Going Home
Future Adaptive Building for Aging-in-Place

A project submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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Declaration

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the project is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

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We’re all on the same road together. Every day, each of us gets a little bit older, and slightly further along the path of life. For my young grandson, right now is a wondrous adventure of first times, a two-decade crash course in how to become a fully functioning global citizen. For my son, daughter, and their spouses, right now is about building careers and families of their own; a four-decade period in which to flex their increasing power and capacity to shape the world.

For me, right now is a time to start thinking about what happens next. Although I’m still in the middle phase of life, and not yet part of the so-called third act of old age, I can see on the horizon the signposts for what lies in store for the two to three decades that I hope remain for me. I am starting to better understand the journeys of those who, like my parents and grandparents, have passed this way before. What does it mean to grow old instead of up, or out? When our horizons contract instead of expand. When our bodies and minds start to betray us.

These are some of life’s big questions, but I am not a philosopher. For me, the questions, and any potential answers, are of a more practical nature. I am an architect who designs and builds houses. I see the world through the domestic lens of everyday life. My job is to tailor homes to fit the way people want to live. Increasingly, my clients are older, with grown children, mature careers, and a family house that doesn’t work so well anymore. They’re trying to define how they want to experience this next part of their lives, and to determine what kind of home will help them to realize those goals.

Both tasks require a combination of optimistic imagining and realistic planning. We all have things we dream of doing when work is finally done and our children are grown and gone. We’ll refine a hobby, start a new career, go back to school, exercise more, eat better, and enjoy life’s simple pleasures. The “bucket lists” we create are endlessly varied. At the same time, there are the pending and inevitable realities of decline and death. We don’t really want to think about them, yet we ignore them at our peril.

A good house can help us to live better – in both good times and bad. Like a pair of properly fitted shoes, a well-designed home can make the road feel a little less bumpy, make our stride a bit more confident, and ensure that the journey is that much more enjoyable. For most of us, the houses we live in through childhood and middle age probably suit our needs rather well. The same cannot usually be said about the home in which we grow old and frail, the one we want to live in for as long as possible. We need to rethink the nature of the houses that will help see us through this last stage of life. This extends far beyond things like adding well-placed grab bars and accessible showers to include a fundamental reconsideration of the way our houses are designed, built, and used.

I believe this means reconciling our homes to the reality of the many changes associated with aging. Change is the only constant in life, and, as we enter old age, the degree of this change becomes increasingly profound, the rate more rapid, and the direction less predictable.
Traditionally, houses are built to be static and fixed; crystallizations of a pattern of life decided at the time they were built. The result is that as we age, a house that properly fits our life one day can become unsuitable, perhaps even dangerous, the next. Evolving functional needs, physical and cognitive degeneration, the progression of chronic disease, and the onset of critical illness often result in residents, or their family members, undertaking radically desperate alterations to make the interior of the home work a bit better. Too often, the result is, at best, a stop-gap measure that doesn’t properly meet the requirements of old age and leaves the house with little retained sense of domesticity. Thus changed, the house conveys an implicit message to everyone, including the residents, that it is now a place for someone who is old, sick, and “past their sell-by date.”

But even after enduring such violent upheaval to their homes, a large number of seniors still end up moving rather quickly into long-term institutionalized care. While this is medically necessary for many, a significant proportion of older individuals who would otherwise still be able to manage independent living are forced into old age facilities, not because of the severity of their own condition but because of the unsuitability of their current house. In fact, a recent Canadian study indicates that 20 - 50 per cent of people on residential long-term care wait lists could remain in their own community and homes if there were an appropriate home and care regime available.1

‘Home-health’ has become the rallying cry to solving this crisis. Physicians, nurses, occupational and physio-therapists are developing new regimes of care that transfer more and more of the responsibility for elder healthcare out of the hospital or long term care facility and into individual homes. Engineers are working hard to develop home-based versions of medical equipment that can be safely operated by older adults and their family members. Computer scientists are developing remote monitoring and sensing equipment that can remotely track the health and safety of seniors.

To date, however, precious little work has been done to look at the home side of the home-health equation. Advances in home-health technology have the potential to solve some of the issues facing the challenges of growing old, but have achieved only limited real world success. One of the reasons for this is because they’ve been developed in isolation from the expertise of architects. They’ve failed to connect into a broader, more holistic, understanding of the importance of the home as domestic space. A house is not a hospital or a tech company test bench. A house is too important to our sense of well-being for it to be converted into a far-less-than-adequate medical space or prematurely wrested from us at the time in our lives when we could most benefit from its comforting domestic embrace.

The scale of this problem is expanding as the world’s population rapidly ages. Declining birth rates and improved longevity are increasing the proportion of older individuals in society. The World Health Organization projects that by 2050, 22 per cent of the global population will be 60 or older, up from 11 per cent in 2006. By the middle of the 21st century, and for the first time in human history, seniors will outnumber children.2

Over the next 30 years, the situation will become particularly acute in Canada, the United States, Australia, and New Zealand as the population bulge of their post war baby boom generation passes through old age. In Canada, for example, the senior’s population is expected to jump from 4.9 million in 2011 to 10.3 million by 2036.3 With a birthday in 1958, I am near the middle of this baby boomer cohort, where every seven seconds, another one of us turns 60.4

The baby boomers’ impact on culture has always been dramatic. As young children in the 1940s and ’50s, they provided the impetus for their parents to embrace the new world of modern convenience with the invention of fast food, drive-in movies, and the first wave of mass-produced suburban housing. As teenagers in the 1960s and ’70s, they spawned rock and roll and the youth revolution. When they became parents in their own right in the 1980s and ’90s, their interest in family values made the mini-van a best-seller, spawned the development of discount retail outlets, and drove the proliferation of single-family homes in the far-flung edges of our cities. As their children and careers matured in the 2000s, the baby boomers’ interest in personal fulfillment created a surge in the sale of SUVs, golf club memberships, and super-sized estate homes. As this cohort now enters its senior years, its focus has shifted to preserving youth through health food, exercise, Botox and plastic surgery, as well as far too many revival tours by the aging rock bands of their youth.
This 21st century generation of seniors is not willing, in the words of Dylan Thomas, to go gentle into that good night. Baby boomers want to remain active, relevant, and engaged in the world to the very end, even as they experience physical disability, cognitive decline, chronic disease, and critical illness. For many, this can be an extended process. Most people consider old age to start at 65. Men who reach this age can expect to live until 81; for women, it’s 84. A significant number live to be over 90. This means that the majority of baby boomers will live about 16-20 years as a senior citizen. That’s roughly equivalent to the amount of time they spent growing up and 1/2 of the time they spent as working adults.

How can our homes contribute to ensuring the highest possible quality of life over those years? No one chooses to live out their senior years in a poorly fitted house that’s inconvenient, inhospitable, and makes the daily chores of life more difficult and perhaps even dangerous. We all want to eliminate, or, at least, postpone for as long as possible, being forced to live in institutionalized care.

It’s time to start thinking about a new kind of house, one that is more agile and fluid to help us to age well. With a rapidly expanding senior population, this new definition of home is something that’s needed right now. It’s also a fitting legacy to pass on to those whose journeys are just beginning.

1. Hermus, “Home and Community Care in Canada,” 25
2. “Global Age Friendly Cities,” 3
3. “Housing for Older Canadians,” 7
In the Gomez Residence all of the furniture, except for one couch and a small table, has been removed from the living/dining room to accommodate the movement of a power wheelchair. The chair has caused considerable damage to the walls and finish-work throughout the house because of the narrow width of the spaces.

In the Sutherland Residence a hospital bed and bathtub have been located in the main floor family room. The bathtub has no permanent water supply or drain and must be filled and emptied with a garden hose.

In the Chen Residence the dining-room table has been pushed into a corner of the living space to allow movement by a scooter. An oxygen concentrator and numerous cylinders dominate the living space and the associated tubing is a tripping hazard. Because of limited mobility, a mechanical “picker” is used to reach medication and other items. In the bedroom, rubber gym floor mats have been taped on the walls around the bed to reduce the chance of injury from epileptic episodes.
Gomez Residence

Fig 1 Gomez Residence Interior
Sutherland Residence
Chen Residence

Fig. 3 Chen Residence Interior
7. Project and client names throughout the document have been changed to maintain anonymity.
Introduction

A New Way of Thinking

Nothing endures but change.

-Heraclitus

This book proposes a new housing option for 21st century seniors. Future Adaptive Building (FAB) is an interior system of design, construction, and inhabitation that can adapt to meet changes in lifestyle, physical health, and cognitive health. It supports the dynamic realities of long term aging-in-place across the full spectrum of housing types that includes single-family houses, townhouses, and low-rise and high-rise apartments. FAB incorporates strategies from a diverse realm of ideas about mass customization, serious leisure, and the geography of care to create an adaptive residential interior building system. The FAB system can help improve an individual’s functional, emotional, and physical resilience to the natural changes that occur with aging. FAB can be applied to both new-build and major re-build projects and is designed to readily and cost-effectively integrate into the normative processes of the residential development, design, and construction industries.

Future Adaptive Building comprises three tightly integrated systems that help older individuals live well in their own homes for an extended period of time.

FABmodular is a system of prefabricated cabinetry components that replaces the fixed interior site-built walls typically used in residential construction to define the spaces within a home. The components include kitchen and bath cabinetry as well as free-standing closets, bookshelves, and display units. FABmodular uses mass customization techniques to create interior floor plan layouts that can be custom-configured to meet the specific functional requirements of the resident, without additional cost. Over time, the components can be easily rearranged to change all or part of the floor plan as the resident’s needs change. Although life is in a state of constant flux no matter what our age, FABmodular is particularly well-suited to the homes of older individuals because the rate of change at this stage of life is often more rapid and unexpected.

FABstudio is a web-based information and communication platform that helps older individuals maintain a sense of agency and control over the design and operation of their homes. FABstudio is centred on a DESIGN app that enables residents to customize the FABmodular layout of their home. A COMMUNITY app empowers residents to share best practices with other FAB house residents. FABstudio also includes a MANAGE app for monitoring and controlling all aspects of the home’s operation. A HEALTH app provides access to personal medical vital signs data, a library of health information, tracking of medication and therapy regimes, and distance communication with health care professionals. A LIBRARY app provides access to design and age-in-place resources including instructional videos on the use of the DESIGN app. The FABstudio interface can be adjusted for varying levels of technical ability and cognitive capacity. Maintaining a sense of agency and control is an important part of wellbeing in old age. FABstudio enables the resident to maintain a level of control that is dynamically attuned to his or her evolving level of ability.
FAB+ is a series of specialized medical modules and safety systems that can be unobtrusively integrated into the FABmodular interior to provide physical and cognitive support as well as individually tailored levels of home care, including physical therapy, chronic disease management, and palliative care. The FAB+ units can be quickly and easily added into any FABmodular layout on an ‘as-and-where-needed’ basis, in collaboration with the resident’s health care team. FAB+ accommodates mobility and frailty issues and facilitates the effective delivery of high quality medical care without undue disruption to the essential domestic character of the home.

Future Adaptive Building is based on the Ecological Theory of Aging that focuses on the relationship between an older individual and his or her environment, rather than on just the person or their environment in isolation. Figure 4 illustrates the changing nature of the traditional relationship with a conventional house. During childhood, the demands of our environment clearly exceed our individual physical and cognitive capacity. As a result, we require our parents to provide a social and physical environment that sustains the necessities of life. As we grow, we gradually gain levels of independence in more aspects of life. When we reach early adulthood, most of us achieve a level of competence whereby we’re able to completely look after ourselves and live independently.

This ability continues until we experience some kind of physical or emotional disability that reduces our capacity to cope with the demands of our environment. Barring a mid-life injury or illness, this most often occurs during old age. The severity and nature of this disability is highly individual and can include mobility issues, cognitive impairment, chronic disease, illness, or any combination of the above. The rate of decline is also highly variable and individual. At some point in this downward trajectory, our personal capacity may fall below the fixed demands of the house and we are no longer able to live independently in this particular situation. Conventional home modifications can sometimes extend the length of this period, but the inherent rigidity of a conventional house, combined with the prohibitive cost of undertaking more extensive interior changes, usually makes this a short-term fix at best.

Living in a FAB house can significantly delay, and sometimes even eliminate, this tipping point between individual capacity and environmental challenge. The adaptability of the FABmodular interior means that lifestyle changes, including, for example, the resizing or relocating of the primary bedroom, or adding quarters for a live-in caregiver, can be completed quickly and for very little cost. The FABstudio system can easily adjust the level of automation to operate the home, for example by activating automatic appliance shut-offs and water temperature controls. Finally, FAB+ components can be readily installed to support increasing levels of medical care, including, for example, grab bars for mobility challenges or a home dialysis machine for renal therapy. The flexibility and customization potential of FAB allows each house to dynamically adjust to the unique and ever-evolving needs of its resident. The result is that the resident can remain living in his or her house for a much longer period of time.

This kind of environmental adaptability creates resilience, which is defined in ecological terms as a measure of a system’s capacity to adapt to stress. In the ecological theory of aging, resilience describes a situation in which an older person is “able to remain feeling competent and in control within the stress of evolving physical, social, and emotional limitations.” This stress can be induced by a number of external factors, including physical decline, the progression of chronic disease, cognitive impairment, a loss of friends and social support, or the potential onset of terminal illness. Depending on individual circumstance, the level of stress can be quite high, quick to develop, and volatile in nature.

The responsiveness of Future Adaptive Building helps older individuals manage this stress in order to maintain a sense of well-being. FAB helps to increase an individual’s resilience to aging by continually modifying his or her relationship to the surrounding environment according to evolving capacity. The three strategies of Future Adaptive Building foster three types of resilience. The adaptability of FABmodular provides functional resilience; the connectivity and automation of FABstudio increases emotional resilience, and the medical specialization of the FAB+ components provides physical resilience. Together they form a design-based resilience support system for older individuals that helps to maintain well-being throughout the various challenges of the aging process.
I define functional resilience as an increased capacity to negotiate the stresses of rapid changes in lifestyle. These are usually associated with the early stages of old age, when we’re still actively engaged in the external world and transitioning out of the demands of our full adult lives. The FABmodular components enable older residents to easily adjust the spatial organization of their homes to account for changes in household composition and evolving functional requirements. FABmodular uses a mass-customization strategy of design and production that makes this level of functional resilience affordable and easy to realize within the practical realities of the North American residential construction industry.

Emotional resilience is the ability to cope with the stress that comes from a loss of independence, control, and individual agency. This typically occurs in the middle stages of old age, when the realities of aging begin to catch up on us. We start to experience a pending loss of control when decisions we used to make on our own begin to be made by family members and caregivers. Emotional resilience gives older individuals the capacity to participate in decisions about the detailed functioning of their home and how they want to live. FABstudio encourages older residents to participate in the design process in order to foster a deeper, more substantive relationship with his or her home. Advanced home automation strategies also help to create a nuanced level of capability and control that matches individual capacity.

Physical resilience is the ability to manage the stresses associated with physical and cognitive decline, chronic disease, and end-of-life care. This is usually most acute in the advanced stages of old age, when physical and cognitive decline can seriously limit our abilities, or we are suffering from one or more chronic or terminal diseases. FAB+ seamlessly introduces safety systems, physical and cognitive assistive technologies as well as advanced medical equipment for therapeutic care into the home without disrupting the home’s essential domestic quality.

Although it’s convenient to describe the three levels of resilience as distinct and separate, following each other in a linear timeframe, the reality is rarely so clear cut. Some people may simultaneously require all three levels of resilience early in the aging process, while others may only ever need one or two during their lifetime. FAB can adapt to almost any potential scenario. The assets for actualizing each level of resilience are built into the DNA of every FAB house, where they remain waiting as latent potential capabilities to be deployed whenever it becomes necessary.
Each of the three sub-systems that make up FAB are connected into a broader external network of support and services that further reinforce and extend the functional, emotional, and physical resilience of a FAB house. FABmodular connects the resident with a product support network for the after-market fabrication and installation of cabinetry that is required whenever residents make future changes to the interior layout of their home. FABstudio connects the resident with a community of other FAB house residents to share best practices, help newcomers understand the FAB philosophy, develop common solutions, and learn about new product ideas. FAB+ links residents with their health care providers as well as a suite of optional community-based support services such as housekeeping, homecare, meals, and transportation.

Future Adaptive Building is predicated on an open building strategy. The design and construction of the ‘interior fit-out’ of each individual living unit is separated out from the ‘base building’ components of the building’s structure, enclosure, and mechanical support systems. A key feature of the open building strategy is that the base building is specifically designed and constructed to easily accommodate different interior layouts for each of the units. This has long been standard practice in the commercial construction of office buildings and retail centres, where each tenant develops the interior of their raw space to meet their specific needs. This approach is desirable for the project developer because it reduces risk and future-proofs the development against changing market forces. It’s popular for tenants because they can precisely customize their office or retail outlet.

Open building is used in residential projects in Europe and Asia but has not yet found wide application in North America, even though similar development benefits have been demonstrated to accrue to residential projects that incorporate this design idea.  

10 Probably the most familiar North American example of this
kind of thinking in housing is the New York loft, in which open-plan commercial spaces in old buildings are converted into living spaces by the residents, using large-scale furniture components and other temporary construction that does not permanently affix to the building’s shell.

