may improve as vegetation matures. Spatial looseness was incorporated into the housing through some removable partitions and high and sloping ceilings allowing mezzanine additions.

The most profound feature of this development is the promenade and cycling path that connects the terrace and pent-houses to the ground level. This extends possibilities for lingering and neighbourly and spontaneous interaction up off the ground level facilitating a better sense of community, and provides an incredibly rich journey to the private home. Instead of sanctuary, this journey utilises expanse and exhilaration. This promenade is developed with clear hierarchy and spatial ownership.

Figure 53:
8House floor plan courtesy of BIG (Divisare, n.d.)

This content is unavailable. Please consult the figure list for further details.

Strategies from theses used

Voided building mass (light-wells)

Common open-air access-ways

Interlocking apartment units

- Interlocking strategies used: split levels, a range of ceiling and floor heights, shared views to spaces between apartments, building voids, multiple aspects, a wide range of external sightlines, a range of external spaces, integrated circulation, softer thresholds between both inside and outside, and private and public

Spatial looseness

Figure 54:
8House section courtesy of BIG (Divisare, n.d.)

This content is unavailable. Please consult the figure list for further details.

MOUNTAIN DWELLINGS

Architect: BIG

Location: Copenhagen, Denmark

Date: 2010

Dwelling sizes: Terraced housing (51-100m²), apartments (46-152m²), penthouses (73-171m²)

Other Programmes: Retail, offices, public park and natural reserves

Strategies from theses used

Spatial looseness (possibility for extra room and super flexible outdoor space)

Interlocking strategies used: multiple aspects, wide range of external sightlines

The Mountain Dwellings is a housing project focused on marrying high-rise housing, copious amounts of covered parking and the suburban backyard. The parking structure creates the apartment access and a sloped base that steps each row of apartments up. This form and externally oriented layout, provides ample privacy from the street and dwellings below, sun, light and unobstructed views of the sky. However, it is at high risk of being undermined by equally tall neighbouring buildings. All apartments face the same way, with service areas at their back to dampen noise from the parking lot, adding to the sense of sanctuary and privacy.

Figure 57:

Mountain Dwellings image courtesy of BIG (Kring, n.d.)

This content is unavailable. Please consult the figure list for further details.

Figure 56:

Mountain Dwellings image of private outdoor space courtesy of Jens Passoth (McGrane, 2009)

This content is unavailable. Please consult the figure list for further details.

Figure 55:

Mountain Dwellings image of car park and access courtesy of JDS Architects (Kring, n.d.)

This content is unavailable. Please consult the figure list for further details.

The private space is incredibly successful, supporting personalised space, pleasant and personalised outlook, extension of living into outdoor space and retreat. Apartments are L shaped, allowing multiple aspects and a gradation of shelter and privacy for the outdoor space. Planter boxes between all dwellings, combined with the building form, create a great privacy division. These are covered with slats, preventing an opportunity for personalisation and gardening but ensuring low maintenance due to the buildings watering system. It would be desirable for residents to be able to opt out of the building-wide gardening if they would prefer to do it themselves. An interesting neighbourly relationship exists. Residents standing near the outer edges of their private space have the positive opportunity to directly interact with all adjacent neighbours, but potentially enabling uncomfortable surveillance. There are also gates provided between adjacent gardens in a row. This provides the rich possibility to open up and share outdoor spaces, if desired by friendly neighbours.

This content is unavailable. Please consult the figure list for further details.

This project includes two distinct atmospheres, contributing to an interestingly rich and reconsidered journey between the street and private home. Access is through large stairways and elevators in the underbelly of the building containing the carpark which has intensely coloured, vast, industrial spaces. There are no shared functions other than access and car parking minimising the opportunity for community development through extension of living patterns and potentially isolating residents. This is distinctly different from the private spaces which are light, airy and calm. This atmosphere is facilitated through light, material (white paint, natural timber and planting) and integration with the outdoors. The only diversity in private space is between inside and outside.

*Figure 58:
Mountain Dwellings floor plan (ArchDaily, 2009)*

*Figure 59:
Mountain Dwellings section (ArchDaily, 2009)*

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TREE-NESS HOUSE

This content is unavailable. Please consult the figure list for further details.

Figure 60:
Tree-ness house section of tangled indoor, outdoor, shared and private space (a+u: Architecture and Urbanism, n.d.)

Architect: Akihisa Hirata

Location: Tokyo, Japan

Date: 2017

Dwelling sizes: 1 bedroom, 3 bedroom
(331.38m² total)

Other Programmes: Galleries, offices, a park

Strategies from theses used

Voided building mass (both light well and perforated arrangement of room masses)

Common open-air access-ways

Interlocking apartment units

- Interlocking strategies used: split levels, a range of ceiling and floor heights, increased length of internal sightlines, shared views to spaces between apartments, building voids, multiple aspects, wide range of external sightlines, integrated circulation, multi-use space and softer thresholds between both inside and outside, and private and public

Figure 61:
Tree-ness house image of central void (a+u: Architecture and Urbanism, n.d.)

This content is unavailable. Please consult the figure list for further details.

Figure 62:
Tree-ness house image of tangled indoor and outdoor space (a+u: Architecture and Urbanism, n.d.)

This content is unavailable. Please consult the figure list for further details.

Japanese architecture provides a strong precedent because of its relationship with nature in the home, micro-housing, collective housing and individualistic design. Tree-ness House provides a strong precedent for small but spatially interesting, humanized housing. The design uses three-dimensional, spatial “tangling”, creating intense complexity throughout the interconnected internal, external and garden spaces (Tree-ness House, n.d.). The outcome is a 5 unit development that juxtaposes the typical provision of inside and outside space, through an abundance of intimate and diverse environments that are calm but rich. All units are multiple aspect, support retreat and feel spacious due to the treatment of the quality of space.

The shared circulation exists at the edge of the building, adjoining the central light-well. Both external and internal spaces are visible creating a route from the street that encourages lingering, sanctuary and social interaction. There is visibility through this space into other housing units, increasing possibilities for neighbourly interaction, extended living patterns and semi-public personalisation. Careful placement of sightlines and the intimate scale of this design prevents inhabitants from feeling like their privacy is jeopardised. The main critique is the lack of typical outdoor activities able to be performed, due to the tight outdoor spaces intended only for sitting, gardening and standing.

Figure 63:
Mountain Dwellings image of car park and access courtesy of JDS Architects (Kring, n.d.)

This content is unavailable. Please consult the figure list for further details.

NEXUS WORLD HOUSING

Figure 65:
Nexus World Housing, view across private courtyard, image courtesy of OMA (Nexus World Housing, n.d.)

Figure 64:
Nexus World Housing, housing units from above, image courtesy of OMA (White, 2005)

This content is unavailable. Please consult the figure list for further details.

Architect: OMA/Rem Koolhaas

Location: Fukuoka, Japan

Date: 1991

Dwelling sizes: 2 bedroom units (110m²), 3 bedroom units (180m²)

Other Programmes: Public office at the street interface, access to dwellings is behind this

Strategies from theses used

Voided building mass (light-wells)

Interlocking apartment units

- Interlocking strategies used: split levels, a range of ceiling and floor heights, increased length of internal sight lines, shared views to spaces between rooms, building voids, multiple aspects for individual units, a range of external spaces, integrated circulation, softer thresholds between both inside and outside, and private and public

This content is unavailable. Please consult the figure list for further details.

OMA uses vertically oriented units that are internally focused, similar to courtyard housing, to ensure light and privacy. Dwellings comprise of three storeys around a central, open courtyard that also creates the entry patio. These units interlock and are sandwiched together horizontally, in a tight grid leaving only shared access and storage space at ground level. This results in minimal opportunities for neighbourly interaction, lingering or invitation into the shared zone.

The success is the creation of spaces which are qualitatively diverse from one-another, open into the outdoors and have total privacy from the public eye, achieved through the internal courtyard. Most units have four completely different outdoor spaces in addition to a multitude of carefully considered interior spaces. Separating the messy and service outdoor activities allows a more pleasant and quiet outdoor space as part of the living space, and more spatially efficient outdoor spaces. Their placement above the access-way also creates an interesting condition for social interaction in what is usually regarded the less public, functional zone. Diversity is created in the interior spaces through ceiling and floor heights, natural lighting conditions, outlook and some use of materiality.

A notable feature is the grassy dome at the top of the stack, which provides visible and playful greenery that can be seen from the adjacent living spaces. It seems a lost opportunity that this is not accessible for either recreation or personal gardening. However, it had the potential to affect the privacy of neighbouring units.

Of interest is the treatment of the entrance to the dwelling. Ownership transitions are clearly marked by translucent walls and mesh doors, as well as level changes, providing clear hierarchy. The visibility and scale of the access softens the public to private threshold, allowing several atmospheric zones for a gradual, psychological transition as one enters the home. It is a lost opportunity to provide better semi-public personalisation and potentially more inviting common space through material choices, glazing opacity and planters on the threshold.

Figure 67:
Nexus World Housing , image courtesy of OMA (White, 2005)

This content is unavailable. Please consult the figure list for further details.

Figure 68:
Nexus World Housing study sketches of relational space

Figure 66:
Nexus World Housing section study sketch

PRACTICE EXAMPLES CONCLUSION

The case studies provided a range of unit to building scale strategies for providing interesting and desirable outdoor space. Spatial arrangements for providing private outdoor space were diverse, but can be summarised under three strategies: 1) external orientation of units with vertical stacking; 2) fluidity between permeable indoor and outdoor spaces; and 3) internal orientation and horizontal stacking. The second technique was the most successful for its diverse spatial qualities created and ability to integrate inside and outside with private and common space. Otherwise, key moves were to shift outdoor space away from the entry into completely private space or to not provide visually private outdoor space and encourage sight lines towards the sky for its inherent expanse. There was a lack of investigation into the possibilities of extending the public private threshold, apart from in 8 House and Tree-ness House. This harsh public to private relationship discourages the extension of a network of spaces. It is difficult to predict how outdoor spaces which are either internalised, or are completely exposed part of a mega-form building will work thermally in the local context with a cool climate and harsh winds.

Planting was common throughout for privacy, personalisation and pleasant outlook. Other opportunities for personalisation were minimal, but buildings all had their own distinct identity. This gives rise the question of whether building identity is enough to offset the opportunity for more personal, externally obvious identity claims. It will not, however, supplement the place attachment, pride and sense of ownership developed through the creation of these.

Figure 69:
Summary diagrams of spatial
strategies from practice

EXTERNAL ORIENTATION +
VERTICAL STACKING

FLUID, PERMEATED INDOORS +
OUTDOORS

INTERNAL ORIENTATION +
HORIZONTAL STACKING

CASE STUDIES DEMONSTRATING SPECIFIC STRATEGIES

New case studies were introduced to address specific, desired attributes and innovations. These are less about providing exterior space and more about spatial relations and features required for successful collective housing.

This content is unavailable. Please consult the figure list for further details.

*Figure 70:
Case studies overview*

A LINKED HYBRID

Architect: Steven Holl Architects

Location: Beijing, China

Date: 2009

Dwelling sizes: 1 – 3 bedroom units (75-150m²)

Other Programmes: Commercial, educational, recreational

Steven Holl's A Linked Hybrid reimagines typically isolated and privatised towers to be a "city within a city" (Spirit of Space, 2015). This pedestrian-oriented project increases urban porosity, extending and integrating diverse networks through. This project demonstrates a deep understanding of collective space through creating a series of linked but diverse, small scale, micro-urbanisms. It provides a valuable precedent for mixed-use developments with a focus on collective space, bridges between towers and internal apartment design.

Figure 73:
A Linked Hybrid (Archdaily, 2009)

This content is unavailable. Please consult the figure list for further details.

Figure 72:
A Linked Hybrid, view from sky bridge (Archdaily, 2009)

This content is unavailable. Please consult the figure list for further details.