By working within an open building strategy of design and construction, Future Adaptive Building is not limited to any one type of residence or scale of project. Developers of senior-oriented housing projects can easily incorporate the FAB age-in-place system into almost any low-density detached housing project or mid- to high-density multi-family building.

Structure of the Documentation

Future Adaptive Building is a tightly integrated system of theory and practice played out across design, construction, and us. It engages the worlds of architecture, medicine, business, manufacturing, computer science, and biomedical engineering. I have structured my PhD presentation as a series of cross-sectional views to describe this multi-dimensional reality.

Part I describes a temporal cross-section of the development of Future Adaptive Building, cut along my personal narrative of practice. It begins with an examination of the lessons learned from my first 26 years of design/build practice in residential architecture and ends with a detailed account of my last four years of PhD research, including my recent academic and practice-based work in age-in-place design.

Part II contains subject-based cross-sections that describe the theoretical underpinnings of the three sub-systems that comprise Future Adaptive Building. The first explores mass customization theory and how the FABmodular system of moveable cabinetry can increase functional resilience through a continuously adjustable interior. The second examines the potential for engaging older residents in a co-design process and design as a hobby to increase emotional resilience through the FABstudio system. The third applies ideas around the geography of care to increase physical resilience through the FAB+ system of medical, physical, and cognitive supports.

Part III consists of three project-based cross-sections that articulate the application of FAB in three different scales of residential development. The first is a case study project for a low-density townhouse development. The second is a small lot mid-density multi-family project. The third is a high-density high-rise apartment complex. The written document contains Parts I and II. The accompanying exhibition describes Part III.

I am an architect in many disguises. Conventionally, I’ve been a university professor and active architectural practitioner for thirty years. But I’m also a real estate broker, a residential contractor, and a furniture retailer. I’ve founded a publicly oriented activist movement for good housing, and advocated to the profession for architectural entrepreneurship and innovative forms of practice.

Running through all of these activities is an over-riding belief in the power of good residential design to improve the quality of life, and a commitment to making this benefit accessible to as many people as possible. I see architecture as a complex means to a simple end, not a fetishized end in itself. I am committed to the power of the quotidian and how domestic space can help to articulate the poetry of everyday experience.

I also confess to having come to age-in-place design rather late in the game.

Like most people, I witnessed from an early age the challenges faced by loved ones as they grew old and ill. As a young boy, I visited my grandparents in various nursing homes. I remember them as scary places filled with funny smells and odd-looking people. With the eyes of a young adult, I began to see the underlying realities of isolation, boredom, pain, and distress as well as a loss of independence and dignity. Years later, I watched my mother valiantly battle Alzheimer’s disease while living first at home, assisted by my father and brother, and later in care. I saw the house she loved, and in which we were all raised, become a dangerous place for her to live.

But none of this, including my mother’s experience, really connected with my life as an architect. It wasn’t until 2013 that I first started to realize how the realities of living with old age and illness intersected with the domestic world of residential design. That was the year my 63-year-old brother-in-law was diagnosed with aggressive terminal cancer. He came to live at our house soon afterward, and thus began a twelve-month odyssey with home healthcare. I witnessed firsthand how even my carefully-designed domestic space could fail an individual with increasingly significant physical and cognitive problems. I saw the stress that occurs when a home is called into service as a quasi-medical facility with oxygen concentrators, wheelchairs, IV poles and pumps, hypodermic needles, countless varieties of pills, and seemingly miles of oxygen tubing snaking through the house. Beyond the equipment and medical paraphernalia, I also observed how unsuitable the typical house is as a place of care, a space for loved ones and nursing professionals to provide the amount of attention and support that’s required by someone with substantial medical and personal care needs.

All of this had added poignancy because my brother-in-law had devoted his life to caring for others. He was a family physician specializing in elder care and had given up his office practice many years before in order to devote himself fulltime to working in the community. Each day he would make his rounds to see patients residing in private homes and residential care facilities. Although I had always been aware of this work, it wasn’t until he became ill, and the pace of his life slowed, that we were able to spend substantive time together, talking about the many people he had cared for over the years.

PART I

Building as Act and Artifact

*There should be as many different kinds of houses as there are types of people.*

-Frank Lloyd Wright
There were horror stories of neglect and loneliness, as well as descriptions of beds in the living room and sponge baths in the kitchen because the upstairs part of the house had become inaccessible. But there were also stories of dignity, courage, and perseverance under stress, despite the inappropriate conditions in which many of his patients lived. Above all, he taught me that everyone, no matter how old and frail they may be, deserves not just respect but a full and meaningful life until their very last breath. I admire and respect his selfless devotion to caring for the people that most have forgotten.

The entire experience profoundly changed the course of my life. Until then, my professional interests had been engaged in other matters surrounding residential design. My brother-in-law showed me the pressing need that exists to improve the quality of domestic life for people as they grow old.

As a full-fledged member of the aging baby boomer generation, I decided to take up this challenge. Working through the PhD by Practice program at the Royal Melbourne Institute of Technology, Australia, I developed Future Adaptive Building as a strategy for helping people better cope with the challenges of aging. In this process, I discovered that this refocusing of intention builds on much of what I have done in the past. In many ways, it seems that designing homes that help people to age well is something I have been preparing for my entire career.

Chapter 1 traces the arc of this professional narrative through the first 20 years of practice. It begins with an account of my early career, my development of a new form of professional practice more suited to the needs of everyday housing, and the creation of the Slow Home Movement. Chapter 2 describes the past four years of PhD research. I describe the evolution of Future Adaptive Building through the adoption of mass customization strategies in our design/build practice and the integration of my university-based home health research.
In 1986, a few years after leaving graduate school, I joined the architecture program at the University of Calgary as a new faculty member. With no connections and few resources, I began to work through my design ideas at a small scale. The school had a well-equipped workshop and I spent several years designing, fabricating, and exhibiting one-off pieces of furniture. The whole endeavor was greatly influenced by the idea of “making in architecture,” which was highly topical in architectural circles at the time. The seeds of my future design/build firm took root in these projects.

But my interest in building extended beyond the act of making and into the realm of use. I believed, and still do, that ‘the proof of the pudding’ is more in the eating than it is in the making.

One of my earliest passions was designing chairs. A chair can be thought of in many ways – as structure, sculpture, political statement, aesthetic fetish. My interest lay in use – not as a human factor’s based functionalist study, but as an embodied experience. We learn something about the world, and perhaps even ourselves, when we sit on a child’s stool or a king’s throne. Chairs enable opportunities for different kinds of being-in-the-world to be revealed, facilitated not by how they look, but by what the act of sitting in a particular chair tells us about ourselves and the world.

The Looking Glass Chair (1988), for example, explores the relationship between people sharing a communal seat. Individuals can choose whether to sit side by side embraced by...
the curved metal arms of an abstracted human figure, or decide to sit face-to-face in opposing directions and separated by the metal curve. Looking Glass Chair asks each individual to decide which perspective, of the room and of themselves, is appropriate for the encounter that awaits.

The poetic potential for use is explored even more explicitly in Firebowl (1988). Three cast bronze elements are presented to the user as individual puzzle pieces that must be assembled, in one of a number of different configurations, prior to use. In some configurations, the abstracted hand element holds the fire up off the table in an act of bestowal. In others, it shields the flame in an act of care and protection.

After completing the assembly, the user is then faced with the task of making and sustaining a small flame by adjusting the location of the cardboard wick in the oil. This is a task that requires practice to be mastered. If the wick is placed too far out of the oil, it will smoke, too far in and the flame will be extinguished.

Firebowl presents an opportunity to move beyond the commodified products of fire in instant-on gas fireplaces and reconnect with a more primitive, skill-based, understanding of fire as process. I see now that it was also an early exploration of mass customization. The three bronze elements are mass-produced but assembled by the user each time, along with the oil, wick, and fire, into a unique composition. Firebowl was designed to be understood, and have its poetry revealed, through assembly and use.

**Affordance**

In analyzing this past work as part of my early PhD research, I realized that this interest in designing a relationship between people and things had a name. Affordance theory was popularized by Don Norman, former chief designer at Apple and the author of The Design of Everyday Things.

*The term affordance refers to the relationship between a physical object and a person. An affordance is a relationship between the properties of an object and the capabilities of the agent that determines just how the object could possibly be used... The presence*
of an affordance is jointly determined by the qualities of the object and the abilities of the agent that is interacting. This relational definition of affordance gives considerable difficulty to many people. We are used to thinking that properties are associated with objects. But affordance is not a property. An affordance is a relationship. Whether an affordance exists depends upon the properties of both the object and the agent.  

Think of a knife. What makes a good one? To my mind, it’s never been the pedigree of who made it, how it’s constructed, or how much it costs. It isn’t about how innovative its shape might be or the quality of the materials that make it great. Rather, it’s about how well it cuts, and how it feels in the hand when it’s working. A good knife affords cutting to a high degree. While I can hack my way through a ripe tomato with just about anything that’s somewhat sharp, there is a small joy in the way a truly good knife slices through the flesh with ease and grace. The fact is that knives that work incredibly well also usually have a good pedigree, are visually striking, use fine materials, and cost a little more than a bargain basement version. A designer obsessed with ensuring that his or her product works most effectively, also typically cares about these other factors as well – but only in so far as they reinforce the primary design task of affording a nice clean cut.

I have identified this interest in articulating the relationship between people, things, and space as the first touchstone in my work. Underlying Future Adaptive Building, there’s an obvious sympathy between Norman’s theory of affordance design and the ecological theory of aging. Both start from the assumption that it’s the relationship between the person and his or her environment that’s significant. I’ll come back to this relationship later in the chapter.

Early Practice

After several years in the workshop teaching myself the craft of small-scale detailing and fabrication, I decided to expand the scale of my work and opened my first residentially focused architecture practice. Housing, as a building type, seemed a natural progression from the furniture projects, and an ideal scale in which to explore an affordance-based approach to architectural design. At the time, the writing of Michel de Certeau and Deborah Berke’s provocations about an architecture of the everyday were also swirling through architectural theory and practice.

The quotidian world of normative market-rate housing seemed to be the right place for me to practice. But this was not a common place to establish a new firm. Only about 7 per cent of all houses built in North America involve the services of an architect or design professional, and almost all of those are at the very top end of the market. I had little interest in this type of high-end work. The group that piqued my interest was, and still is, the large number of people in the middle of the market who can afford to buy a good house but don’t have ready access to the custom design services of an architect. They live, like almost everyone, in what the Sierra Club calls the “Dark Side of the American Dream,” a vast, formless, un-designed place of standardized tract houses.

In the first years of practice, I had little success in attracting these non-traditional residential clients to my traditionally organized one-person architecture firm. I wanted to work with people in the middle of the market, who were looking for an alternative to the cookie-cutter world of production-built housing -- but they didn’t seem to be interested in working with me. I knew the kind of houses I wanted to design, but couldn’t connect with the people they would benefit. Filled with the hubris of youthful frustration, I blamed the client for my problem and started to research the residential industry to see if I could find out what was wrong with the world.

I discovered that the problem was more internal to my profession rather than a character flaw in the general population. Some people will never like the modern aesthetic that most architects favour, or see the value in spending money on a custom design process. However, I discovered that the more significant reason architects are so cut off from single family housing is that our professional consulting model doesn’t easily fit into the workings of the North American residential industry. The standards of architectural practice are geared toward the realities of commercial construction, where extensive construction documents form the legal contract between owner and contractor, and the architect is the impartial third party expert.
In the low density residential world, builders rule the project, supported by real estate agents and retailers. Professionals like architects and engineers are suspect, regarded as too self-important, largely unnecessary, and “disconnected from what’s really going on.” I even had one contractor confess to me that he routinely added a 15 per cent “hassle tax” to his pricing any time a client wanted to use an architect. I came to the conclusion that if I really wanted to work with non-traditional clients, I would have to develop a non-traditional form of practice. I decided that my philosophy should be if you can’t beat’em then join’em (and beat’em). And so housebrand was born.

Housebrand

Housebrand is an architectural practice formulated to mimic, and then subvert, the traditional processes within the North American housing industry. It combines real estate, architecture, construction, and furniture retailing into a vertically oriented one-stop shop that helps people build new or renovate an old home.
Chapter I: Getting Started

Fig. 10 Housebrand Interior Detail

Fig. 11 Housebrand Renovation Exterior

Fig. 12 Housebrand Renovation Interior
Combining real estate and retail increased our accessibility, and the integration of design and construction reduced our project costs and increased quality. The result has been a very popular and successful practice that has helped more than 250 clients build homes in the past 19 years.

Housebrand began as a theoretical business model developed as part of my architectural entrepreneurship research. The model of practice I created on paper seemed promising and, together with my partners, Carina van Otm and Matthew North, we built-out my concept business model in the real world of practice over the next 4 years.

The first step in this process was to get a real estate license so that I could help people buy the right property to either renovate or build anew. My argument was, and still is, that the purchase of a piece of property is a major design decision and that only an architect who understands the big picture is really qualified to help you make the best possible decision. The training I received, as well as the access to market information I received because of having a real estate license, gave me a fluency in property values and the financial realities of buying a home. Both of these became an invaluable part of our design consultation process.

I also got my license to trade in real estate, because when people start thinking about a new place to live, they don’t say, “I need an architect,” but rather, “Which realtor should I work with?” Being part of this club put me in front of my desired client group much earlier in the process. I also found that the rapport and trust I built up by helping people with the very tangible process of finding a property carried on into the much more intangible design phase of the project.

The second step in the creation of housebrand was to take control of the construction process. We became a construction company as well as a real estate brokerage and architecture firm. This gave us control over quality, but, more importantly, allowed us to dramatically reduce the number of working drawings required to build a project. This reduction in scope allowed us to significantly reduce our upfront architectural fees. Usurping the role of the general contractor allowed us, for the first time, to take control of the project from beginning to end. It also gave us access to real-time construction pricing, so we could more accurately integrate construction costing into the design process. For a client in the middle of the housing market, the project budget is very fixed and it’s critical for us to only design things that they can afford. In my experience, the most effective way to reliably achieve this is by being responsible for the construction.

The third step was to open a retail store that carries furniture, lighting, and detail accessories consistent with our design philosophy. Although the products we sell are important to our houses, the primary reason we opened a design store was to increase our accessibility to the public.

A typical architecture practice is just like any other consulting business. There’s a waiting room, a receptionist, and a room where you meet the expert, be they lawyer, accountant, doctor, dentist, or architect. Most people don’t have positive associations with this kind of experience, particularly when, as in the case of architects, they may not be sure if they want, or can even afford, their services. But everyone knows that anywhere in the world you can walk into a retail store, look around, ask some questions, and either take things further or walk out the door.
No expectations, no stress, no embarrassment, and no cost. This seemed like a good model for a residential architect interested in working with clients who weren’t that familiar with his profession. Over the years, a significant number of our clients, including some of our most interesting and largest commissions, first walked into our door on a Saturday afternoon to look around and have an informal chat.

Finally, we needed a name for this new operation. We thought that anything with the word “architect” in it would alienate potential clients, and the term “homebuilder” seemed a little too predictable. The three partners had started a tradition that continues to this day of Friday afternoon drinks at a local restaurant, and it was during one of those “meetings” that we found our name. On the day in question, we had apparently been at the restaurant for some time, because the staff had changed shifts. A new server came to see if we wanted another round of martinis, and asked if we were drinking the premium gin or the house brand. The name stuck. It fit our philosophy and I liked the subtle reference to Naomi Klein’s just published book, No Logo.

The overarching intent of Housebrand’s vertically integrated structure was, and still remains, to transform a service-based model of business into something that can compete in a market dominated by product-based options. I’ve been asked many times if it would have been easier, and clearer to the public, if we had simply opened a development company that builds homes “on-spec” and markets them to prospective buyers. I rejected this model of practice because it subverts the essential consulting relationship of architect and client into a transactional relationship of seller and buyer. Inherent in the transactional relationship, whether it’s about buying a toothbrush, a house, or an airline company, is the adversarial relationship that naturally arises between the two parties. The seller strives to get the most return for the least effort and the buyer is looking for the most effort for the least cost.

The consulting model of business used by doctors, lawyers, accountants, engineers, and architects keeps, in theory at least, professionals and their clients on the same side of the table. Given the shoddy business practices within the residential construction industry, where homebuyers regularly pay good money for poorly made homes, I wanted, above all, to do things differently and maintain a non-adversarial agency-based relationship with our clients.

Professional services are not common in the middle market housing world, and we had to cast the consulting model of practice as a complete system of services that could mimic as closely as possible the ease and simplicity of buying a home as a finished product. The fact that the final house was custom-designed and built was our competitive advantage.

I believe that modes of practice can be designed with the same intentionality and innovation as a built project. The goal of rethinking the role of architects and the nature of their relationships with the public is a second touchstone in my work. It emerges again in a slightly different form with the Slow Home Movement, and guides my most recent speculation about a new form of practice attuned to the nature of Future Adaptive Building.

Tom and Jean

Tom and Jean were early Housebrand clients. They came to us in 2006 and gave us our first experience of designing to age-in-place. These clients were in their late 70s and wanted to update the split-level home they had purchased as a young couple in the early 1960s. Tom was a retired school principal and Jean had been a teacher. They were the first older clients I had ever worked with. Until then, we’d only worked with young families and middle-aged couples who were building a home to start a new chapter in their life. I didn’t know what to make of Tom and Jean. They’d lived in the same house, largely untouched, for almost 50 years, and told me that they now wanted a fresh start. How many years did they have left? Why bother now? But a job was a job. In the end, the results exceeded all of our expectations in terms of both the final product and the larger lessons learned.