Figure 71:
A Linked Hybrid, sky bridge network (Archdaily, 2009)

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BRIDGES AND EXTRA AMENITY

This project has many layers of amenities and spaces. The site is accessible from all sides. The ground level is open to the public, activated by the ground level shops, and includes all public functions, including: green spaces, a large pond, a restaurant, hotel, Montessori school, kindergarten, and cinema. The hotel and cinema are deliberately destination programmes, to entice the public into the space. The lower buildings provide tranquil and verdant public roof gardens, with private roof gardens also provided at the top of towers, to invite moments of calm retreat.

Most daringly, the eight apartment towers and hotel tower are joined by a series of bridges creating a “sky-loop” (Linked Hybrid | Steven Holl Architects, n.d.). Here, there is space for art galleries, small shops, cafes, auditorium and a fitness club with a swimming pool, completing the comprehensive mini-city. The intention is that this network will interact with those below to become lattice-like space, with intensity supposedly ensured through the density of the development. This enables the generation of random and unique relationships, and increased spontaneity and social interaction. Due to the perceived length and barriers of the passage between these networks it is difficult to predict the level of success. The need to travel vertically, and the lack of visual connection between spaces due to their large separation distances will deter casual movement that occurs without a destination or excuse (Coxhead, 2017; Gehl, 2011).

Figure 75:
A Linked Hybrid apartment interior (Archdaily, 2009)

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This content is unavailable. Please consult the figure list for further details.

Figure 74:
A Linked Hybrid apartment floor plan (Archdaily, 2009)

INTERNAL APARTMENT FLEXIBILITY

All necessary structure for the towers is incorporated into the facades, allowing interiors to be column free for a variety of possible layouts. Apartment fit-outs utilise hinged space, which is already discussed in the previous section about spatial looseness. Walls and doors pivot, slide and fold to create adaptable rooms. Success is especially found in the flexibility of the office space between the living room and bedroom. Due to its configuration it can be discrete from or joined to its adjoining rooms for a dressing room from the bedroom, separate study, or social annex. Apartments are also occupy a corner each, for views in two directions and natural cross-ventilation.

HOUSING ON LINDENSTRASSE

Architect: Herman Hertzberger

Location: Berlin, Germany

Date: 1986

Other Programmes: Common outdoor spaces

Figure 76:
The shared courtyard in Housing on Lindenstrasse (Uwe, n.d.)

This content is unavailable. Please consult the figure list for further details.

Herman Hertzberger is included as a character for his approach to function that emphasizes the creative responses of users and is sensitive to neighbourliness (Buchanan, 2012). His designs are successful at creating vibrant and personal social spaces and neighbourly communities (Buchanan, 2012; Zhou, 2005, p. 153). He has a few common techniques for promoting community interaction and personal display, which are demonstrated in his Housing on Lindenstrasse.

Firstly, the courtyard that dwellings are accessed through was left incomplete at the start of the project to improve sense of ownership over the space, through participation (Zhou, 2005, p. 65). He also includes many architectural elements which are abstract and ambiguous to invite creative appropriation, for example hollow concrete blocks as balcony balusters allowing adornment and planting. Balconies always include a gradation of more private space, tucked behind partitions or part of the dwelling, to more extroverted. Both dwellings and common roof spaces are accessed externally through open stairs, which are visible through apartment windows. This opens the dwelling to the access, re-imagining a typically uninviting space as an extension of the dwelling. Balconies overlook both these stairs and the courtyard, providing copious opportunities to meet when coming and going and successfully creating vertical streets. To prevent the erosion of privacy from this common area, double doors are used at the entry to dwellings with both a transparent and solid door. This enables residents to indicate whether casual interaction is invited or not.

Figure 77:
An overview of Housing on Lindenstrasse (Uwe, n.d.)

This content is unavailable. Please consult the figure list for further details.

This section of the thesis covers the research by design process and the final, site specific design outcome with critical reflections. It includes site selection and analysis, preliminary design executed through two stages at two different scales, and the developed design.

BUILT FORM
NATURAL FORM
NETWORKS

□ .05

TEST SITE

Figure 78:
Map of Wellington

KEY

Te Aro

Thorndon

Wadestown & Kaiwharawhaura

Northland

Ngaio & Wilton

Karori

Highbury

Aro Valley

Mt Cook

Brooklyn

Vogeltown, Morningtown & Kingston

Island Bay

Berhampore

Newtown

Mount Victoria

Oriental Bay & Roseneath

Hataitai

Kilbirnie

Melrose & Southgate

Houghton Bay & Lyall Bay

Rongotia

Miramar

Strathmore Park & Moa Point
& Breaker Bay

Seatoun

Maupuia & Karaka Bay

TE ARO, WELLINGTON

A site was selected in Te Aro, Wellington as a testing ground for design strategies. It is a main urban area where the need for greater, denser housing growth has already been identified and is in demand (Central City Framework, n.d., p. 20). The proposed site is edged by Buller Street, Ghuznee Street, and The Terrace and is 0.81 hectares (8100m²). It is a common example of an under-utilised site on the fringe of the built-up centre city. For this research, under-utilised sites are regarded as those in a high market appeal location, currently occupied by relatively inefficient, little or no housing, generally in a dilapidated state. This specific site was primarily selected for its proximity and connection to urban amenities, as this is the main attraction of high-density housing in New Zealand (Sowash et al., 2015, p. 14), as well as to greenery and openness to aid positive connection to the outdoors. Site observation, analysis and wider research was used to develop an in-depth understanding of the site's qualities, strengths, weaknesses, and potential opportunities.