Their house was a conventional side split-level bungalow. On one side was the main floor with living, dining, kitchen, and entry spaces. On the other side of the split was an upper floor of three bedrooms with a single bathroom, and a lower floor with an informal family room and laundry. We concentrated our work on the main floor. Tom and Jean wanted a bigger kitchen and
better access to the backyard garden. To accommodate them, we removed most of the interior walls on the main floor to create a large, open space, relocated the kitchen to the front, adjacent to the main entry, and added large windows and a garden door to the back of the house, adjacent to the new living and dining space. We were all a bit surprised that the couple wanted such a dramatic change, having basically discarded all of the things that many people, particularly older individuals, want to keep as familiar memories of their life. Given their appearance, and the original style of the house, we were shocked at how modern their tastes ran for the renovation.

At the end of the project, I remember asking Jean why they’d done it. She told me she did it for Tom. He was recovering from a significant illness and was feeling restless. They had long wanted a new house, but life had always seemed to get in the way. She thought that now was the time because it would give Tom “something to concentrate on.” And so he did, spending a lot of time involved with all of the minutiae in the design and re-construction of his home.

Tom and Jean were delightful clients. Although I didn’t give it much thought at the time, I see now how much this early experience shaped my later thinking about age-in-place design. They were our version of “early adopters,” and it would be a decade before we had another client who challenged us with a design project focused on age accommodation.
The Tailored Home

Tom and Jean’s project was part of a cohort of major renovations that we’ve completed over the years. In fact, almost half of Housebrand’s projects have started with an existing home. We have always concentrated our work in the older, more established communities of Calgary and were one of the pioneers of inner city redevelopment. Unlike many cities in the United States, the neighbourhoods close to Calgary’s downtown are safe and very desirable places to live. There are mature vegetation, good schools, and close amenities. The only problem is the houses. Most were built in the 1940s-60s and don’t fit the demands of contemporary life.

In the early years of our practice, there were only a few neighbourhoods in which a newly built home could be financially justified in the housing market. Buying a property and refurbishing the original home was a much more reasonable, and financially feasible, option for people wanting an alternative to a far-flung suburban house. We coined the term “Tailored Home” for these major renovation projects. Borrowing an analogy from the clothing industry, we described how buying an old home and renovating it to suit your needs was like buying an off-the-rack suit and tailoring it to fit the specific physical reality of your body. In this way, purchasing the home and property shifted from being just a financial transaction based on the “what you see is what you get” premise of real estate shopping, to the first step in a design process in which “what you see is just the beginning.”

From an architectural point of view, we treated the existing house as simply an exterior building shell. The old interior was removed and a new interior constructed that exactly matched our client’s life. Over the years, we’ve completed almost 100 tailored homes. We suffered through the pains of deconstructing the layered construction of a wood-frame house and honed our ability to design a new interior within the size and shape constraints of a pre-existing building shell. The idea that a new house could be made within an existing shell is the third touchstone in the trajectory of my work. The construction efficiency and cost-effectiveness of separating the interior fit-out from the exterior shell would become an important model for the development of FAB.
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**Property Listing**

2028 50 Ave SW
$874,900

**Style:** Bungalow
**Type:** Residential Detached single family

**Year Built:** 1985

**Lot Size:** Rectangular
**Front Exposure:** SOUTH

**Description:** Well kept bungalow on large lot in Altadore. Hardwood under carpet. Most windows have been upgraded. Features 3 bedrooms, 3 piece bath and ensuite on main floor. Large walk out with fireplace. Large backyard with covered patio and garden. All measurements to be verified by buyer. 24 hour notice show.

**Goods Included:** Dishwasher Portable, Refrigerator, Stove-electric, Window Coverings-

**Site Influences:**

**Square Footage:**

- Main level: 1,578.00
- Upper level: 0.00
- Lower level: 0.00
- Total: 1,578.00

- Mortgage: $1,682.00
- Taxes: $339.00
- Days on Market: 83

Fig. 19 Tailored Home Concept Diagram

**Property Listing**

1908 46 Ave SW
$381,900

**Style:** Bungalow
**Type:** Residential Detached single family

**Year Built:** 1954

**Lot Size:** Rectangular
**Front Exposure:** SOUTH

**Description:** As good of a location as you can find in Ward 19. Immaculately cared for. 3 Bedroom Bungalow with a Two Car Detached Garage. Large fenced yard. Gas fireplace, living room, central vacuum, french doors leading directly to covered patio. Large master bedroom with walk-in closet.

**Goods Included:** Alarm/Security System, Garage Opener, Control, Stove, Electric, Refrigerators, Washer/Dryer, Fan Ceiling, Dishwasher Built-in

**Site Influences:** Forested, Flat Site, Golf Nearby, Back Lane, Landscaped, Shopping Nearby

**Square Footage:**

- Main level: 1,240.00
- Upper level: 0.00
- Lower level: 0.00
- Total: 1,240.00

- Mortgage: $900.00
- Taxes: $2370.00
- Days on Market: 13
- Legal Plan: 143712G
- Building: 16
Fig. 20 Andura Tailored Home Before
Slow Home

In 2008, I wanted to expand our reach beyond our typical client group. The office was running very well and we had lots of work, but our reach into the middle of the market was not as deep as I had hoped. I was anxious to find ways to connect with different levels of non-traditional clients, and so we started a web-based advocacy and education service based on the idea of a Slow Home.

I’ll discuss the Slow Home philosophy in more detail later in Chapter 4. For now, let me just say that it emulates the way chef Jamie Oliver and the Slow Food Movement advocate for a healthier, high quality diet through an information and education campaign focused on the simple things we can all do to eat better. Following the demonstration cooking program model, we developed an extensive web-based video library that demonstrated the value of good residential design.

Fig. 22 Slow Home Studio Online + In House Workshops

Hands On Design Workshops

Work alongside John and Matthew in our Calgary studio to learn the practical realities of good house design. We use the same demonstration teaching model as a cooking school to get you started using sketch paper, architectural scales, and our exclusive design templates to complete a series of design activities. Our workshops are informative, entertaining and open to everyone.

Register
Chapter I: Getting Started

Fig. 23 Slow Home Studio Website + Instruction Videos
What’s Wrong With This House

Matthew and I also wrote a book entitled “What’s Wrong with This House: A Practical Guide to Finding a Well Designed Sustainable Home”, which introduces a 12-point rating system that people can use to evaluate the design quality of a house that they’re thinking of buying. The goal of the Slow Home Movement wasn’t to generate projects for housebrand but to increase awareness throughout the entire housing market about the value good residential design can bring to your life.

The Slow Home Movement generated a lot of interest, despite the fact that it’s most active period coincided with the aftermath of the 2008 global financial crisis -- which, incidentally, was caused by the collapse of a U.S. housing market based on fast house principles. It was very gratifying to see how many people were interested in learning about residential design and how to “think like an architect.”

On reflection, I see that Slow Home connects back to my interest in defining new and more relevant relationships between architects and the public. Using co-design to empower people to become more engaged with their domestic surroundings is the fourth touchstone in my work. It will emerge again as a critical component of the FABstudio system.

In 2011, I realized that despite the resonance of the Slow Home concept and the growing interest in learning about do-it-yourself design, our focus on advocacy and education wasn’t enough. After seeing the tangible value that good design could add to the livability of a house, the people from all over the world who had connected with the Slow Home Movement wanted to act on this new awareness and change the design of their homes. This was a problem. We had generated desire and interest with no clear path to satisfying either. Architectural consulting is not something that I, at least, could easily accomplish online or at a distance. It became clear that if I wanted to expand public access to custom residential design in a truly impactful way, I was going to have to do more than simply advocate for it. Slow Home demonstrated the broad desire for change, but I learned that I would need to remain engaged in the tangible world of construction to enact any sort of real improvement.

My hunch was that this would need to involve moving outside of the custom home design and construction process. After 20 years of working with Housebrand, I felt that I had pushed the craft production model of homebuilding as far into the middle of the housing market as it could go. I was convinced that the next step had to somehow engage the processes of mass production in order to increase the scale and type of projects we could do. It was time to venture into the belly of the beast, so to speak, and look at ways of moving out of the craft production model of practice that we had been using since our inception, and more fully engage in the processes of mass production – hopefully, without losing everything I held dear as an architect.

To pursue this agenda more fully, I enrolled in the PhD by Practice program at the Royal Melbourne Institute of Technology in 2012. The next chapter describes this experience, and the development of Future Adaptive Building, over the past four years.
1. Study desktop removed from upper stair landing to improve circulation.
2. Master bed located in center of room to improve connection with exterior view.
3. Free standing wardrobes create dressing area behind master bed and increase closet capacity.
4. Door swing reversed in master ensuite to avoid conflict with vanity.
5. Sink counter extended with additional under counter storage.
6. Free standing storage units added in former library.

1. Over-sized angled stairs disrupts circulation from foyer to family room.
2. Angled counters makes kitchen difficult to work in.
3. Unnecessary kitchen appliances take up too much space.
4. Eating bar is too short.
5. Breakfast nook is too small and table location conflicts with door swing.
6. Corner fireplace in family room causes inefficient diagonal furniture layout.
7. Guest bathroom door opens directly into family room.
9. Foyer has no closet and opens directly into formal living space.
10. Formal living and dining rooms are seldom used.
11. Side yard window in formal dining room does not provide much light.
12. De Certeau, “The Practice of Everyday Life”
The Royal Melbourne Institute of Technology provided exactly the kind of creative space and intellectual support I needed to pursue a new direction. Under the thoughtful guidance of my supervisors, Dr. Leon van Schaik and Dr. Sue Anne Ware, I began to explore the idea of mass customization as an innovative strategy to achieve the economic benefits of large-scale production without losing all the benefits of custom design. Mass customization, which I will more fully discuss in Chapter 3, is the driving force behind many of the newest developments in manufacturing. From breakfast cereal and sports shoes to commercial buses and light fixtures, mass customization allows customers to tailor the initial design of the product to their individual specifications without losing any of the cost and logistical advantages of mass production.

Mary + George

In 2013, at about the same time my brother-in-law’s illness was first diagnosed, Mary and George walked into the housebrand office. At the time, my PhD research was deeply involved in how mass customization could improve the efficiency of our construction. Mary and George’s project forced us to look at mass customization from a design perspective, and resulted in our first iteration of an adaptive interior. In many ways, their project was the birthplace of Future Adaptive Building.

Mary and George were the first housebrand clients since Tom and Jean who were interested in designing a house for aging. But their priorities were entirely different. Mary and George were 15 years younger than Tom and Jean had been at the time of their project, and they were about to retire. They were just embarking on the journey of old age and wanted a house that could accommodate the many changes in lifestyle that they anticipated would occur during this period.

They were both in their mid-60s and had a 19-year-old daughter named Jill. George had a 25-year-old son, Paul, from a previous marriage. Jill still lived at home and Paul stayed with the couple off and on throughout the year.

Mary was a lawyer and planned to work at her firm for another three years before downsizing to a home-based consulting practice. George, a marketing manager, was ready to retire now and unsure about whether he would continue working part-time or not. In either case, he wanted to use his retirement to pursue his woodworking hobby. Mary was passionate about painting and needed a studio in which to practice. They told me they wanted a modestly sized two storey single family house that would meet their needs while they grew old and retain its value when the time finally came to sell.

We develop a residential profile at the beginning of every new project to describe the client’s specific requirements. My role is to design a house that’s perfectly tailored to those requirements, as well as those of the site. I quickly realized that Mary and George had not one residential profile but four or five. They were charting multiple future scenarios, some confirmed and others speculative, that they wanted their house to accommodate over the next 10-15 years.
On their move-in date, the house would need to accommodate four adults. In the near future, they thought that Paul would permanently move out and Jill would follow in another five years. As the couple aged, they wanted the option of a bedroom on the main floor to accommodate any potential mobility and health challenges. Within a three-year time frame, there was the certain need for a home office that could accommodate occasional visits from clients, and a potential need for a second home office. Add the desire for a painting studio and a workshop, and each one of these scenarios could easily have been its own residential profile for a new house.

This was a different kind of project. Until Mary and George, we had not faced a situation in which adjusting to change was the central concern. Change is a fact of life at all ages, but until this point, all of our clients were looking for a home that was tailored to their particular stage of life – a young couple starting out, a family with small children, or a growing family of teenagers. The implicit assumption had always been that, like everyone else, they would deal with changing personal needs when they moved up or down the property market as part of a broader financial plan.

Mary and George had a different point of view. They wanted this to be the house they would live in for the rest of their lives. They had gone through the stages of family/home growth and were now looking towards a different kind of future. Their new home had to accommodate a variety of different life scenarios because they didn’t want to move again.

**Parallel Multi-Functionality**

My analysis indicated that the house should be in the 2400 sqft range in order to meet the clients’ budget, and to ensure that the project was not overbuilt for the neighbourhood and the real estate market. George wasn’t convinced that this was possible. He fancied himself to be an amateur designer and, at our first meeting, presented me with a hand-drawn floor plan with 3500 sqft of living space.

George’s plan had a space for each of the required uses in each of their possible future scenarios. The plan reminded me of a
Swiss Army knife, with three to four houses in one. As a young boy, I treasured my Swiss Army Knife. In addition to both smooth and serrated blades, it had a screwdriver, nail file, scissors, corkscrew, bottle opener, and some sort of pointed thing that could have been a toothpick or an awl. It had everything, a fact I was constantly reminded of when I tried to conceal it in my pocket at school. The truth of the matter was that it was enormous. But the trade-off for having all those cool functions wasn’t just an oversized object. It was also unwieldy, and none of the tools worked as efficiently or effectively as their stand-alone cousins. I also found that, despite the allure of all of those options at the time I bought it, the reality was that there were several parts of the knife that I never used, and quite a few that I only occasionally used.

A Swiss army knife, like George’s sketch plan for his house, is an example of what I call “parallel multi-functionality.” All the options are available all the time, sitting side-by-side and waiting to be used. They’re imbued with all their potential pasts and futures, which can result in a lot of excess baggage. At any given time, the needs of the present are compromised by additional features that may or may not be used in the future.

It was clear to everyone around the boardroom table that George’s plan wasn’t feasible. The couple simply couldn’t afford, nor did they really want, such a large house. It would have been oversized for the neighbourhood and an anomaly in the real estate market. I was concerned that it would also be difficult to sell when the time came for them to recoup their investment.

Serial Multi-Functionality

At the next meeting, I presented my concept plans for a 2400 sqft house that met the family’s immediate needs. I also showed them how they could renovate the house after it was constructed, depending on their actual future needs.

I would characterize this approach as “serial multi-functionality” because the options succeed each other and are made available one at a time. Building a model with Lego is an example of serial multi-functionality. Unlike parallel multi-functionality, serial multi-functionality’s configuration at any given moment is compact and
efficient. However, each time a change is required, there’s a time-
consuming process of dismantling the existing configuration and
reconstructing the pieces into a different version.

This approach certainly met the client’s goals for right-sizing
and long-term value, because all versions of the house (current
and future) would be right-sized and fit the resale market. The
difficulty, of course, was the cost and disruption of undertaking
the renovation work each time a change was needed. In addition,
renovations typically only make economic sense in 20-year
intervals, after the cabinets, finishes, and fixtures are worn out
and the interior is said to have reached the end of its economic
life. The renovation process is time-consuming, expensive, and
disruptive. Serial renovations work well for people adapting to
slow rates of change, or a successive series of residents. This
strategy didn’t make sense for Mary and George. They needed
the house to adapt to multiple changes over the course of five-
15 years.

Distributed Multi-Functionality

Completely frustrated, I searched for a third model of multi-
functionality to inspire the design process. Fortunately, I didn’t
have to look any further than the smartphone on the edge of
my desk. It’s a new paradigm in multi-functional design. With a
click on an app, this slender machine assumes the guise of any
number of devices, including camera, telephone, blood pressure
metre, GPS route-finder, flashlight, and game console.

How does it do this and still remain so small and compact?
Unlike the Swiss Army Knife, the smart phone isn’t a telephone
AND a camera AND a flashlight. The functions don’t all sit beside
each other waiting to be used. If that were the case, we would
need a briefcase just to carry the device around. The smartphone
is based on a hybrid strategy that combines the best of parallel
and serial multi-functionality into a new kind of tool. It offers the
same multiple choices as a Swiss Army Knife, but only serves
one function at a time. When we need a camera, it becomes a
camera. A flashlight? Click the app and so be it. One more click
and it will take our blood pressure.

The smartphone achieves this adaptive ability because it’s
conceived as a system of assets – microphone, lens, speaker,
gyroscope, light, and screen, to name a few, instead of a
collection of complete functional objects. App developers use
only the assets they need for the functionality they are creating.
For a camera, the assets are the light, the microphone and the
lens. For the telephone, they’re the microphone and the speaker.
The flashlight and the blood pressure gauge require only the light.
The underlying Central Processing Unit (CPU) binds these assets
together to provide the particular service we require. When we’re
done, the click of the big button at the bottom of the screen
releases the configuration until it’s needed again.

In a smartphone, functionality is a transitory coalescence of
selected assets, instead of a collection of fixed functional
features. The strategy is compact and efficient because the
assets are reused in different ways for different applications.
Although the camera, the flashlight, the blood pressure gauge,
and potentially a dozen more applications require a light source,
the smartphone only needs to have one in its arsenal of assets.
The same is true for the microphone, which is reused multiple times in apps that range from the telephone and the camera to something more exotic, like Soundhound, which identifies song names from samples of music. The result is a very efficient use of assets in a small physical footprint. Perhaps most importantly, and very much unlike the Swiss Army Knife, the assets can be continuously reconfigured into new functional configurations, limited only by our needs and the imagination of app developers. I call this a model of “distributed multi-functionality” and, as we all know from using our smartphones, it’s a revolutionary way to think about how objects are made.

House as Smartphone

How could this strategy be applied to architecture?

As I’ve previously mentioned, we were exploring the potential of mass customized construction when we started working with Mary and George. A large part of this investigation focused on improving the cost and scheduling of the millwork or built-in cabinetry that’s defined our housebrand interiors for many years. We were developing a system of standardized units that we could custom-assemble into a unique configuration, before permanently building that configuration into the layered construction of the house.

But what if, like furniture, the configuration was not fixed, but remained independent of the house and could be easily moved around the interior throughout the home’s existence? What if the house were designed so that the mass-produced cabinetry components retained the ability to be custom-configured and re-configured multiple times over the course of their lifespan? And if we used floor-to-ceiling wardrobes and bookcase-sized cabinet units to define the interior spaces, instead of fixed drywall walls, could we not reconfigure the spatial layout of the floor plan without undertaking a major renovation that’s destructive, time-consuming, and expensive?

In developing the adaptive floor plan for Mary and George, the answer to all of these questions became a resounding yes. The system that would become the core of Future Adaptive Building applies the smartphone’s model of distributed multi-functionality to residential design, so the interior layout of the home can be adapted to meet the changing functional needs of the resident.
Of course adaptable residential interiors are not new in the cannon of architecture. As I will discuss in the conclusion, a number of architects and theorists, particularly in the middle of the 20th century, were interested in flexible housing. None of their ideas achieved wide popularity, however, and the promise of a house that can be flexibly adapted to meet changing needs has largely gone unfulfilled. I think there is a better chance of success at this point. Recent developments in digital fabrication are rewriting the rules of production. User participation through mass customization is becoming more and more commonplace in everything from sports shoes to automobiles. Perhaps most importantly, smartphones and other 21st century disruptive technologies have opened up a cultural space in which adaptable homes may be perceived as more desirable by the public.

It’s interesting to note how the final plans of Mary and George’s house are quite similar to the serial renovations that I had first proposed. However, instead of using fixed stud and drywall walls, moveable storage cabinets create the spatial layout of the interior. These units are like big pieces of furniture. They are non-load bearing and don’t contain any of the house’s mechanical system. They sit on top of the finished floor and only temporarily connect to the surrounding walls and ceilings. As such, they can be easily reconfigured into a new spatial layout with a minimum of time, energy, and cost. The changes can be made with no demolition and little to no damage to the rest of the house.

Mary and George’s house can be configured to meet their current needs and then adapted to meet any of their anticipated future scenarios, and almost anything else that occurs in their life. The count of bedrooms can change according to the number of residents, and delineated spaces for uses like a home office, formal dining room, music room, and workshop can come and go as necessary. The couple can make all these adaptations, no matter how specific, without any concern about the long-term value of their home. When the time comes to sell, the buyers can simply reconfigure the house to meet their exact needs, all without a costly renovation.

This project was the first example of the FAB way of thinking. Instead of a house designed as a collection of fixed functions like the Swiss Army Knife, or a succession of re-constructions like the Lego model, it was designed as a system of physical assets...
that, like the smartphone, temporarily come together to meet a specific functional need.

It’s unfortunate that the project did not proceed to construction, but the lessons learned about using modular millwork to define residential space continues to infuse all of our projects since that time. On reflection, I also observe that the more generalized theory of distributed multi-functionality has become an important fifth foundational theme underlying the larger definition of FAB for aging-in-place.

Yi + Lilly

The next project that pushed forward our research into the development of Future Adaptive Building was a new home project for Yi, Lilly, and their three teenaged boys. This project had been in development for some time, and the concept design predated Mary and George and the adaptable interior research.

When Mary and George’s project ended unexpectedly, I was eager to carry the development of the system forward. I convinced Lilly that, even at this late stage in their project, we should incorporate the adaptable cabinets into the second floor of their home. In the end, it was not a difficult sell because it promised to solve an ongoing layout issue we had been having with the bedrooms.

The footprint for the house was quite restricted because of the size of the lot. I was finding it a challenge to design the second floor with four bedrooms plus a large yoga studio for Lilly. We had settled on a compromise solution that co-located a modest practice area in the master bedroom, behind a free-standing headboard. Lilly had really wanted a dedicated room and we agreed that this would only be a temporary measure because her eldest son would be leaving for university in five years, and she could move the studio into his old bedroom. The problem we hadn’t been able to solve was that Lilly wanted a larger yoga space than we could assign to any of the bedrooms in the current configuration of the plan.

I proposed to use the modular cabinetry system to define the three children’s bedrooms that were currently required and then successively open up these spaces as each child left for
university. In the end, this would result in a one-bedroom house with a large studio for Yi and Lilly to enjoy as they grew old.

In the first attempt, I simply replaced the existing closets with modular cabinets so that the two back bedrooms could be combined into a larger studio space. While this added some degree of flexibility and solved the original problem, the fourth bedroom was “spatially trapped” in between the two bathrooms. This organization prevented the space in that room from being incorporated into any sort of adaptive reconfiguration of the floorplan.

To maximize the reconfiguration options, I needed to integrate this fourth bedroom into the adaptive floor plan by rethinking the base building, or shell, of the house. In the final, built, version of the floor plan, I flipped the orientation of the master bedroom and bathroom so that the two fixed bathroom spaces were relocated to opposite corners of the plan. This increased the spatial flexibility of the front-facing fourth bedroom, as it was now defined by a modular storage closet shared with the master bedroom.

As the project neared the completion of construction, the hardwood floor had been installed continuously throughout the space and all of the walls and ceilings were painted with a finish coat. Shortly before substantial completion, the closet cabinets arrived and were installed on top of the finished floor and against the painted walls and ceiling.

We were all very pleased at how solid and permanent the modular closets appeared. The collective concern that the system would feel too flimsy and temporary for a bedroom wall proved unfounded. At the end of the project, I presented Yi and Lilly with a series of drawings that demonstrated how they could progressively reclaim the surplus bedroom space that resulted when each of their sons left home. When the time comes to sell the house, the cabinetry components can be easily reintroduced to reconstitute the second floor back into a series of bedrooms that would make the property more appealing to young families.
Fig. 34 Yi + Lilly Bedrooms with Moveable Cabinets
FAB is for Fabulous

Housebrand had purchased a piece of inner city property to build a 2900 sqft two storey house that we intended to use as a demonstration project for our adaptive modular interiors, as well as our new systems-based approach to construction. Having a dedicated show-home was a significant shift in our business model, as we had always relied on our office-cum-retail store as the “front door” for clients.

In the spirit of embracing the tactics of the normative housing industry, we decided that it was time to try out the production builder’s show-home marketing platform.

The purpose of a typical show-home is much like a pair of shoes displayed in a store; it illustrates to potential shoppers exactly what they will get. Our version was slightly different. Although we had radically changed the way our houses were being designed and constructed, we had not changed our commitment to offering our clients a process rather than a completed product. Our show-home needed to describe a set of ideas about design, building, and living, more than it needed to show the type of flooring we specify or the brand name of the appliances. We had learned from our success with the Tailored Home campaign that we needed to give this new process-as-product a name.

After much debate, we settled on Future Adaptive Building, or FAB, as the name for this new page in Housebrand’s history. The long form of the name spoke to our change-based strategy for the interior, while the initials alluded to the many pre-FAB systems we were using for construction.

We also liked the 1960s connotation of FAB as short for fabulous, an idea we used as the foundation for our first marketing campaign. We adopted this lifestyle-based strategy because we needed to start advertising our new direction before we had actually finished the show home and fully worked out all of the FAB details.
Fortunately, Yi and Lilly generously let us use their house to get the photographs we needed for our campaign. We produced six months’ worth of print advertising and a short lifestyle-based video, complete with a “family” of actors to describe how a FAB home made the daily activities of family life better.

The images and video were inspired by the revolutionary lifestyle photography campaigns that Ernie Braun created for Joseph Eichler’s mid-20th century dream homes. Braun was one of the first architectural photographers to use people in his images, often caught mid-flight in a quirkily composed tableau of idealized domestic bliss. 16

Following this precedent, we assembled our actors to create a series of tableaus of an idealized domestic routine. We included an ironic dimension in the video by occasionally turning the camera to reveal the presence of the film crew within the home.

Fig. 35 “It’s a FABulous Day” Print Ad

Fig. 36 “It’s a FABulous Day” Video stills
The FAB Concept House was completed and opened to the public in fall 2015. Using our new, systems-based construction techniques, the project’s construction took just seven-and-a-half months. This was significantly faster than our previous 14-18-month schedule, a timeframe common for most builder-grade custom home projects. To put this in context, an architecturally designed home in our city typically takes 24-30 months to build. With the time savings from our new system, we were starting to close in on the typical production-built house schedule of five months.

In addition to the time saving, we discovered that the quality of construction increased, our pricing stabilized, and we had fewer completion deficiencies and warranty issues. Since this first iteration, we now consistently construct our single family house projects in six months, with almost no deficiencies. We also confirmed that mass customization, and a systems approach to building that focuses on fabrication and assembly rather than on site-based construction, does not impede in any way our ability to custom design each house for both the client and the site.

To accommodate this new construction strategy, and to facilitate an adaptive floor plan, the Concept House was designed as two separate systems – a high-performance building shell, and an adaptive interior. Appended to the shell is a “technology chimney” running up the side of the house that contains all of the mechanical servicing.

The building shell starts with an exterior building envelope consisting of a prefabricated foundation system, prefabricated SIP walls, and a rain-screen cladding system. Also included in the FAB building shell is an interior armature of conventionally framed wood walls. This armature defines the bathroom spaces, plumbing walls, and other parts of the house that do not need to move in order for the plan layout to be adaptive. Including these fixed interior components into the building shell is a key feature.
of our system. We discovered that it’s not necessary, or even desirable, to start with a completely blank slate for the interior. This would be extremely expensive and unwieldy to design and build. We found that we can achieve high levels of adaptability with only key pieces of the floor plan designed to be modular and moveable. The rest can be conventionally built as part of the building shell, with no loss of future flexibility.

However, as we saw in Yi and Lilly’s house, this strategy does require that more careful consideration be given to the organization of those fixed elements in order to ensure maximum future flexibility. This includes, for example, the location of the bathrooms to maximize the amount of open space in the plan, and the placement of windows and doors to avoid conflict with future placements of the cabinetry components.

I’ll discuss the various strategies we’ve developed for designing the interior components of a FAB building shell in the next chapter.
Living Space Adaptability

The main floor of the Concept House is designed to accommodate several different spatial layouts. In a review of past projects conducted as part of my early PhD research, I realized that approximately one third of our clients requested a closed, private study on the main floor. Another third wanted a more open study space that retained some visual/spatial connection to the primary living area. The remaining third of our clients did not want a study or so-called “away room” of any kind on the main floor.

The Concept House can easily accommodate all of these options and more. The house is currently configured with an open study, partially enclosed by a set of glass sliding doors. To convert this into a private room, the doors would be removed and a series of floor to ceiling bookcase cabinetry components installed. The front hall closet unit would be relocated to the opposite side of the entryway in order to open up the doorway into the newly created room. Should the size of this private space need to be increased, perhaps to accommodate a growing home-based business, the bookcase components would be relocated to separate off a larger portion of the main living space. To convert the office space into an open living area, two or more of the bookcase components would be removed, creating a more formal sitting and dining space. Moving the bookcase components closer to the stairway changes the layout once more into a partially enclosed kitchen space adjacent to a large open living area.

To accommodate longer term flexibility, the kitchen cabinetry is detailed as a discrete set of elements in the middle of the space. When the cabinets have reached the end of their life, this arrangement allows the entire kitchen to be easily replaced and/or moved without damage or disruption to the rest of the house.

In the back entry, the house also accommodates a finer grain and shorter term type of adaptability. The open storage shelving is designed as a series of shelves, drawers, and hanging rods that clip into a series of concealed vertical stanchions. The system allows residents to easily adjust the layout to meet their evolving needs.
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Large Living, Dining, Kitchen + Office

Living, Dining, Kitchen + Home Office

Living, Dining + Eat-In Kitchen

Formal Living, Dining, Kitchen, Family Living

Fig. 39 FAB Concept House Main Floor Layout Options
Fig. 40 FAB Concept House Main Floor Interior
Fig. 41 FAB Concept House Closet Detail
Bedroom Adaptability

The upper floor of the Concept House is also designed to accommodate a variety of changing needs. In reviewing our past projects, I realized that 75 per cent of our clients required three bedrooms, 14 per cent needed only two bedrooms, seven per cent required four bedrooms, and four per cent wanted only one large bedroom, usually with a master ensuite of rooms and some other quasi-private living space such as a studio, music room, or study.

The Concept House is currently configured as a three-bedroom house with a separate dressing room for the master suite. It can be easily adjusted into four bedrooms by separating the dressing room from the master and opening up the doorway to corridor. In this configuration, the lost master closet space would be replaced with additional closet cabinetry units in the oversized master bedroom.

To create a two-bedroom house, the cabinetry between the two secondary bedrooms would be removed. This space could be used as a studio, an office, or a bedroom with a sitting space or walk-in dressing area. An alternate two-bedroom layout can be created by removing the dressing room cabinetry to create an extended living space that’s part of the master bedroom suite. The final option is to remove all the cabinet units defining the secondary spaces to create a one-bedroom home with a large flexible living space.
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Bed 2
Studio
Bed 2
Dressing
Bed 3
Master
Bed 4
2 Bedroom + Studio
Fig. 42 FAB Concept House Upper Floor Layout Options
4 Bedroom
Double Master + Dressing Room
Master 1
Master 2
Dressing
Bed 2
Studio
Bed 2
Master
1 Bedroom, Dressing + Studio
Dressing
Master

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Fig. 43 FAB Concept House Upper Floor Interior
Hail Clouds and Panda Facades

An interesting sideline to the genesis of the FAB interior is our development of a cladding system for the single family FAB house. In analyzing our past projects as part of my PhD research, I discovered a design bias for developing the exterior design of our homes as a series of tectonic volumes logically articulated with two-three materials.

In the spirit of assimilating the lessons of the mass housing industry, we decided to explore a new approach that is less complicated and expensive to execute, and had fewer completion deficiencies. Using the standardized concrete siding product favored by suburban developers, we flattened the exterior massing and developed a surface-oriented exterior finish system. This included the design of a new trim detail to more elegantly finish the siding around openings and corners. The result is a more standardized installation of the exterior finish that closely mimics the production industry standard in both time and cost.

To complement this “mass production model” of installation, we introduced a mass customization process for introducing a unique colour composition to the concrete siding.

In the FAB Concept House, for example, we developed a pattern-based surface using four shades of grey that we extracted from a photograph of a prairie summer hail cloud. One of these clouds was looming over the site the first time I visited the property, and it seemed appropriate to use this image as a starting point for the exterior finish design. One of our interns mapped the image over the elevations and used Grasshopper to distribute the colours over the facades. Bundles of siding were painted in each of the four colours and the installers followed a diagram to install the correct pattern.
In subsequent projects, we developed what we call Panda facades that use a graphic composition of free floating blocks of color on the exterior. Like the spots on a panda, these blocks of color are not tied to any sort of tectonic articulation of volumetric elements.

The Walker Residence, completed in 2016, is a hybrid of these two approaches. I first met the clients at one of our Saturday FAB open houses. While showing them through the house, I described the story of the hail cloud and thought that this rather conservative young couple would probably find this exterior finish strategy a bit too extreme. Interestingly, the first thing they mentioned when they began the design process was their plan for the exterior. They were both from a small town in the foothills of Southern Alberta and had a deep connection to the landscape. They brought a photo of a creek bed filled with smooth white stones dotted with hues of grey and brown. This, they proudly announced, was what they wanted us to use as the starting point for their home. It was interesting that this abstracted approach to composing the exterior of the project was not only of interest to this couple, but generated a higher level of client engagement in the exterior design than we typically experience.
Open House

The Concept House opened to the public in September 2015. A display area in the basement included wall posters describing the many advantages of FAB as well as the “FAB is for Fabulous” poster campaign. In the center of the space is a big model table containing large scale floor plans of the building shell. Visitors are encouraged to move the 3D printed model cabinetry components around the floor plans to experiment with new layouts.

In the first 10 months of weekend open-houses, more than 250 visitors toured the home, some even travelling from other cities. The reaction to a floor plan constructed with cabinets instead of framed walls has been extremely positive across all market segments. Young couples still dealing with the shock of having a new addition to the family appreciate the way the house can accommodate unknown future needs. Families with teenagers speak of the freedom to adjust the house as young adults and aging parents come and go. Most interestingly, we’ve had a large number of older couples at these open-houses. They see value in being able to tailor the home to their precise, non-child-based needs without jeopardizing long-term value.
The first of these age-in-place-centred projects was a new house for Akbar and Somi that could accommodate a future live-in suite for his father, Jack, who used a wheelchair. The couple is planning to retire in the next five years and want a moderately sized house with an open plan main floor containing kitchen, dining, and two seating areas – one with a large television. The upper floor is to have a large studio space and a master bedroom with dressing room and sitting area. The basement is to have an informal living area that could become, if necessary, a modest live-in suite for Jack, with its own separate entrance, kitchen, and bathroom. An elevator would connect the floors.