WIDER NEIGHBOURHOOD

KEY

- Selected test site
- Public green space
- Public space (e.g. public parks)
- Grocery store
- Educational facilities (marked with T, C, P, PP to indicate tertiary, college, primary or pre-school respectively)
- Cultural facilities (e.g. museums, community centres)
- Major public transport routes
- Golden mile
- Childcare facilities
- Healthcare

INNER CIRCLE: 5 minutes walk from site (400m)

OUTER CIRCLE: 10 minutes walk from site (800m)

15 minutes walk from site (1200m)

- Museum of New Zealand Te Papa
- Basin Reserve
- Waitangi Park
- New World Wellington City Supermarket
- Frank Kitts Park and Waterfront

20 minutes walk from site (1600m)

- Wellington Train Station
- New Zealand Parliament Buildings
- Zealandia Ecosanctuary
- Mount Victoria Town Belt
- Oriental Parade
- Wellington High School

WELLINGTON 1:10 000

Figure 79:
Plan of Te Aro, Wellington

WIDER NEIGHBOURHOOD SECTIONS

Figure 80:
Sections through site and Te Aro, Wellington

SOUTH-NORTH

WEST-EAST

SITE OUTLOOK

Figure 82:
Analysis of the view and features visible from site

LOOKING EAST

LOOKING SOUTH

LOOKING WEST

LOOKING NORTH

GHUZNEE STREET

70m

95m

THE TERRACE

97m

IMMEDIATE SURROUNDINGS

Figure 83:
Plan of the test site at 1:500

KEY

- selected test site
- buildings
- buildings on selected site
- 5m contours
- kerb edges
- division between meshblocks (used to calculate density)
- public transport route
- vehicular transport route
- pedestrian transport route

MB 2129500

Meshblock area extends to include the rest of the urban block outside of the selected site area

BULLER STREET

URBAN MOTORWAY

SITE SHADING

WINTER

SUMMER

AM

MIDDAY

PM

Figure 84:
Study of sun exposure in plan

NATURAL FORM

The contained position strengthens the sense of accessibility to the city and the urban quality of the site. The visibility created by the slope provides a natural podium for visibility both of the development as a new typology, and from the development both to the city and nearby greenery. Much of this greenery is on incredibly steep slopes so is not threatened by constant development. Connectivity to the natural environment is further strengthened by the proximity of several parks within a five-minute walk and the town belt and harbour within a ten-minute walk. The contours of the site sloping down towards the north also provides the opportunity to create level changes beneficial to the positioning of a greater percentage of dwellings and comfortable outdoor space for sun exposure, outlook and privacy.

NETWORKS

The site is a very accessible site for both motor and pedestrian networks because it is on an existing main transport route, edged by three busy streets that are relatively pedestrian scale, and is very convenient to other amenities. This supports easy pedestrian accessibility and walkability for the residents as well as the opportunity for amenities that are on site to benefit the wider public. This also makes the site very exposed. The treatment of noise, access to less public spaces and visual privacy is pivotal to the success of this design, especially along Ghuznee Street where both sun exposure and external disruption is at a maximum. The urban motorway is separated and below the street level of the directly surrounding streets so its traffic levels would not significantly impact the site.

SITE SECTIONS

Figure 85:
Sections through the site

NORTH-SOUTH SECTIONS

WEST-EAST SECTIONS

CONCEPTUAL VISION
MASSING
FROM SITE TO HUMAN SCALE

06

PRELIMINARY DESIGN

A CONCEPTUAL VISION

Initial explorations were undertaken at a site scale to begin to plan how the site may be occupied. Although shown separately for clarity, sketching and digital massing occurred simultaneously.

*Figure 86:
A conceptual vision*

MASSING

HIGH-DENSITY IN CONTEXT

VICTORIA STREET PRECINCT

Total dwellings: 77
Dwelling density: 62 D/HA
Single level apartments
Point access
Apartment tower

DIXON STREET FLATS

Total dwellings: 117
Dwelling density: 144 D/HA
Single level apartments
Gallery access
Apartment slab

The original buildings used for this massing exercise are shown below, simply positioned on site. Four different local, residential buildings are chosen to demonstrate what this dwelling density translates to as an urban form. The use of New Zealand examples provides contextually relevant dwelling sizes and consequently, analysis.

Figure 87:
Original forms for density massing

THE PROMENADE

Total dwellings: 18
Dwelling density: 22 D/HA
Multi level, single lot apartments
Individual ground access
Row housing

ZAVOS CORNER

Total dwellings: 8
Dwelling density: 10 D/HA
Single/Multi level apartments
Individual ground access
Interlocking apartments

Below are the same buildings, but altered to reach the target density of 125D/HA on site. This study clearly demonstrated the need to stack dwellings vertically to provide any open ground level space.

Figure 88:
Digital density massing exercise

VICTORIA STREET PRECINCT

Total height: 45m, 15 storeys
Total volume: 41,040m²
Site coverage: 11%

DIXON STREET FLATS

Total height: 26m, 11 storeys
Total volume: 33,620m²
Site coverage: 16%

THE PROMENADE

Total height: 11m, 4 storeys

Total volume: 58,630m²

Site coverage: 66%

ZAVOS CORNER

Total height: 8m, 3 storeys

Total volume: 52,830m²

Site coverage: 82%

SUN EXPOSURE BASED MASSING

Figure 89:
Study of sun exposure in section.
Section is cut 12 degrees before
north so that it aligns with site
boundaries

Sun exposure is essential to the comfort and usability of outdoor spaces. Although some sun exposure is desired in some interior spaces, it is less essential due to the possibilities of shelter, insulation and mechanical heating. The following investigates the relationship between sun exposure and form. It establishes the maximum distance of overlap possible whilst still allowing full sun exposure for the floor below and speculates possible form based relationships. For a three metre high storey, an overhang can be a maximum of five metres for winter sun and a maximum of half a metre for summer sun before ground level sun is affected. Of course, sun exposure is much more desirable in winter. These investigations are driven by the intention that the design will include an array of intimate outside spaces.

Winter Solstice

Summer Solstice

Figure 90:
Example of sun based
massing studies undertaken.
Plan studies were not found to
be useful at this stage.

Figure 91:
Example of sun based
sectional explorations

MASSING DESIGN

Figure 92:
Example of porous massing
studies undertaken

These are an example of the massing studies undertaken, showing the three most promising form typologies: a porous agglomeration, towers, and row housing. As already identified, row housing cannot reach the target density without being combined with more dense forms.