We started the project by searching for a piece of property. This was not an easy task. In our early discussions about the house, we’d concluded that we needed a front-back sloping lot that would allow on-grade access to the main floor at the front of the house and an on-grade entry to the basement from the back garden. At the same time, the back garden had to be relatively flat to provide wheelchair accessible passage from a rear detached garage to the basement entry. Akbar and Somi wanted to live on a quiet street and hoped to have a view. They’d also restricted the search to two 1970s suburban neighbourhoods that were just starting to see some redevelopment.

After five months of scouring the property market, we found the right site. The front faced onto a large park and there was a distant south-facing mountain view from the back. We completed a concept design and preliminary budget as part of the due diligence review to confirm that all of the couple’s needs could be included on the property, including both at-grade entries.

The new house has a C-shaped exterior shell that faces the back garden and creates two open but separate spaces on the main and lower floors. The exterior cladding was previously described as an example of a Panda façade. The two-colour exterior composition wraps around the corner, providing visual interest and scale to the exposed side elevation.

The main floor is currently configured as two living spaces on either side of the terrace. The kitchen is located at the front of the house, with a view of the park. The main floor layout can also adapt into several other living configurations, including a main floor study or a more formal separation of dining and living spaces.
PART I

1 Bedroom, Sitting + Studio

Open Family Room

4 Bedroom

Wheelchair Accessible Secondary Suite

Fig. 54 Akbar + Somi Upper Floor Options

Fig. 55 Akbar + Somi Lower Floor Options
The upper floor is equally flexible. It’s currently configured according to Akbar and Somi’s brief, with a large studio and master bedroom facing out to the view. Two bathrooms and a dressing room sitting area complete the plan. In the future, when the house is required to have more bedrooms, the layout can be easily modified into a three- or four-bedroom configuration.

The basement is currently finished as an informal living area. Should Jack ever need to move into the house, the floor plan can be easily adapted to include a bedroom and small kitchen.

The project is an interesting case study in adaptive multi-generational living. It is currently configured as a two-person house. Changes to the basement would create a live-in suite for an aging parent. In the future, this suite could be rented out to generate revenue after the couple has retired. It could also be used by a live-in caregiver to look after Akbar and Somi in the later stages of their lives. Alternatively, the couple could move downstairs and either have younger family members move into the main body of the home, or rent it out for additional income. Finally, the value of the property as a part of their estate is protected, because the house can be readily converted into a more normative family home when the time comes to sell.
Home Health

Few people want to admit their mortality, but everyone is going to die. For some, death comes quickly; for others, it’s a slow process of decline. A long-term strategy for aging-in-place has to involve more than just adding or subtracting bedrooms, an exercise studio, music room or home office. Aging well also requires additional levels of multi-functionality to help cope with a wide range of physical and cognitive changes that threaten health and limit the ability to live independently. Understandably, very few of our older clients have these items on their wish list for a new house. They sometimes use euphemisms such as “if I ever need a wheelchair,” or “should I ever get sick,” but even these are presented as insurance against a remotely possible event, like requesting a basement pump just in case there’s a flood.

Although I had co-led a research study on residential accessibility in 2008, my first substantive professional experience with this other side of age-in-place design didn’t occur until 2012. The W21C Research and Innovation Centre in the University of Calgary’s Cumming School of Medicine was embarking on a study into the future of home health, and invited me to participate as the sole representative from the “home” side of the equation.

Until then, my academic research had largely paralleled my professional interests, which included advancing the theoretical context of making and the everyday, architectural entrepreneurship and design advocacy, and critically interrogating the built results produced through housebrand. This collaboration with the medical school was something new and distinct. At the time, I considered it a pleasant distraction from professional life and something that I could integrate into my studio teaching.

The first expression of this medical collaboration was a 2013 Senior Master’s level architectural research studio. Dr. Peter Sargious, a chronic disease specialist, and a member of the W21C team, assisted in the studio. We have since become close collaborators in all of my home health research projects.

After designing age-in-place housing projects, the architecture students worked in groups to design modular stations that allowed medication management and medical therapies to be integrated into their residential units. In the spirit of evidence-based testing, we invited several retired members of the architecture faculty to try out the mock-ups and provide anecdotal evidence-based feedback to the student design teams. The studio was sponsored by a local residential construction firm, and the firm's president, Charron Ungar, participated in the studio. My goal was to bring medically based technical constraints and the realities of market rate multi-family development together with my interests in the domestic realm. We invited physicians and human factors researchers from W21C to participate in the final review, alongside members of the residential development industry.

I was struck by the difference in world-view between practitioners of medicine, who are very much driven by protocols of care based on rigorous evidence-based testing, and architects, who are much more intuitive, explorative, and open-ended in their thinking. Peter and I discussed how the process of clinical diagnosis is perhaps the closest he got in his practice to the type of lateral design thinking common to my profession. He thought that physicians could benefit from thinking a bit more like architects. From the other side, I found the rigour of continually evaluating a procedure or piece of equipment to see if things worked as expected to be quite refreshing.

It was during this project that my brother-in-law became ill and moved into our house. I have previously described how this experience brought home, so to speak, the significant impact that physical deterioration has on even a well-designed home, and also reset the course of my career.

Design Research Innovation Lab

The combination of working with the W21C researchers, completing the first collaborative studio with medicine, and coping with my brother’s illness made it very clear to me that architects needed to have a much stronger presence in the discussion of home health. Despite all the work being done by bio-medical engineers, computer scientists, nurses, gerontologists, and other medical specialists around aging-in-place, the potential of the built environment to contribute to this conversation is not being realized. The home is seen as little more than a receptacle for a series of devices and care regimes. On the flip side, by not...
considering the physical realities of old age, and the requirements for increasing levels of support and care, the design of the home can very quickly become an impediment to the pursuit of long-term well-being.

To address these deficiencies, I established the Home Health Design Research Innovation (DRI) Lab in 2014 as an interdisciplinary collaboration with the W21C’s Healthcare Human Factors and Simulation Laboratory and Ward of the Future in the Foothills Hospital. The broad intent of the 170sqm DRI Lab is to explore the architectural implications of home health. In the first iteration, we would concentrate on age-in-place design.

DRI Lab complements W21C’s acute care testing with a modular test-bed environment for the full-scale mocking up and testing of residential spaces. The Lab is located in close proximity to the faculty’s workshop for fabrication and prototype construction. It’s interesting to note that this collaboration marked a return to the place where I had fabricated my early furniture projects many years before.
Laneway House I

It was during the first six months of the lab’s operation that my brother-in-law passed away. Later that year, we started planning our second major design research project, investigating how to make traditional age-in-place design interventions such as grab-bars and accessible bathrooms less obtrusive and more pervasive.

In early 2015, I ran another senior architecture research studio with 12 students. Together we would design and build a small dwelling over the course of a semester. I chose a small laneway, or garden, house, as the building type for the project, simply because it would fit in the space of the DRI Lab and would give the students the opportunity to design and construct the building’s exterior as well as interior.

Laneway housing is an emerging house type in Calgary, envisioned as a way to increase the density and affordability of existing single family house neighbourhoods. A laneway house is a small second dwelling unit placed in the back yard of a single family house and typically rented out for additional income. Dr. Sargious and Mr. Ungar participated in the studio once again, along with other researchers from nursing and medicine.

The final result was a 420 sqft L-shaped home that accommodated multiple levels of physical disability. Our first plan was to design the house for wheelchair accessibility. As all architects know, this requires large open spaces throughout the house, including the bathroom, to provide turning room for the chair. During an early concept design review, Dr. David Hogan, a gerontologist and researcher who has since become an important participant in the DRI Lab, challenged that assumption. He cited studies indicating that only a small percentage of older adults who live independently use wheelchairs but that stability limitations requiring mobility aids such as walkers and canes are very common. The design strategy for this group is the opposite of that required for wheelchairs; to minimize open floor areas and keep architectural features such as walls, counters, and cabinets as close together as possible, so the resident can use them for stability assistance as they move through the space.

Fig. 59 Age-in-Place Laneway House I Exterior Render
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Fig. 60 Age-in-Place Laneway House I Plan + Mock-up
The studio took up the challenge of designing a house that could accommodate both cohorts of residents and developed several adaptive detail design solutions. One of these was an attached dining table adjacent to the kitchen whose location could be set far from the kitchen counter for wheelchair use or brought to within 24” of the work surface for someone requiring stability assistance.
The bathroom was another site where this dual design strategy worked well. It was conceived as a two-part configuration that located the bathroom sink and counter in an open hallway connecting the living area and bedroom. The toilet and shower were located behind two swing doors. When closed, these doors formed a support surface that minimized the open space in front of the sink and reduced the risk of injury from a fall. When the doors were in the open position, they created a fully private bathroom with the required floor space for turning a wheelchair. Removing the glass panel beside the toilet made the entire bathroom wheelchair-accessible.

We learned from home care nurses that the bathroom sink is a common location for providing medical and personal care support. With the double doors in the closed position, the more intimate and private components of the bathroom (toilet and shower) were hidden from view. Thus defined, the bathroom sink area is a more appropriate location for care support from nurses and family members.

Fig. 62 Age-in-Place Laneway House I Mock-up Bathroom + Plan Variations
The final design exploration in the bathroom was to replace the standard grab bars around the toilet and in the shower with a whimsically sculptural element that winds around the bathroom walls to provide required physical support, as well as storage for bath towels and a place for the toilet roll.

The team designed the lower cabinetry in the kitchen and bathroom to include a continuous grab-bar that visually integrates into the millwork and unobtrusively provides stability support as well as hand towel storage. Under-cabinet lighting connected to a motion detector was introduced to illuminate the pathway to the bathroom without requiring the resident to turn on the overhead lights and disrupt their night vision. Working with occupational therapists, the student team also developed multiple storage strategies that helped compensate for different levels of ability to reach and bend.

The construction of the laneway residence was finished in May 2015. With the studio complete and the students graduated, W21C researchers descended on the DRI Lab over the summer and fall to conduct an evidence-based evaluation of the functionality and desirability of the unit. Cohorts of older individuals, home health care professionals, and residential real estate professionals were asked to walk through the home wearing eye-tracking glasses and answer a series of questions. The eye tracking results were collected to correlate with the commentary in an effort to determine what a participant was looking at when he or she made a particular comment about the design.

Our design research and subsequent user evaluations focused on rethinking age-in-place design features for mobility and stability. We were satisfied with the results and the team was looking towards a second round of design and construction that incorporated the results of the testing.

At the same time, the fact that we had integrated these features into a purpose-built age-in-place laneway house started to garner significant interest from the media, local planning department, and civic politicians. The almost accidental choice of using the laneway house type as the site for our work had unexpectedly caught the public’s imagination and the project received a 2015 Mayor’s Urban Design Award for Housing Innovation. We were getting weekly requests for tours of our Laneway House.
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Fig. 64 Age-in-Place Laneway House I Integrated Grab bar Design Options

Fig. 65 Age-in-Place Laneway House I Student Build with Conventional Construction

Fig. 66 Age-in-Place Laneway House I Mock-up Kitchen with Integrated Grab bars
A Deeper Question

In the face of this sudden attention and the aftermath of personal grief, I had a professional crisis. Was this really the best that I could do? Did this project and the overall agenda of the DRI Lab honor the legacy of my brother-in-law? Designing more inconspicuous grab bars and a clever bathroom layout might have been valuable, but it also felt somewhat empty. How would this approach be any better than, or significantly different from, other instrumental approaches to age-in-place design? How did it connect with a career spent trying to infiltrate the normative housing industry and improve the quality of our domestic circumstance?

What started out as an exploration of interfaculty collaboration and an opportunity to have industry partners fund design-build studio projects was beginning to gather momentum and a life of its own. It was threatening to distract me from my primary interests, and the focus of my PhD research. I needed to find a deeper and more meaningful intersection between domestic architecture and healthy aging if I wished to continue my involvement with home health. The path forward came from a nursing colleague in our research collaborative, who pointed me to recent academic research in the Geography of Care. I will discuss this work in more detail in Chapter 5.

The World Health Organization defines health as “a state of complete physical, mental, and social well-being, and not merely the absence of disease or handicap.” Reading this statement for the first time gave me a sense of what was missing in my DRI Lab work. Like most architectural contributions to the aging-in-place field, our research to that point had focused on the more restrictive part of this definition, namely designing a house that could better help older individuals prevent harm and manage disease. I started to realize that this instrumental approach, although critically important, can sometimes obscure the larger and more aspirational goal of well-being in old age, as well as the potential role that architecture can play in helping to realize that goal.

Well-being is at the core of architecture’s social agenda and resonates deeply with my personal understanding of the value of good residential design. At a tangible level, the domestic environment enables well-being through the provision of shelter and security, functional efficiency, and a sustainable environmental footprint. At an intangible level, it also includes more qualitative aspects, such as well-proportioned space, natural light, good materials, and a strong relationship to the site. I have always aspired to incorporate these aspects of good design into our built work.

From the nursing literature, I began to understand how the intangible contribution to well-being that the home environment makes can extend beyond any of these physical characteristics. It also helped me see an underlying trajectory in my work that I had not realized before. This critical observation helped me to connect the world of housebrand with home health.

I realized that, for me, the process of design and construction is almost as meaningful as the artifact that results. I am interested in “building as a verb” as well as “building as a noun”; house as both process and product. It explains my enduring fascination with the affordance theory of design and my focus on the relationship between the person and his or her home.

The idea of “building as a verb” is the reason that the Firebowl has to be assembled before use. It’s why I spent so much time and energy creating a new business model for Housebrand that engages more people in the architectural design experience. It explains my attraction to the Slow Food movement, which values the gathering of the ingredients and the preparation of the meal at least as much as the final result. It explains why I created a design education and advocacy website based on the demonstration cooking shows of Julia Child and Jamie Oliver. It wasn’t that I wanted people to learn how to design their own kitchens as much as I wanted them to experience the power of design to connect them to their world in a more grounded way.

This realization opened a path to a more fundamental idea about architecture’s contribution to aging-in-place. Housebrand’s business model and the Slow Home Movement are about empowering people to take control of their domestic environment through the act of design. For the first 30 years of my career, I have focused on enabling individual agency in the face of the mass-produced housing industry.
In the same way, and with many of the same tools, I realized that I can also use design to help enable individual agency in the face of growing old – to help maintain an older individual’s ability to have some level of authority, autonomy, and control over his or her domestic setting and the acts of daily living.

By the middle of 2015, my professionally based research into Future Adaptive Building had begun to merge with my home health research.

Enabling Agency

According to Stephan Golant, the most pressing and ambitious demand that older people have “is to maintain as much normalcy as possible in their residential arrangements, even as they are afflicted with worsening chronic health conditions and debilitating declines in their physical and cognitive capabilities. This implies living in places where they experience overall pleasurable, hassle-free, memorable feelings and activities that have relevance to them; and where they feel both competent and in control – that is, they do not have to behave in personally objectionable ways or to unduly surrender mastery of their lives or environments to others.” 19 This notion of agency, of feeling both competent and in control, resonates with my interest in “building,” as a verb. It goes to the heart of architecture’s essential contribution to age-in-place design.

The results of the European based ENABLE-AGE Project support this theory about the importance of personal agency. Researchers conducted home interviews with over 1900 people, aged 75-89 years, living alone in their own homes, and used the concept of “healthy aging” to address selected aspects of physical, mental, and social health that were relevant to housing.20 The research indicates that having the agency to be in control plays a significant role in maintaining a sense of well-being and satisfaction with home.

“Concerning our main research aim, findings showed that very old participants living in accessible homes, who perceive their home as useful and meaningful on a behavioural level, and who think that others are not responsible for their housing situation are independent in daily activities, have better well-being, and suffer less from depressive samples in all five national samples… In other words, participants who perceive their homes as meaningful as a result of physical, social, or cognitive–emotional aspects tend to be more independent in daily activities, feel better in terms of environmental mastery, and—in some national samples—in terms of positive affect; they also suffer less from depressive symptoms and negative affect.” 21

Future Adaptive Building can help enable this kind of environmental mastery and individual agency for older individuals. First, with its modular system of cabinetry, FAB Modular converts residents into active co-producers by giving them control over the spatial layout and functional organization of their homes. Second, with its web-based design and operational control platform, FAB Studio empowers older individuals to take more control over the design and operation of their home and practice design as a meaningful activity of continual engagement with, and in, the world. Finally, as an integrative system of therapeutic and assistive modules, FAB+ reframes the more instrumental side of age-in-place design so that it also reinforces emotional well-being by unobtrusively providing the practical realities of mobility support and home health care only when and where necessary.

A New Idea

At the same time that I was formulating this expanded idea of FAB for aging-in-place, the Laneway House Project was continuing to gain momentum. During one of the many tours of the original mock-up, a visiting physician remarked that he would “love to be able to write a prescription for one of these homes.” This off-hand remark got me thinking about the nature of the project, particularly in light of the more comprehensive theory of wellness and enabling agency I was developing for FAB.

I started to consider the potential scenario of a portable version of the laneway house that could be leased to an older person or couple and temporarily located in the backyard of a family member’s property. When the unit was no longer needed, it would be picked up and redeployed to another location. This would amortize the upfront cost of building and outfitting the home with advanced medical capacity, across a large number of people. This would make it more affordable and also more
feasible for someone to live in the unit for a relatively short period of time.