All explorations looked to provide shared space at the ground level and desirable views to the surroundings by stacking units vertically. The porous designs created potentially more interesting and diverse spaces, likely to be privately accessed. They also created interesting views. However, access and structure will be incredibly difficult to resolve and spaces near the ground at the south of the site are at risk of never receiving sun. This creates an incredibly labour intensive way to design.

POROUS PIXEL CITY

Access: unknown

Total height: 26m

Total volume: 49,300m²

Apartment volume: 30,860m²

Figure 93:
Example of tower and row
housing massing studies
undertaken

For this type of development, outdoor space within the tower becomes totally private to access, but public to view. This will be a difficult threshold space to mediate. Sense of identity is highly degraded due to the absolute repetition.

2

LOW-HIGH _ STEPS AND TOWER

Access: point + ground

Total height: 65m

Total volume: 70,060m²

Apartment volume: 51,070m²

SITE PLANNING

Figure 94:
Example of site scale sketch
explorations

The following sketches explore possible solutions for site organisation and further investigate site conditions such as privacy erosion and walking routes. These did not lead to any conclusive forms or arrangements as it is not possible to assess the potential for providing the desired conditions from the literature review at this scale. Useful lessons arose once the investigations began to focus on a smaller scale.

REFLECTION

The massing investigations were useful to understand the amount of building mass likely to be required, and some other site qualities. These investigations lack the level of detail and resolution required to form lessons. There is minimal understanding of the influence of these arbitrary forms ability to actually provide desirable spatial qualities at the human scale. Therefore, the decision is made to start developing strategies and spaces that work at a human scale to piece together into a larger scale complex. Most beneficial is the finding that at this density, dwellings must be stacked vertically to allow for any open space at ground level.

AN INDIVIDUAL UNIT
COMBINING UNITS
A CONCEPT TO CONTINUE WITH

07

PRELIMINARY DESIGN _ STAGE TWO

THE FIRST APARTMENT UNIT

SKETCHES

The concept of a room that is both indoors and outdoors. Technically inside, but it can be completely opened up to the outdoors

Exploration of physical
manifestation of permeable
layers of space and gradations of
privacy

Investigating how glazed edges and corners can invite a strong sense of the outdoors into the space through increased angle of view, like a large scale bay window

Investigating how interlocking forms can create nooks

The design of an individual unit intends to address desirable spatial qualities, especially the sense of the outdoors, and opportunities for combining interlocking units that allows outside space between a maximum of three units to retain intimacy and a level of privacy.

Figure 95:
Example of unit scale sketch
explorations

[illegible]

Beginning to explore the idea of a shared balcony for a space that is more usable and pleasant

THREE DIMENSIONAL MODEL EXPLORATIONS

Figure 97:
Example of digital modelling
explorations at the unit scale

Investigating incorporating the view at the entryway of the apartment in a manner similar to a patio

Beginning to explore strategies for privacy and identity using fine slatting and planting as a privacy barrier

An apartment unit has been developed that begins to have a seamless sense of the inside and outside in appropriate areas as well as a diversity of spaces. The floor plan is not completely resolved but provided an understanding of how much space is required to begin to be able to support the desired features and affordances. The generation of a concept of a space that is both indoors and outdoors through an idea of spatial hinging remains prominent throughout the design.

At this stage, the decision is made to move back into a slightly larger scale, to allow alterations to this unit that will aid relationships between units before the floor plan becomes solidified.

Figure 98:
Example of unit scale sketch explorations

ADDING MORE DWELLINGS

Figure 100:
Example of bubble diagrams exploring the flow of space

Figure 99:
Example of building
scale sketches to explore
combining dwelling units
(right)

Figure 101:
Example of building scale sketches to explore combining dwelling units in plan, around an open air platform

Many different spatial structures for combining individual dwelling units were explored. The intention was to use interlocking apartment units, with only some single storey units as well. However, this proved to be too complex to allow efficient and well-designed floor plans whilst juggling so many complex factors, especially if accessibility is to be a design consideration. Following this, a concept of units on each floor being adjoined onto a common floor space was developed. Careful attention was paid to which spaces should flow together.

A lot of the sketch explorations were done on tracing paper to allow them to be overlaid on the site to assess building positioning throughout.

Repetition of the same unit allowed exploration of how intermediate spaces work. But it was found that this unit is not well suited to being mirrored without privacy in their living space being jeopardised.

This representation of the domestic garden in high-density was too literal for a translation that addressed qualitative principles other than flow of public to private spaces. However, the nook created for an entry yard soace has potential.

①

DEVELOPING THE SHARED PLATFORM

Figure 102:
Main digital iterations of the shared platform.
Related interior shared spaces are indicated in yellow.

Platform was critiqued for being too ambiguous in programme. Although flexibility is beneficial, spaces also need to provide an excuse for residents to visit. The corner is exposed in this iteration to promote a sense of the outdoors.

Multiple ledges to form multiple pockets

Common space undesirably encloses shared platform, diminishing a sense of the outdoors

Figure 103:
Main digital iterations of the shared platform

Figure 104:
Example of sketch explorations, especially
investigating the relation between private spaces
and the shared platform

Directly repeating the levels, so they are directly stacked on top of the other created dark and unattractive conditions for the platform. Hence, floor to floor heights were increased and shared platforms were provided for every two levels allowing them to be double height.

A key issue was the need to negotiate between convenience of shared space to encourage use, privacy for the individual dwellings and a reasonable level of intensity to prevent neglect of shared spaces. Although the idea that dwellings could simply extend their living space and open onto the shared space was originally explored, there were too many issues created. For example, interiors of dwellings facing the space became dark and space ownership and purpose became too ambiguous to promote territoriality.