Using the FAB strategy, the shell of the house could be mass-produced and the interior customized to each resident’s exact needs and medical requirements. The residents could use the FAB studio interface to configure their unit and operate all of the smart home features. The interior could be adapted to changing circumstance, including the introduction of FAB+ components as necessary. When the unit was redeployed to a new site for a new resident, the FAB modular components would go back into a common pool for future use in other deployments. I also envisioned how the physical units could be augmented, as required, with service components that could provide homecare, housekeeping, meals, and transportation.

I casually mentioned this idea to a city councillor who was visiting the DRI Lab for a tour of the first mock-up and the response was more than enthusiastic. The feedback from a series of meetings and presentations with health officials, city administrators, and the public in the fall of 2015 was equally promising. I decided to undertake a second version of the laneway house in another design/build architecture studio. We raised more philanthropic donations to fund the project, and started working with a new industry partner, DIRTT Environmental Solutions, a Calgary-based company with a global reach in supplying adaptable commercial interiors, generously donated all the material for the project, including the manufacturing of the cabinetry components.

Laneway House II

In January 2016, a second class of senior architecture students and I embarked on the design and construction of a prototype mockup for a portable, mass customized age-in-place residence that could be temporarily deployed into the backyard of most single family houses in Calgary. The project was an articulation of the age-in-place strategies I was developing for FAB, and was guided by the results from the evidence-based testing of the previous project.

The unit was a 12' x 40' rectangular structure with approximately 460 sqft of living space. It was prefabricated as two components to facilitate transportation. The units would be craned from a truck onto a level gravel bed, and connected together. A utility tether to the primary house would provide electrical, gas, water, and sewage service to the unit.
Fig 68 Age-in-Place Laneway House II Exterior Render
The interior of the residence was a variation of the first laneway house layout, with a double space bathroom separating the bedroom and living spaces. Sliding doors transformed the circulation zone in front of the bathroom vanity into a private bathroom space, replacing the double swing doors that were identified as problematic in the user evaluations of the previous home. The double-access configuration was also a safety feature in case the resident collapsed in the bathroom and obstructed one of the doors. A translucent glass sliding door separated the toilet and shower area from the bathroom sink and counter zone. As in the previous prototype, the bathroom became wheelchair-accessible when this door was removed.

A continuous wall of millwork was located along the back wall of the residence. A catalogue of 2 foot wide cabinet modules was designed, comprising a variety of different kitchen, closet, display, storage, and medical support options. Each resident could select components from this catalogue and custom-configure the cabinetry wall to reflect their exact needs. For example, someone who likes to cook might create a larger kitchen cabinetry zone. For someone who collects books, preference might be given to more bookshelves. The same decisions could be made about the proportion of space devoted to clothes storage and entertainment, as well as such things as pet stations and home offices.

All the cabinet modules hung off the back wall from a series of concealed horizontal supports. This allowed the units to be individually swapped out without disruption to the rest of the cabinetry as needs evolved, or physical and cognitive capacities changed. This adaptability also facilitated the easy transformation of storage units to accommodate limited functional capacity for reaching and bending, as well as making the kitchen wheelchair-accessible, when required.

We also developed a clip-on system of horizontal grab-bar supports that were integrated into all of the lower cabinetry units. This idea was developed in the first iteration of the Laneway House and received positive testing feedback. Our current grab-bar system is fabricated in two-foot increments to match the cabinet modules, and can be placed wherever the resident desires. As in the previous generation of the project, the bars visually integrate into the cabinetry and do double-duty as a dish cloth rod. When fully deployed along the length of the cabinetry wall, they provide continuous mobility support from the front door to the bedroom. The same grab-bars can be added anywhere in the rest of the house by clipping into a concealed horizontal support stanchion integrated into all of the wall surfaces.

A motorized sit/stand counter for the bathroom sink and vanity

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Fig. 69 Age-in-Place Laneway House II Floor Plan
Chapter 2: A New Beginning

ACCESSIBILITY

STORAGE

PERSONALIZATION

Fig. 70 Age-in-Place Laneway House II Modular Cabinet System + Configuration Options
allows continuous height customization to accommodate various functional disabilities. The glass-topped counter also includes a built-in touch screen that provides a permanent access point to the FAB studio system. This screen supplements the remote access available through smartphones and other portable devices. For home care professionals, the built-in screen allows secure access to data about the resident’s vital signs and electronic medical records, in the area of the house where most home care will probably occur. It’s also immediately adjacent to the nurse’s secure storage cabinet and medication dispenser.

The back wall of the bedroom is outfitted with dedicated special voltage electrical outlets, as well as oxygen, suction, and air, so that it can become, when necessary, a full medical headwall. Concealed storage spaces on either side of the bed accommodate a variety of different plug-in FAB+ cabinets. Each module is designed to support different medical technologies for a variety of chronic disease therapies. The sliding patio door in the bedroom provides a secondary emergency entrance to the unit and is sized to allow for easy stretcher access by emergency medical service responders.
The project was designed and built by the students using DIRTT Environmental System’s proprietary commercial interior wall system. It was interesting to note the difference between the two design/build experiences. In the first iteration, the project was built using conventional wood-frame construction techniques. The design was developed to a conceptual level and the students spent the majority of the semester working through the complexity and frustrations of layered residential construction. In the second studio, the students worked with a sophisticated mass-customization system of digital fabrication that required much more up-front detailed design work in order to provide the necessary instructions to the manufacturing plant. Near the end of the semester, all of the components arrived at the DRI lab on palettes and were quickly assembled by the students under the guidance of DIRTT’s installation manager.

The FABstudio system was not included in Laneway House II due to a combination of time constraints, resources, and the limitation of an appearance-only mockup. However, in collaboration with the medical consultants, the design team completed the conceptual design for the monitoring component of FABstudio that could be included in the residence. This included an extensive smart home app to enable the resident to program and control the various systems in the house. All of the appliances, mechanical, and technical systems would be monitored by this app and include algorithmic overrides for safety.

The house would also facilitate and collect comprehensive medical monitoring of vital signs data gathered through third-party devices. A weight scale built into the floor in front of the bathroom sink would check for rapid weight change as an early warning sign for heart failure. Sensors in the floor would monitor for changes in gait, as an early warning sign for stroke. A wearable device would monitor hydration levels as an early warning sign for general medical distress. Finally, movement sensors in the bed and chairs would identify undue changes in sleep patterns and activity routines, as early warning signs of emotional distress. These early warning monitors would act like the “check engine” light on a car, notifying residents and their health care team that something might be going wrong, potentially preventing a medical emergency.

Fig. 73 Age-in-Place Laneway House II Mock-up Bedroom with Integrated Grab bar + Medical Module
More recently, a computer science grad student has been hired to develop a beta version of the DESIGN app that residents would use to custom-design the interior of the unit.

Laneway House II was completed in April 2016 and a second round of user testing was immediately started. The full results of this expanded evidence-based evaluation will not be available until late fall, but preliminary findings from both the older adult and medical professional cohorts indicate positive reviews for both the project as a whole and individual functional components such as the bathroom layout and the grab-bar system.

The project generated even more public interest and media attention, and I am currently working on the third phase of the Laneway age-in-place project, which will involve the construction of a full working prototype unit. Calgary City Council unanimously approved a Notice of Motion directing its administration to facilitate an in-situ test of this prototype in early 2017. The goal is to conduct two trials in which older couples or individuals would live in the unit for a period of four or five months. The plan is to select test subjects with two different health profiles and place the unit in their family member’s backyards. It’s hoped that we can find test subjects living in different neighbourhood types in order to test the delivery and hookup process under different conditions. Ideally, one will be in an older community with rectangular lots and real lane access, and the other will be in a newer cul-de-sac suburb with pie-shaped lots and front drive access.
Fig. 75 Age-in-Place Laneway House II Student Build with Modular Construction + Moveable Cabinets
The goal of the in-situ study is to evaluate the residence from a variety of perspectives. First is the livability of the unit from the point-of-view of the resident. Second is the acceptability of an age-in-place laneway house option for both immediate neighbours as well as the community as a whole. Third is examining the impact of the secondary living unit on the family members living in the primary house. Finally we are interested in evaluating the medical functionality of the unit from the point-of-view of the resident’s health care team.

Following the two rounds of user testing, the prototype is scheduled to be relocated to the medical school for rigorous testing and calibration of the medical vital signs monitoring systems. I’m also working with several interdisciplinary biomedical engineering research teams to then utilize the prototype as a home health laboratory for beta testing of new age-in-place technologies.

Should the in-situ testing indicate general acceptance for the laneway house idea from the various groups as well as the City, I anticipate the next step to be a broader research study involving the deployment of multiple units, over a more extended period of time. This would examine the potential health effects of living in a purpose-built age-in-place unit located close to family. The study would compare the economic cost and health benefits of the laneway house to other housing options, including long-term care and hospitalization.

On reflection, I see that even though the approach and type of work I do in the DRI Lab is quite different from the way we normally work at Housebrand, the establishment of the DRI Lab was driven by the same interdisciplinary spirit that drove the creation of housebrand twenty years earlier. It’s a natural extension of my goal to rethink the role of the architect and the nature of his or her relationship to the public.

Although the Home Health DRI Lab is an arms-length academic research lab and not part of our private consulting practice, it extends the vertical integration of residential expertise that started with real estate, construction, interior design and retailing. The DRI lab now examines evidence-based research and includes collaboration with a range of healthcare practitioners and a new breed of sub-consultants, among them, computer visualization experts and biomedical engineers.

The Laneway House Project was the catalyst for integrating my university-based home health work into my broader practice-based research with housebrand. It opened the door to seeing...
age-in-place specialization as the next logical development of Future Adaptive Building. Although I believe that everyone’s life is filled with change and could benefit from a flexible house, the rate and type of change experienced throughout the various phases of growing old is particularly well-suited to FAB.

I’ve begun to conceptualize a more comprehensive definition of Future Adaptive building that leverages our past work in mass customization with our new knowledge and growing expertise in age-in-place detailing to produce an extended definition of age-in-place design thinking. This new formula addresses the broader challenges to, and promise of, aging well. I’ve learned from clients like George and Mary, as well as Akbar, Somi, and Jack, that there can be a great deal of functional turbulence in the early years of retirement, as both younger and older family members come and go, home offices may or may not be required, and new hobbies are pursued. The FAB modular system can facilitate most, if not all, of the functional changes that may be required, and, when all is said and done, can be easily reset into an appropriate functional layout for the next family to inhabit the home.

As time goes on, physical and cognitive challenges can emerge that make the routines of daily living much more difficult to manage. I’ve learned from the Laneway House research that these adaptations tend to be smaller and more detailed in scope. Although there may still be spatial changes required in these instances — for example, to make a bathroom wheelchair-accessible — the majority of the adaptations pertain to the nature of the millwork cabinetry rather than the cabinets’ location in space. We’re developing these FAB+ components to seamlessly integrate into the FABmodular system in order to accommodate functional disabilities in reaching and bending, make modifications to kitchen and bathroom counters for wheelchair use, and include grab-bar supports for stability issues. Much work remains to be done on the medical therapy side of FAB+ to accommodate deterioration in health from chronic disease and critical illness. The intention is for a suite of FAB+ medical modules to be developed that are integrated into the FABmodular system. They might delay, or perhaps even prevent, the need for a FAB home resident to go into long-term care.

Finally, and perhaps most critically, I’m working on the development of an integrated resident engagement strategy that will bring all the adaptive capacities of FAB+ together with the functional adaptability of FAB modular in a context that promotes individual agency and empowerment. Although the FABstudio platform is perhaps the most nebulous component of FAB, and contributes least to the tangible livability of the house, I believe that it has the potential to touch some of the most fundamental and important intangible conditions of well-being.

Conclusion

Part I has told the story of FAB as a narrative cross-section through my 30-year career in architecture. What began as furniture studies into the intersection of form, material, and poetic use evolved into a business model for bringing high-quality residential design to a broader segment of the market. From this emerged a design education advocacy platform, which then transformed into an interest in mass customization for construction. This evolved into a flexible design strategy for accommodating change that’s most recently merged with a parallel program of home health research to become an architecturally centered resilience support system for aging-in-place. As part of this narrative reflection, I identified a series of foundational themes in my work that have shaped the arc of my career and continue to influence my current work. Common to all these themes is my unwavering belief in the positive role that architects can play in helping people engage in the action of building, and participate in the process of visualizing themselves and their needs in the future.

In Part II of this book, I describe three subject-based cross-sections through Future Adaptive Building. They outline my non-project-based research, which contributed to the development of the three FAB systems. The first cross-section is a review of mass-customization theory and its contribution to the FAB Modular system. The second describes how theories of co-design and the pursuit of design as a hobby can shape the FAB Studio system. The final cross-section examines the geography of care and its contribution to the FAB+ system of medical support.
17. Clarke, “Wheelchair use among Community-Dwelling Older Adults,” 191-198
18. Oswald, “Relationships Between Housing and Healthy Aging in Very Old Age,” 97
20. Oswald, “Relationships Between Housing and Healthy Aging in Very Old Age,” 97
21. Ibid., 104
I believe that good architecture is the foundation on which aging-in-place begins.

Future Adaptive Building is a strategy for creating homes that help older individuals age-well and live independently for an extended period of time. FAB is based on an expanded definition of health that focuses on the pursuit of overall wellbeing, and not just the absence of disease. From my perspective as a residential architect, that means starting with a high quality domestic environment, expressed through the basic architectural building blocks of space, form, material, and light. Home is a place for the soul as well as the body.

And yet we cannot escape the reality of the body’s decline. With increasing age, our functional needs evolve, physical and cognitive capacities change, and health concerns develop. These changes in condition can be drastic, unexpected, and quick to appear. Functional, emotional, and physical accommodations are often needed to counteract these changes and extend the ability of an older person to remain living independently. Too often, however, these accommodations soon dominate the house, overwhelm its domestic functionality, and undermine the broader goal of health as wellbeing. Future Adaptive Building’s goal is to provide a comprehensive set of functional, emotional, and physical supports for aging-in-place that are pervasive but essentially invisible, delivering a tailored level of support without disrupting the essential qualities of home and the benefits of good architectural design.

Eyeglasses are a useful example for how to achieve this goal.

I suffer from Presbyopia, a medical condition most probably caused by a loss of power in the ciliary muscles. In Latin, the term means old eyes, and refers to the fact that I need to wear glasses to read. This only became apparent about five years ago, and I admit to having been excited by the prospect. It meant that I could finally join the club whose membership includes 70 per cent of the population – and I could go shopping for glasses. The architect in me had always harbored a secret penchant for those black round specs that Le Corbusier wore. Of course they looked ridiculous on me when I finally tried on a pair, but, with some searching, I eventually found eyeglasses that I thought suited my face, personality, and sense of myself. Like clothes and homes, glasses are part of our constructed self, of how we want others to regard us. This combination of vanity and self-imagination drives the $28 billion eyeglass industry.

Oh, yes -- and they also help us to see things more clearly. Whether we like to admit it or not, glasses are not just about vanity and self-perception. They are medical devices, sophisticated pieces of assistive technology that compensate for a specific and usually evolving physical disability. Imagine a world in which eyeglasses were only designed as pieces of medical equipment. The result would probably be a large clunky apparatus akin to the machine optometrists use to determine our correction. None of us would want to wear them, because they’d obscure our personality and telegraph our infirmity to the world. Fortunately,
eyeglasses aren’t like that. In fact, from the earliest history of their use in the 13th century, eyeglasses have been treated like clothes, as a physical artifact with both objective and subjective properties.

Eyeglasses are an indelible part of our daily life, not just our medical life. The type and style of glasses we choose to wear tells the world how we want to be seen. The fact that they also provide a medical assist is almost beside the point. Eyeglasses can range from being a big statement about who we are to making no statement whatsoever. The development of contact lenses in the late 20th century offered the option of making the medical assist seem to disappear. Contact lenses allow us to decide if, or even when, we want to telegraph the fact that we have a deficiency in our vision. While this makes no difference to me, I know a number of people for whom this is a significant issue.

Houses are a lot like glasses.

Houses do more than just keep us warm, dry, and safe. If that were not the case, we’d all be living in identical grey boxes. The choices we make about how, and where, we live tell a story about who we are and what we value. Style, interior finishes, organization, and housing type all project, to both ourselves and the world, a sense of who we are, and aspire to be. The subjective value of this form of self-expression is no less important just because we’re old or ill. In fact, as we get older, the discursive value of our home probably increases, as other components of self-description, such as employment and hobbies, recede.

Older individuals are just as interested in finding a pair of eyeglasses that suits their face, their personality, and their sense of self as someone in their 20s, 30s, 40s, or 50s. The same desire for self-expression holds true for their homes. The functional, emotional, and physical supports required for aging-in-place should exist within the essential domestic qualities of the home in the same way that the corrective lens exists within the stylistic expression of the eyeglass frame.

With eyesight, we use the term “prescription” to describe the corrective adjustment that the optometrist makes to the lens to help us to see properly. For growing old, I use the term “resilience” to describe the adjustments required to be made to our houses to help us to properly age-in-place.

**Resilience**

Resilience describes FAB’s operational agenda. In the book’s introduction, I proposed resilience as a measure of a system’s capacity to adapt to stress and showed how Future Adaptive Building helps to increase our resilience to the challenges of growing old by adjusting the domestic environment to better fit the ability of the individual.