A CONCEPTUAL TOWER TO DEVELOP

Figure 105:
A programmatic diagram of the developed tower

COMMUNAL ROOFTOP AND GARDEN

POSSIBILITY: COMMUNAL VOID GARDEN LEVEL CENTRE OF BUILDING OR EVERY X FLOORS

COMMUNAL INDOOR AMENITY (WORKSHOP, STUDIO, THEATRE, GYM)

DIFFERENT EACH STOREY AND REPEATING EVERY FOUR STOREYS

SHARED "STACKED-YARD" REPEATS ON EVERY SECOND FLOOR

PRIVATE LIVING SPACE

DIFFERENT EACH STOREY AND REPEATING EVERY FOUR STOREYS

Figure 106:
Example of sketch explorations of how the tower will be combined with the rest of the site

A CONCEPTUAL TOWER TO DEVELOP

Figure 107:
A programmatic diagram of the developed tower
in section

Increased floor to floor heights greatly improved the quality of the shared outdoor space through increase light and a sense of expanse.

Storey above, looks onto shared space directly to improve sense of ownership, connection and invitation

SHARED "STACKED-YARD"

REPEATS IDENTICALLY ON
EVERY SECOND FLOOR
AND PROVIDES FOR TWO
STOREYS

CONCEPT EDGE STRATEGIES
DESIGN OVERVIEW + SITE
ELEVATIONS
PLANS
SHARED ROOF SPACES
THE NEIGHBOURHOOD BLOCK
INDIVIDUAL UNITS

DEVELOPED DESIGN + PRESENTATION

CONCEPT EDGE STRATEGIES

PLANTER GUTTER

1

FLUSH LAWN

2

The following are a series of edge strategies investigating the experience of greenery, enclosure and the edge.

.3

RAISED LAWN

.4

LOWERED LAWN

Figure 108:
First series of edge studies

5

FLUSH PLANTER

6

RAISED PLANTER

.7

EYE-LEVEL PLANTER

.8

GREENERY SCREEN

Figure 109:
Second series of edge studies

DESIGN OVERVIEW

*Figure 110:
An overview render*

Figure 111:
An overview render

TE

ARO, WELLINGTON

SITE INDICATED IN RED

Figure 112:
Site location

INNER-
RESIDENTIAL
AREA

TE AR

URBAN MOTORWAY

GHUZNEE STREET

THE TERRACE

BULLER STREET

BULLER STREET

WATSON STREET

CENTRAL AREA

SITE PLAN

Figure 113:
Site plan at 1:1000

WILLIS STREET

VICTORIA STREET

AXONOMETRIC DESIGN OVERVIEW

Figure 114:
An programmatic, isometric overview
Each block outlined is two storeys.

- Additional uses
- Apartment floors
- Bridges and rooftops

— Library and tea room

— Minigolf and games room

— Gym

— Cafe and retail

ELEVATIONS

Figure 115:
North site elevation at 1:1000

Figure 116:
East site elevation at 1:1000

Figure 117:
South site elevation at 1:1000

Figure 118:
West site elevation at 1:1000

*Figure 119:
North-west elevation of tower 3,
showing variations possible in the
facade at 1:200*

A manipulatable facade and threshold allows individual control over privacy, outlook, sunshine and ventilation for a sense of control and ownership. This promotes thermal comfort, choice and a psychological connection to the space through functional and ritual use. The externally placed staircase is glazed and placed in a centrally visible location to encourage use and movement between the floors.

GHUZNEE STREET

THE TERRACE

BUILED STREET

UNDERGROUND PARKING PLAN

Figure 120:
*Underground carparking plan at
1:500*

Moving the parking under the complex frees up the ground floor for public space and allows extra storage space for residents.

GHUZNEE STREET

TOWER 1

1

1

1

1

2

6

TOWER 3

5

5

4

3

TOWER 2

A

a

B

THE TERRACE

BUJIFER STREET

GROUND FLOOR PLAN

Figure 121:

An overview in plan, showing the ground level to highlight the connections between spaces at 1:500

Programmes for the ground floor are selected to be destinations for both the residents of of this housing development and others beyond. They intend to add to the liveliness of the site, activate the park and increase the amenity of the local area. Passages cross through the space and connect to an existing walkway to draw pedestrians into the site as a more attractive route.

KEY

selected test site
buildings
buildings on selected site
5m contours
kerb edges
planting
grass

- 1 Retail
- 2 Cafe
- 3 Cinema (that can be open air)
- 4 Swimming complex
- 5 Function space
- 6 Tennis court

GHUZNEE STREET

TOWER 1

THE TERRACE

TOWER 2

TOWER 3

BUJIB STREET

a >

a >

A >

B >

APARTMENT FLOOR PLAN

Figure 122:

A plan view of the first apartment floor in each neighbourhood block, through all of the towers. Shown at 1:500.

Each two storey neighbourhood block of apartments shares a common area. These spaces are orientated to have a desirable amount of sunshine, an attractive outlook and visual connection to both each other and the public space below. Spaces are arranged as a gradient in terms of levels of privacy, intimacy and connection.

GHUZNEE STREET

THE TERRACE

BUJIB STREET

COMMON AND PUBLIC SPACES

*Figure 123:
A plan view of the level 7 at 1:500 (left)*

*Figure 124:
Bridge between tower 1 and 2, looking towards tower 1*

Spaces can be booked by both residents and non-residents through the booking system. Non-residents are required to pay a small fee to contribute to maintaining the space. Bridges connect the buildings to allow occupants to move between the towers with more ease. These also provide a further diversity of environments available, contributing to choice and a spatially rich and diverse environment.

*Figure 125:
Bridge between tower 2 and 3, looking south*

SECTIONS

Figure 126:
Section A at 1:200

Figure 127:
Section A zoom at 1:50

Figure 128:
Section A zoom at 1:50

Figure 129:
Section B at 1:400

NEIGHBOURHOOD BLOCK FLOOR PLANS

Figure 130:
Floor Plan for Apartment level
configuration A at 1:200

These two floor plans make up a two storey neighbourhood block of apartments, with plan A as the lower level and level B as the upper. These are repeated and stacked within the towers.

Key

- Grass
- Planting
- Water
- Section line

Shared and common spaces can be booked out through an app system, allowing users to indicate whether or not the space is occupied and if others are welcome. This facilitates obvious purpose and ownership of space and extends control over privacy and interactions to outside of the strictly private dwelling.

To increase a sense of intimacy and ownership, only 7 dwelling units share an outdoor space. All units look into the space through glimpses, allowing opportunities for opening between the private and shared spaces. Allowing visibility, without negatively eroding privacy.

1	Apartment 1	10	Apartment 5
2	Apartment 2	11	Shared conference/function/flexible room
3	Lift well	12	Shared laundry
4	Shared workshop space	13	Apartment 6
5	Fire stairs	14	Apartment 7
6	Apartment 3		
7	Apartment 4		
8	Shared outdoor space		
9	Fire stairs		

FLOOR PLAN B

PRIVACY STUDY

Figure 131:
Gradations of privacy in plan,
within a block of units at 1:200

Gradations of privacy within a block
off units

THE SHARED OUTDOOR SPACE

Figure 132:
The shared dining space with apartment 14 above. The louvres and glazing walls are open to allow fresh air and an outside dining experience.

Figure 133:
The spa, looking towards apartment 6 (below) and 13 (above),
with apartments 2 (below) and 10 (above) to the right of the
image.

SHARED ROOF SPACES

Key

Figure 134:
Rooftop plan at 1:200

All buildings have a shared rooftop space with planting plots. A barbecue, seating, coffee machine, planting boxes to hire, and a garden shed provide for ample excuses to enter the space. These activities support placemaking and ritual.

Figure 135:
Example of explorations of the rooftop and the edge

Figure 136:
Section exploration of the planter edge

Figure 137:
View from the rooftop of tower two, looking towards tower three.

INDIVIDUAL UNITS

Key

- Furniture and furnishings that can be removed
- Movable features
- Fixed features
- Adjacent units
- Grass
- Planting

Figure 138:
Key plan indicating location of apartment 1 (right) at 1:100

Number of bedrooms shown: 1
Number of bedrooms possible: 2
Floor area: 30,860m²

FLEXIBLE GLAZING SYSTEM

*Figure 139:
Render looking across the shared outdoor
space to unit 1, with unit 2 (below) and unit
10 (above) to the left. These private living
space are all able to be connected or closed
off from the shared space, using sliding door
and screens.*

Key

- Furniture and furnishings that can be removed
- Movable features
- Fixed features
- / / / / Adjacent units
- Grass
- • • • Planting

Figure 140:
Key plan indicating location of apartment 2 (right) at 1:100

.2

Number of bedrooms shown: 1
Number of bedrooms possible: 3
Floor area: 30,860m²

*Figure 141:
Render looking through the kitchen, over
the breakfast bar towards the double height
living space of unit 2. The diversity of ceiling
heights and sightlines through spaces aids
the sense of spaciousness and spatial
diversity within the unit.*

Key

- Furniture and furnishings that can be removed
- Movable features
- Fixed features
- / / / / Adjacent units
- Grass
- • • • Planting

Figure 142:
Key plan indicating location of apartment 3 (right) at 1:100

.3

Number of bedrooms shown: 2
Number of bedrooms possible: 3
Floor area: 30,860m²

Figure 143:
Render looking through the kitchen and dining
space of unit 3 towards the shared outdoor space,
with the manipulatable threshold between.

Key

- Furniture and furnishings that can be removed
- Movable features
- Fixed features
- Adjacent units
- Grass
- Planting

Figure 144:
Key plan indicating location of apartment 4 (right) at 1:100

4

Number of bedrooms shown: 1
Number of bedrooms possible: 2
Floor area: 30,860m²

Figure 145:
Comparison renders of the use of the variable walls in unit 4 for
flexible spatial configurations

Key

- Furniture and furnishings that can be removed
- Movable features
- Fixed features
- Adjacent units
- Grass
- Planting

Figure 146:
Key plan indicating location of apartment 5 (right) at 1:100

5

Number of bedrooms shown: 1
Number of bedrooms possible: 1
Floor area: 30,860m²

Key

- Furniture and furnishings that can be removed
- Movable features
- Fixed features
- / / / / Adjacent units
- Grass
- • • • Planting

Figure 147:
Key plan indicating location of apartment 6 (right) at 1:100

6

Number of bedrooms shown: 1
Number of bedrooms possible: 1
Floor area: 30,860m²

Figure 148:
Render looking through the kitchen and living space
of unit 6 towards the private outdoor space, with
sliding glazing for an ease of connection to the
outside and greenery..

Key

- Furniture and furnishings that can be removed
- Movable features
- Fixed features
- Adjacent units
- Grass
- Planting

Figure 149:
Key plan indicating location of apartment 7 (right) at 1:100

Number of bedrooms shown: 1
 Number of bedrooms possible: 1
 Floor area: 30,860m²

STRUCTURE

Figure 150:
Ground floor plan example showing lateral load resisting structure at 1:500

Figure 151:
Plan configuration B showing lateral load resisting structure at 1:500

Heavy structure and services are required for high-rise buildings in New Zealand. Structure for this project was developed through analysis in the programme RESIST, relevant literature (Charleson, 2012) and consultation with an engineer.

Steel framing, as opposed to shear walls, is used in this design to mitigate negative spatial effects and maintain flexibility, allowing for layout changes. Moment resisting frames are used in conjunction with eccentrically braced frames where more rigidity was necessary to avoid invasive members deeper than 1m. This structure for resisting lateral loads is kept away from the double height outdoor spaces as the obvious, heavy members are required at every floor level and would disrupt the openness of the outdoor space. Members are evenly spread to the extents of the building envelope. This keeps the buildings centres of mass and rigidity relatively aligned to minimise undesirable drift and shear and moment forces within members. It is also supplemented by simple gravity structure. All frames are made from universal beams and columns.

There are two bridges that connect the buildings, bridge A which runs parallel to the terrace and bridge B at the southern end of the site. Trusses that are the height of the two storey bridges are used to span between buildings, with the longer bridge also supported by intermediate structure to prevent critical torsion issues in the adjoining buildings. Bridges are connected to gravity structure within the building with a pin joint at one end, and a simple sliding joint at the other. The sliding joint has barriers allowing movement of up to 400mm either direction parallel to the edge of the building and 3000mm perpendicular. Both joints are also seismic gaps with flexible connections to the building envelope.