Resilience theory emerged in the 1970s as a way to describe how dynamic and complex ecological systems maintain stability. C.S. Holling coined the term to describe the persistence of relationships within a system and the ability of the system to absorb change. A resilient system is able to recover, to revert back to its original state of stability, following some sort of shock. Holling also argued that resilience can involve the shift to alternative or multiple states of equilibrium in order to establish a new kind of stability.

Resilience is an integral component of ecological thinking, and in the 1970s and 80s, the environmental psychologist M. Powell Lawton applied the ecological approach to the issue of aging, defining it as a complex interaction, and continual adaptation, between the person and his or her environment. Lawton describes this relationship in terms of Person-Environment (P-E) Fit. Research indicates that a close degree of Person-Environment Fit better aligns with health and well-being than a consideration of just the person or the environment alone. In more recent iterations of the ecological theory of aging, “the term transaction has been suggested to underscore the notion that person and environment are hard to separate from each other and that the view of an ongoing process of mutual interchange may best reflect the everyday world.”

The ecological theory of aging suggests that the demands (press) of the environment should be adjusted to match the individual physical and cognitive capacity (competence) of the older individual. This thinking has driven much of the research and
practical implementation of accessibility standards over the past three decades. It’s also been criticized for over-characterizing the individual as a passive receiver of the environment, instead of an active participant and engaged contributor.

To address this shortcoming, contemporary researchers have added “usability” as an additional factor in the Person-Environment Fit model. Usability focuses on the user’s perception of his/her individual functionality within the environment, across physical, social, and psychological levels. 27

Accessibility is about adjusting the physical relationship between the person and his or her environment. Accessibility modifications are quantitative and tangible, and include such things as ergonomic standards for functional reach, lighting and material contrast standards for vision, and minimum dimensions for wheelchair accessibility.

Usability modifications are more qualitative and intangible, helping to ensure that an older individual’s broader needs, desires, and goals are met. Examples of usability include bench gardens that enable people to pursue their hobbies without the physical stress of bending down, or a simplified computer interface with fewer controls and larger buttons that enables older individuals to communicate with loved ones.

I use the twin concepts of accessibility and usability to help describe the three types of resilience – functional, emotional, and physical -- that Future Adaptive Building builds in the lives of older individuals.

Functional resilience is the ability of an older person to cope with the changes in lifestyle and functional needs that develop as we age. These include changes in the size and number of bedrooms, the layout of bathrooms, and the configuration of the living spaces. FABmodular helps build functional resilience for the aging resident with a system of adaptable cabinet components that can be adjusted to meet these changing needs. Through the idea of “building-as-a-noun,” FABmodular increases the accessibility and usability of the home as a pathway to well-being.

Emotional resilience is the ability of an older person to maintain a healthy sense of agency, self-regard, and life purpose. FABstudio helps build emotional resilience with a digital platform that empowers the aging resident to co-design and manage his or her home and potentially engage in the communal activity of design as a hobby. Through “building-as-a-verb,” FABstudio increases the usability of the home to help ensure well-being.

Physical resilience is the ability of an older person to manage the stresses associated with physical and cognitive decline, chronic disease, and critical illness. FAB+ helps build physical resilience for the aging resident with a comprehensive suite of physical and cognitive support systems and healthcare modules that can be seamlessly added into the FABmodular layout if, and when, they become necessary. Through “building-as-a-noun,” FAB+ increases the accessibility of the home and bolsters the health of the individual to help maintain overall well-being.

In the following three chapters, I describe the theoretical investigations that led to the development of FABmodular, FABstudio, and FAB+. I outline the ways in which each, in its own way, contributes to building forms of resilience that can help older individuals to age-in-place without disrupting the essential domestic qualities of home.

22. Swanson, “Meet the Four-Eyed, Eight-Tentacled Monopoly That is Making Your Glasses So Expensive”
24. Ekerdt, The Encyclopaedia of Aging,” 4045
25. Oswald, “Relationships Between Housing and Healthy Aging in Very Old Age,” 105
27. Wahl, “Aging Well and the Environment” 306-316
Chapter 3
FABmodular

Managing Change

Change is a fact of life. The way we live one day can change dramatically the next. This is particularly true in the later stages of life, when changes in our functional needs can become dramatic, rapid, and unexpected. For the young-old, who are transitioning out of an active career and may have adult children or aging parents living with them, this is a time of lifestyle upheaval. The functional requirements of their homes often shift as a new balance is sought between post-retirement work, new hobbies, and family commitments. For the middle-old, who are probably spending more time at home and may be experiencing new levels of physical and cognitive challenge, functional changes can result from their refocusing on a smaller range of domestic activities, pursuing more entertainment at home, and needing to make new allowances for mobility limitations. For the oldest-old, functional changes vary widely, and can include the need for wheelchair accessibility, increasing assistance with the essential activities of daily living, and higher levels of health care.

FABmodular helps the resident to better cope with these changing needs through an interior construction system that’s built for customization and change. The system provides a simple and inexpensive way to modify the functional layout of the owner’s home without undue cost, disruption, or even much damage. FABmodular helps the resident to increase their functional resilience and better cope with the stresses of growing old, helping them to maintain a sense of well-being and age-in-place for as long as possible.

In this chapter, I outline the theoretical framework of FABmodular and its relationship to the traditions of residential construction. The framework complements the practice-based development of FABmodular within housebrand that I have previously described. I begin with a review of the two traditions of custom and mass production and then describe how the recent development of mass customization provides an effective strategy for creating adaptive houses. I conclude by describing the design parameters for the FABmodular system and a case study deployment of the FABmodular system in a high rise apartment building marketed to seniors.

Functional Resilience
Performance Objectives

Functional resilience is the ability of a person and his or her home to adjust to changes in functional circumstance. These include changes to the composition of the household, in lifestyle, and in physical and cognitive capacity. Most of these changes have spatial implications that affect the layout of the house. There are two performance objectives that enable functional resilience. The first is initial customization, or the ability of the home’s floor plan to be custom-designed at the time of move-in to meet the current functional needs of the resident. The second is continuous adaptability, or the ability of the home’s floor plan to be changed in the future as functional needs evolve. Both of the performance objectives are about the physical nature of the home and engage the idea of ‘building as a noun.’
Custom vs Tract Houses

It should be clear from the housebrand project examples in Part I that a custom-designed home meets the first age-in-place performance objective of initial customization. Creating a home that fits your life like a glove is the raison d’être of custom design. For older individuals, this functional fit includes lifestyle needs plus any specific accommodations that may be required for physical and cognitive challenges or chronic health concerns. These could include, for example, having a wheelchair-accessible bathroom, a bedroom large enough to accommodate significant medical care, or waist-height storage cabinets for someone who has difficulty bending down or reaching up.

The same degree of malleability cannot be claimed for tract houses, where residents have no substantive involvement in the design of their homes. Tract houses are where most of us live. They can be any size, cost, or type, ranging from single family houses to townhouses, low-rise or high-rise apartments. The defining characteristic of a tract house is that it’s based on a limited set of standardized floor plans, generated from a generic program of resident needs. Like buying an off-the-rack piece of clothing, the resident’s involvement in the design of a tract house is reduced to shopping for it. We “try on” different houses until we find one that sort-of fits and make the best of a mediocre situation. As with clothes, if we’re fortunate to have a profile that’s similar to the one that was used to create the mass-produced options in front of us, then we probably won’t have much trouble finding a home that works.

However, if our needs fall even slightly outside of the marketing standards used by homebuilders and developers, the probability is small of our finding a well-fitting house. For older individuals with more specific needs and who require some form of age-related accommodation, the situation becomes almost impossible. Therefore, in the vast majority of cases, standardized tract houses fail to meet the first age-in-place performance objective of initial customization. As a result, these homes can reduce an older resident’s resilience to the stresses of functional change. A sudden change in health or lifestyle can suddenly make it difficult or even dangerous for an older person to continue to live in a tract house.

It’s important to note that neither custom-designed nor tract-built houses meet the second performance objective of continuous adaptability. Both are conventionally constructed with permanently fixed interior walls and cabinets that are expensive and time-consuming to renovate. While custom designed houses allow for initial customization, they’re not easily adapted to meet future needs.

Despite the fact that tract houses fail to provide either initial customization or continuous adaptability, the majority of older individuals live in tract houses for the same reason almost everyone else does -- affordability and ease. Builders and developers trade off a diversity of choice with a standardization of product in order to minimize costs and maximize efficiency. Despite my best efforts over the past 20 years with Housebrand, custom-designed homes are too expensive and the process too difficult for most people to contemplate. For older individuals on a fixed income, this choice is even more unlikely.

The tension between the flexibility of the custom-designed home and the affordability of the standardized track house is nothing new. It’s also not limited to the housing market, but part of a much broader cultural trend that has dominated the 20th century.

Craft vs Mass Production

Throughout most of human history, almost all of our cultural objects, including houses, have been made by craftspeople. “Everything was crafted by the hands of someone who had the requisite material, tools, and most important, skills. Craftsmen were also called artisans and their skill (or know-how) in turning raw materials into finished goods was not only an art but a source of pride.” 28

The Industrial Revolution introduced the use of machines and mechanization into the production process and caused the simultaneous development of two types of production - Craft
and Mass Production. Craft production is based on “the idea that machines and processes could augment the craftsman’s skill, allowing the worker to embody his or her knowledge in ever more varied products; the more flexible the machine, the more widely applicable the process, the more it expanded the craftsman’s capacity for creative expression.”

Mass production, on the other hand, uses the machine to replace human skill. It reduces the complex skills of a craftsman into a series of individual machine operations on an assembly line in order to drastically reduce production costs. “These two paths can be seen today in the different management systems that produce a Rolls Royce and a Chevrolet; a Tiffany Lamp and a Wickes Lamp; a Paris designer original and an off-the-rack dress from T.J. Maxx; and a five-course meal at a five-star restaurant and a cheeseburger and fries at McDonald’s.”

To that list of opposites I add the different philosophies that produce a custom-design home and a standardized tract house.

All of these examples are part of a broader story of late 19th and 20th century innovation that saw the automobile, clothing, consumer goods, food industries and housing replace craft production, where skilled artisans create a small number of high-quality goods, with mass production, where relatively unskilled labour creates a large volume of affordable products. The prime example of this change is Henry Ford’s transformation of the automobile from an exclusive and expensive craft-produced vehicle into the Model T, which even his factory workers were purportedly able to afford.

“When Ford’s engineers introduced the assembly line to Model T production in October 1913, the amount of labor time spent making a single car dropped from 12 hours and 8 minutes to 2 hours and 35 minutes. Six months later, Model T’s could roll off the assembly line at the rate of 1,000 a day, with the average labor time dropping to just over an hour and a half.”

In 1908, a Model T cost $850 and Ford sold just under 6,000 units. By 1916, that sales number had risen to over 575,000, allowing the price to drop 57 per cent, to $360. The famous trade-off, of course, was that you could have your Model T in any colour you wanted, as long as it was black.

In housing, the paradigmatic founding story of mass production is William Levitt’s post-war transformation of a craft-based industry of artisan builders into a production line process. Up until 1945 the number of new homes built in North America averaged fewer than 100,000 a year. Before Levitt, “the American housing industry was not so much an industry as a loose affiliation of local builders, any one of whom completed an average of four houses a year. What Levitt had in mind was 30 to 40 a day.” As Alfred Levitt said, “As in your car, the parts in a Levitt house are standardized; each part will fit any house of the same model... the Levitt factory ... is the land on which we assemble our house.”

Levittown, Pennsylvania was ultimately built out at 17,400 separate houses with 82,000 residents. It was the largest housing development ever completed by a single builder. “The early Levitt house was as critical to post World War II suburban development as the Model T had been to the automobile. In each case, the actual design features were less important than the fact that they were mass-produced and thus priced within the reach of the middle class family.” According to New York Times architecture critic Paul Goldberger, “Levittown houses were social creations more than architectural ones – they turned the detached single-family house from a distant dream to a real possibility for thousands of middle-class American families.”

“Before the war, one-third of all houses were built by their owners. Small contractors, who averaged fewer than five houses a year, built another third. By the late 1950s, about two thirds of the new houses in the United States were produced by large builders. Leading the post-war housing efforts were large developer-builders who could hand the government paperwork, achieve economies of scale, and undersell small builders. They totally reorganized the industry.”

The shift from an industry originally based on craft-produced homes to one based on mass produced housing was not about materials, design features, or even the manufacturing process. Houses have never been built in a factory by big machines run by an unskilled labor force. In fact, even today, production built houses are constructed in much the same way as one-off custom houses are made; site-built by teams of sub-
contractors. Instead, the shift is one of mindset and management priorities. Like all other industries that converted to a mass production paradigm, the housing industry made a deal with its customer - to accept standardization in return for affordability.  

Mass Customization

Mass customization emerged in the 1990s with the promise to erase the longstanding schism between craft and mass production. Joseph Pines, author of one of the seminal texts on mass customization, describes it as the “mass production of individually customized goods and services.”

“Now, at the beginning of the 21st century, we’re moving into the next major shift in consumption: from mass produced to totally customized. This seismic movement toward custom everything is, in many ways, the pendulum swinging back to the way we used to live. By moving from pre-made to made-to-order, we’re eating fresher and less-processed food, we’re living with goods (furniture, cars, homes) that are customized to our needs and styles and we’re wearing clothes that fit our styles and bodies perfectly because they were made for us.”

Whereas in mass production, the goal is to use the standardization of products to increase volume and reduce costs, in mass customization, the goal of creating affordable products remains the same, but with the addition of more customization and variety in the product offering. “In Mass Production, low costs are achieved primarily through economies of Scale – lower unit costs of a single product or service through greater output and faster throughput of the production process. In Mass Customization, low costs are achieved primarily through economies of Scope – the application of a single process to produce a greater variety of products and services more cheaply and more quickly.”

“One of the results of mass customization is that it can become profitable to supply smaller markets, such as the demographic made up of older individuals. In the past, age-in-place housing formed part of what marketers call the “long tail” of consumers who’ve been historically ignored by production builders. To reduce risk and maximize economic return, homebuilders and developers, like all other industries based on a mass production model, focus on satisfying the needs of the large homogenous group of consumers in the middle of the market. They abandon the niche markets as unprofitable, concentrating instead on the more stable market in the big, juicy centre of the graph. Those on the margins usually end up having to make do with a house that only sort-of fits their needs.”

Mass customization rewrites this historic condition by enabling homes targeted at smaller market segments, such as age-in-place houses, to be designed and built at the same price as the standardized models. To better understand the broad concept of mass customization and how it’s able to achieve this feat, I review in the following section several non-residential examples.
Cereal, Shoes, Trucks, and Homes

A good example of the shift to mass customization is in the area of breakfast cereals, one of the flagships of 20th century mass production. In 2007 a trio of young Germans launched mymuesli.com, a website “offering consumers the ability to design their own breakfast cereals – mixing and matching all sorts of oats, nuts, dried fruit, and flakes – and then the company would make the cereal, put it in cool tubular boxes and send them to consumers’ doorsteps.” Every cereal order is uniquely tailored to each customer with no change in production cost. The company now ships its mass-customized breakfast cereal to five European countries and has two production facilities employing more than 100 people.

Nikeid is an on-line service launched in 2012 by sportswear giant Nike that allows its customers to design many different products. For example, customers can design a completely unique sports shoe for themselves by choosing from multiple options for 11 different customizable shoe parts: base, vamp, tip, swoosh (logo), foxing, collar/lining, lace, midsole, outsole, tongue logo, and medial ID, as well as more than 18 different colour combinations. As of September 13, 2016, Nike listed more than 82 different material and option choices. The company makes each pair of shoes to order and delivers them in about five weeks.

On a completely different scale, Scania, a Swedish based heavy truck and bus manufacturer, has become a global leader, due, in part, to its focus on mass customization. Scania focuses on component sharing between truck and bus designs so that more than 85 per cent of chassis component types can be shared across multiple platforms. This concentration on component-based design allows the company to create highly customized one-off products at a very competitive price.

In the realm of housing, Blu Homes of Northern California offers a mass customized home made up of a series of prefabricated house modules with various customization options. Customers use a tablet based app to customize the design of their home in an immersive 3D digital environment. As of September 13, 2016, 2,304 possible combinations using 16 base homes, 116 different layouts, and multiple detail choices for siding and roofing, exterior additions, kitchens, living spaces, bedrooms, and bathrooms. Although Blu Homes does not, as of yet, include any specific age-in-place options, there’s nothing in their mass customization process that would preclude them, or anyone else, from easily doing so.

Blu Homes demonstrates the potential of mass customization to bring a fairly high degree of functional fit to the tract home segment of the housing market. Like conventional craft-based custom homes, a mass customized house like this could meet the first age-in-place performance objective of initial customization. This represents a major step forward in the evolution of residential development, particularly when mass customization strategies are adopted by mainstream homebuilding companies that have the volume to take substantive advantage of the economies of scale.

However, prefabricated mass customized homes are still built with conventional fixed interior layouts, just like their custom designed and mass produced, or tract-built, cousins. They fulfill only the first performance objective of initial customization. None of these options meets the second performance objective of continuous adaptability. The only way to accommodate future change in custom, mass produced, or mass customized housing is to undertake a costly and time intensive renovation, or move to another house. Neither of these is a particularly acceptable option for older individuals because of the stress and upset that inevitably occurs.