SERVICES

Floor to floor heights are generous to allow the depth for structure and services to be concealed in the ceiling. Services for drainage, sewage and ventilation cannot be concealed within the wall framing. Space for their risers is provided with the concealed lateral bracing structure.

- KEY
- Grass
 - Planting
 - Water
 - Eccentrically Braced Frame (Inverted V)
 - 1000mm deep by 370mm wide UB above, as part of moment resisting frames
 - 900mm wide by 900mm deep UC, as part of moment resisting frames
 - 330mm wide by 350mm deep UC
 - 330mm wide by 350mm deep UC, as part of eccentrically braced frame system

NOTE: Only beams for lateral resisting structure shown for clarity, as these have the most impact on the space due to their size.

Figure 152:
Plan configuration A showing lateral load resisting structure at 1:200.
Dimensions indicate structural member centers.

KEY RESEARCH STEPS
LIMITATIONS
REFLECTION

10

CONCLUSIONS

CLOSING DISCUSSION

This research aimed to understand the role that outdoor space plays in enhancing the dwelling and how the associated benefits can be used to realise an alternative desirable high-rise housing design. It developed a qualitative benchmark of guiding principles, a series of strategies and tools that can be used across scales for new designs and a final architectural design to demonstrate how these can be realised.

The process began with a series of precedent reviews and multi-disciplinary literature review, which provided a number of strategies and a theoretical foundation to drive the investigation of design methods. The approach used typical architectural design methods with a strong focus on the human scale, generating a solution that is more concerned with the residents experience and perception of the design, to address the research question, aims and objectives.

KEY RESEARCH STEPS

TARGETED LITERATURE REVIEW

The analysis of literature of residents experience and perception of outdoor space, across ownership types, provided a strong theoretical grounding for the development of this research. As the focus was highly targeted to affordances and meanings, the review was able to generate new insights into the role of outdoor spaces that considered atmosphere and was grounded in environmental psychology. This allowed a better understanding of why different outdoor spaces may or may not work in different circumstances, instead of just a list of spatial features. However, the concepts and principles discovered were highly abstract and difficult to translate into architectural features and design.

A CATALYST DESIGN OUTCOME

This was completed for both the typological precedent of the backyard, and a series of dense housing projects. The analysis of the concepts defined by literature through a typological precedent provided a critical physical and spatial grounding of what is considered desirable. This provides the basis for translating amenities and concepts typically associated with low-density into benefits for high-rise housing. The dense housing projects demonstrated how existing developments have attempted to do the same, and provided an evaluation of the levels of probable success of different methods.

ANALYSIS OF LITERATURE CONCEPTS THROUGH CASE STUDIES

This was completed for both the typological precedent of the backyard, and a series of dense housing projects. The analysis of the concepts defined by literature through a typological precedent provided a critical physical and spatial grounding of what is considered desirable. This provides the basis for translating amenities and concepts typically associated with low-density into benefits for high-rise housing. The dense housing projects demonstrated how existing developments have attempted to do the same, and provided an evaluation of the levels of probable success of different methods.

THE QUALITIES FOUND TO BE MOST EASILY SUPPORTED BY A
HIGH-RISE TOWER TYPOLOGY WERE:

- a clear hierarchy and flow of spaces that communicates ownership and activities permitted;
- thermally comfortable spaces;
- opportunities for the range of expected outdoor activities;
- inviting shared spaces;
- the possibility to exercise control over the degree of privacy and interaction;
- a transition between the private dwelling and the public space to invite neighbourly interaction; and
- good visibility and ease of access into non-private spaces from individual dwellings; a pleasant outlook from most living spaces.

While precedent case studies proved the success of some strategies, it is not clear whether they would be as successful in this context without feedback from potential residents.

LIMITATIONS AND CHALLENGES

Research was limited to the creation of a residential model that addresses the identified gap in the high-density housing market of housing that supports outdoor and neighbourly lifestyles, sited in down-town Wellington. The target market was limited to people who are likely to already be considering dense, inner-city housing, or are on the fence about it. It is specifically aimed at people who feel the loss of outdoor space and typical facilitation of community between neighbours. It is not possible to capture those who require a completely different housing typology; however, it is possible to broaden the market with housing that supports a wider range of desires and needs.

Several challenges arose over the course of this research. A big limitation was the scale and complexity of this project, especially for digital modelling and translation of two-dimensional representations to three-dimensional space. This highly limited the level of detail to which extra amenity spaces could be resolved, as precedence was placed on the experience of the dwellings and directly adjacent spaces. Upon reflection, a revised site allowing a smaller number of total dwellings at this density and potentially more strategic placement within a network of outdoor spaces, would have allowed a more in-depth exploration. Alternatively, a more focused investigation of items from the qualitative benchmark could have allowed the development of more specific strategies, applicable to a wider range of housing

typologies and situations. The challenge of translation was negotiated through a change in method, to beginning design work from the human scale rather than the site scale. The issues were addressed at the scale these are felt at, allowing an appropriate assessment of success through a representation of an appropriate level of detail, without the wider scale complications. Although the design challenges typical residential building and tenant management, resolution of these issues is beyond architecture alone.

FURTHER RESEARCH AND IMPLICATIONS

The findings presented have implications across the development and planning, as well as architectural disciplines. It provides a series of qualities and affordances, a series of techniques and a catalyst precedent project. An ideal continuation of this project would be to investigate how the market respond to the developed typology.

Some affordances and qualities could only be partially addressed without sacrificing other requirements. There are opportunities to exercise territoriality. However, the opportunities outside of private space are temporary and do little to facilitate creativity and display of identity, beyond gardening. This area would benefit from further exploration. Additionally, a sense of sanctuary has been considered throughout the design through the creation of pleasant spaces, through light, greenery and materiality. However, it could not be completely investigated and incorporated within this scope as it is a highly complicated, atmospheric concept.

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FIGURES

BIBLIOGRAPHY _ FIGURES

BIBLIOGRAPHY

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