There’s also nothing inherent in the broader history of mass customization that addresses the notion of future change. Mass customization emerged from the world of objects, not buildings, and most of the things we use on a day-to-day basis don’t need to change substantively over their lifetime. While we may highly value the ability to choose the exact composition of our breakfast cereal, we most likely won’t have a need to remix it halfway through the bag. We value the visual and performance customization of our sports shoes, but we probably don’t need them to change mid-season. Small consumer goods like these don’t need to be adaptable after they are purchased. Our cereal will be consumed before our breakfast preferences alter. Our sport shoes will wear out before our feet start to change. A Scania truck is anything but small and typically lasts a long time. Once configured to a specific performance specification, the
mass produced modules are irrevocably joined together as part of the built-to-order fabrication process. But this is rarely an issue because the probability for any sort of change beyond a typical maintenance schedule is rather slim.

As I demonstrated in the previous chapter, an age-in-place house is different. It has to be built for change. The initial custom-designed layout, however well-fitted, is only the beginning of a process of adaptation and adjustment to a variety of evolving functional needs. This could include, for example, an adult child returning to live at home, requiring the need for an additional bedroom; closing down a home based consulting practice and repurposing the now unused space on the main floor; or a resident’s fall that suddenly restricts mobility or even requires complete wheelchair accessibility. To achieve the second performance objective of continuous adaptability, the age-in-place home requires a systems-based design approach that can effectively manage unanticipated, and unpredictable, change.

Fortunately, there is a precedent for this kind of system in mass customization. Track-lighting systems are literally built around the twin ideas of initial customization and continuous adaptability.

Mass Customized Track-lighting

Lighting manufacturers use mass customization to offer highly individualized track light solutions at an affordable price. In a track-light system, all of the components are mass produced and installed as a single product. But each installation is a customized selection of mass produced pieces that are combined together at the point of sale. The result is a system composed of a limited number of modular components, each with a discrete level of built-in customization that can be configured into a wide variety of end products. “Economies of scale are gained through the components rather than the products; economies of scope are gained by using the modular components over and over in different products; and customization is gained by the myriad of products that can be configured.” 47

Track-light systems are also designed for continuous adaptability. Add a new piece of art on the wall and we simply purchase an additional track head for extra illumination. Move the furniture in the living room and it only takes a few minutes to adjust the location and directionality of the heads. We can even add new lengths of track to a different part of the house and reuse some of the heads we already own without any damage to the system or the house. It’s interesting to note that track lights were originally designed for flexibility, rather than for mass customization. The first system was introduced in the 1960s, several decades before mass customization theory arose. It was a fortunate convergence that the modular design that provides the flexibility for long-term use also affords the magic combination of a custom-designed light fixture with the cost efficiencies of mass production.

Track-lighting and Bus Modularity

It’s interesting to note that with track-lighting, the design and assembly process used for the initial configuration is also used to enable all subsequent modifications. That’s because track-lighting is based on the “bus modularity” typology of mass customization. In bus modularity, there’s a standard structure, or ‘bus’ (track), on which are attached different kinds of modular components (light fixtures).

“Bus” is a technical term that comes from the electronics industry and is the technical name given to the armature in a computer through which information is transferred, and into which various components are plugged. I find it easier to remember if I think of a school bus, which is really nothing more than an armature of seats in which an infinite variety of children (modular components) can travel to and from school each day.

“The key to using bus modularity is of course the existence of a bus. If your product or service has a definite standard but changeable structure, think about breaking it up, first, defining the product architecture or service infrastructure that is really required for each customer, and second, modularizing everything else into the components that can be plugged into that standard structure.” 48

Bus modularity systems naturally lend themselves to continuous adaptability because the modular components retain their independence after installation. As long as the connections to the bus are properly detailed, the modules can be moved around,
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Exchanged, substituted, or replaced with no damage and for very little cost. The bus modularity strategy behind the flexibility of track-light systems drove the development of FABmodular.

Bus Modularity and FABmodular

FABmodular uses the bus modularity typology of mass customization to meet both the initial customization and continuous adaptability performance objectives for age-in-place functional resilience. In a FAB house, the bus is the base building comprised of the exterior walls, the fixed service components such as bathrooms and mechanical service chases, and any permanent interior partitions. The modular components are the mass produced cabinets that define the rest of the interior layout and provide all of the different types of storage required by the resident.

As with the track light precedent, the process of deploying the cabinets to create the initial custom design of the house is the same that’s used each time a functional adaptation is required in the future. In existing buildings, each new resident is simply the start of another cycle of adaptation in the life of the house. Bus modularity provides these benefits without jeopardizing the speed and cost-effectiveness of mass production building practices. In the language of Pine, economies of scale are achieved through the mass production of the cabinet components rather than the house itself (like the tract house), and economies of scope are gained by repeatedly deploying the modular cabinet components over and over again in different houses and housing projects.

With the FABmodular system, each new older resident can initially customize the functional layout of their home at the time they move in, thereby taking advantage of the first strategy for increasing functional resilience. Second, the resident can easily, and for very little cost, adapt the layout to accommodate any functional changes that might unexpectedly develop during their tenure in the home. This helps them to take advantage of the second strategy for building functional resilience. Finally, no matter how eccentric and individualized the required functional adaptations may turn out to be, the future value of the home is preserved because the next resident can simply and easily reset the layout to his or her own needs.

Modular Cabinetry

Cabinetry may, at first glance, seem like an odd choice for the modules in a mass customized housing system. If the primary goal of the components is to define space, why aren’t the modules spatial, either as an entire living unit or a room within the unit? There are two reasons that whole-unit or whole-room modules won’t work as mass customized modules. The first is the cost and complexity of the module. Mass producing sufficient quantities of complete housing units with enough design variation to provide meaningful choice for the resident would be prohibitively expensive and very risky for the developer. Second, the size of the module precludes continuous adaptability. It’s hard to imagine a situation in which a complete residential unit could be feasibly and cost-effectively removed and replaced to meet changing needs.

To be effective, the modular components must be modest in size and weight so that they can be readily transported and easily handled on the building site. They need to be sufficiently standardized so that they can be mass produced in large enough quantities to be economically viable. The modules also need to be easily adjustable or replaceable to accommodate future change. To be practically viable and achieve wide acceptance, they should also match, as closely as possible, the levels of complexity and trade practice found on a typical residential jobsite. Finally, they need to be large enough to define space and delineate room layouts.

The FABmodular system of moveable cabinetry fulfills all of these objectives. The individual cabinet modules can be delivered in a typical cargo truck, easily transported by elevator or stair, and set into place by a small group of workers. Cabinet manufacturing is already standardized, and there are well-established options for cost-effective cut-to-fit mass customization of the individual components.

Kitchen and bathroom cabinetry and built-in shelving are also a well-established and longstanding component of houses at all scales and types. Builders, owners, financiers, and other sub-trades understand how cabinetry fits into the residential construction process.
However, there remains one big difference between the FABmodular system of cabinets and the cabinetry currently found in every other home. In the latter, and as we would expect, the cabinets provide the affordance of storage. The type and nature of the storage is dependent on their location in the plan. The kitchen cabinets hold dishes and food; the bathroom vanity store toothpaste, hairbrushes, and towels; in the study bookcase there are books and household papers; in the living room entertainment centre, perhaps a TV and a collection of family treasures; and in the dining room sideboard, there’s grandmother’s best table cloth and our mother’s wedding dishes. In most European homes, where built-in closets are rare, there are also wardrobes in all of the bedrooms for the storage of clothes.

With the FABmodular system, the various cabinet components afford all of these different storage needs. At the same time, they must also afford the spatial enclosure for most of rooms. Replacing the permanent interior walls with large-scale moveable cabinetry is the only way to achieve the floor plan flexibility necessary for the age-in-place performance objectives of initial customization and continuous adaptability. Instead of the cabinetry sitting in front of a permanent drywall partition separating one room from another, the cabinetry IS the spatial separation that creates the two spaces.

In the story of Mary and George’s house, I described these space-defining closet cabinets as a form of distributed multi-functionality. I argued that the smartphone was a key precedent in making this breakthrough and I now return to it once again.

FABmodular and the Smartphone

Interestingly, a smartphone is also based on the bus modularity framework for mass customization. In fact, it’s one of the best examples of how mass customization provides both initial customization and continuous adaptability. Every smartphone is mass-produced. However, within a few minutes of taking it out of the box, we’ve downloaded the applications that customize its functionality to our exact needs and wants. The App store makes the customization experience rewarding and easy to accomplish by even the novice user. As times change, we can add or subtract apps to continually adapt the smartphone to our evolving needs.

As I discussed in the previous chapter, smartphones achieve this amazing level of customization and continuous adaptability through the use of a small number of assets that can be combined in many different ways to create each unique application. Having now introduced the concept of mass customization, I can now properly describe these assets as the modules within the smartphone’s bus modularity system.

Smartphone as Bus Modularity

In a smartphone, the case, screen, CPU, and motherboard form the bus armature on which the modules are attached. It is the innovative definition of these modules that creates a 21ST century definition of bus modularity, as opposed to the 20th century track-light example. At first glance, we might think that the mass customized modules in a smartphone are the apps that each of us select for download when we customize our phones. It’s as if the applications for the camera, flashlight, radio, calendar, heart rate monitor, and so on plug into the bus armature of our phone. While this is the way we experience the device, it’s not actually what’s happening.
The innovation of the smartphone to achieve what I called distributed multi-functionality is that the functions are disaggregated into a set of assets that are shared across all of the applications. It is these assets that are the modules in the Smartphone’s bus modularity system and not the applications they enable. When I push the camera button on my phone, the CPU doesn’t activate a camera module through the bus armature. Instead, my action causes the lens and light modules to temporarily coalesce with the CPU and screen components in the bus armature to provide the affordance to take a picture. If I select video instead of photo, the system adds the microphone module to the group. When I select another app, a new set of modular assets coalesces to provide the new functionality I require.

This new kind of distributed bus modularity adds an additional level of functionality or affordance above and beyond that provided by each of the modules. For example, the light module in a smartphone provides the first order functionality of illumination, just like the track-head. However, when combined with other assets to become a number of different apps, it also contributes to the functionality of camera, flashlight or heart rate monitor, to name just a few. To date, smartphones have been designed with a fixed set of asset modules connected to the bus. The much-anticipated Google phone promises to open this up and allow the user to choose from a selection of options which particular kind of microphone, light, lens, etc. they’d like to have in their device.

The same strategy is used in the FABmodular system. In addition to each cabinet module providing individual storage needs as a first order affordance of functionality, the cabinets coalesce together into a particular spatial layout of rooms. When it’s time to change the layout, the cabinets are easily “disaggregated” into separate components and recombined into any number of future options.

This multi-functional capacity allows residents to use a small number of standardized cabinet components to uniquely configure each area of their home in terms of both the degree of spatial enclosure and required functional support. The residents decide what size and level of spatial enclosure is required for each use and arrange the cabinet modules accordingly. They specify the nature of the cabinet interior based on functional needs and add any exterior details such as shelves and work surfaces that may be required. This level of design organizes the

![Fig. 79 Smartphone Apps as Assets on Bus Modularity](image-url)
specific domestic patterns of use within each of the spaces, and enables a more intimate and individual shaping of the character and functionality of the home.

FABmodular combines the financial advantages of a mass production tract house with the individualization of a custom-designed home. It uses an asset-based system of bus modularity to enable older residents to easily customize the initial functional layout of their home according to their lifestyle needs and health requirements. In this way, FABmodular meets the first age-in-place performance objective of initial customization. As needs evolve and health challenges progress, the resident can adapt the functional layout by reconfiguring the same system of modular cabinets into a new arrangement. This meets the second age-in-place performance objective of continuous adaptability. The inherent flexibility of bus modularity means that the FABmodular system can be integrated into any type or size of residential unit, from a small high-rise apartment to a large single family house.

FABmodular in Practice

So what does this mean on the ground, in the real world of production built housing? A theory is only as good as its relevance to practice and the constraints of normative residential buildings are longstanding and well entrenched. After all of this theorizing, a concrete example is in order.

The case study residence is a typical production-built unit located in a recently completed high rise housing development. As a descriptive exercise, I’ve used the FABmodular system to speculate on how it could be transformed into an age-in-place home that meets the performance objectives for functional resilience.

The 650 sqft size is typical for a one-bedroom-plus-den unit. Both young professionals and retirees are featured as the primary target markets in the project’s promotional material. I will begin with an analysis of the floor plan of the existing unit to analyze its suitability for an older resident. I then recast the project using the FABmodular system and demonstrate how the layout of the unit can be easily customized at the time of initial occupation and then adapted to meet changing lifestyle needs and health related conditions.

Analyzing the Plan

The case study unit has a long narrow rectangular floor plan. At one end there is an entry from a common corridor. On the other, a window wall leading out to a terrace. The party walls to the adjoining units complete the long sides of the space. The layout is organized as two parallel and essentially equal zones of space. One contains the more public functions of the house while the other contains the private spaces. The living room is adjacent to the window wall in the public zone. The entry and a study are located at the other end of this zone, closest to the corridor. A kitchen with a combined dining table/island is situated in between the living room and study. In the private zone, the bedroom is located beside the windows and the bathroom is situated next to the corridor.

This layout is a very standard typology for units of this size. A functional analysis of the floor plan confirms a normative percentage breakdown of floor area by use. The living room is the largest room and, with a corner window out to the terrace, has the prime location. The bedroom is slightly smaller and its location by the window confirms its status as the second most important space in the house.

The kitchen has the third largest floor area, but its location in the centre of the plan places it in the middle of the circulation zone, which jeopardizes its efficiency. As a result, the work area of the kitchen is very small and ineffective. This is a kitchen that’s not intended to be extensively used for cooking. The combination dining table/island confirms this intentionality towards entertainment rather than eating. It is small and more appropriate for a quick breakfast or drinks with friends rather than regular communal meals. The counter height eating bar also requires stools, which are not suitable for long periods of sitting and can be dangerous for people with balance issues, such as the elderly.

The study is the smallest room outside of the bathroom and is more of a marketing ploy than a functional part of the house. The addition of a study on the feature sheet adds an average 10 per cent premium to the sales price that developers can charge for a unit of this size. It makes little difference if the space is pleasant to be in or even large enough to use. The addition of a study also
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takes space away from other parts of the unit, which makes all of the spaces feel smaller than they really need to be.

In the case study example, the small windowless study is no exception to this marketing rule. It is clearly intended for someone who doesn’t really need a home office or secondary living space as much as a place to charge the laptop, store some files, and perhaps have a friend crash overnight on an undersized sofa. The main appeal of this space will be at the time of resale.

The bathroom is, quite naturally, the smallest room in the house. But even in relation to bathroom standards, this particular version is very tight. The layout is complicated by the double door design that allows it to be used, and perhaps more importantly marketed, as an ensuite bathroom, while also having a separate door from the hallway for guests.

The additional doorway has a significant negative impact on the functionality of the bathroom and limits the amount of storage in the unit. This configuration is intended for someone who does not have a lot of items to store but does have enough regular visitors to make the guest door an appealing feature.

Interpreting the Design

This quick analysis of the floor plan reveals that, despite what it says on the marketing brochure, the unit is really designed for the lifestyle needs of young urban professionals and not older individuals. The dysfunctional kitchen, absence of a dining table, the unusable study or second living space, and a very limited amount of storage makes the house not particularly well-suited to the needs of someone who is older and spends more time at home, involved in domestic activities. Even if the active urban lifestyle suggested by the layout is appealing for a recent retiree in the young-old stage of life, the house will probably become less and less appropriate as time passes and life becomes more centered on home life rather than street life. Because of the size of the rooms, the unit is also ill-equipped to deal with mobility challenges that might require the use of a wheelchair or any medical conditions that might require significant levels of home care.

The developer of this project is using a tried-and-true youth-oriented floor plan for a project that is also being marketed to the older demographic. In my opinion, the only consideration made
to older homebuyers are the happy marketing brochure images of white-haired people drinking wine at the stand-up dining bar and reading a newspaper in bed. Although there’s certainly nothing wrong with the aspirations underlying these images, the lack of any substantive age-in-place design strategies makes the marketers’ promise hollow and empty. I will discuss in the next chapter how media-based imagery like this has the power to overcome a rational evaluation of suitability.

In addition to the specific functional disconnects between the floor plan and the needs of older individuals, the case study unit, like all standardized tract houses, fails to deliver on either of the age-in-place performance objectives for functional resilience. The initial layout is fixed and cannot be customized by the resident to their lifestyle needs and health requirements. The only choice options would be to look for other units with different layouts as part of the design-as-shopping experience described earlier in this chapter. In addition, the floor plan is constructed of fixed interior partitions and cabinetry that have been permanently attached to the floor, ceiling, and exterior walls. Outside of a major and costly renovation, there’s no opportunity for older residents to adapt the floor plan to meet their changing needs. Neither of these options is acceptable for an age-in-place project.

This case study example is not an isolated case. Our cities are filled with new residential projects being built to capitalize on the burgeoning market of new seniors without really making any sort of concerted effort to ensure that the product they’re selling is actually suited to their customer. With that said, I also understand the reluctance of the developer to include too many obvious age-in-place accommodations. As my developers friends have told me, “You can’t sell death.” I discussed in the first chapter how the baby boom generation does not want to acknowledge the fact that it is growing old. Buying into a young, hip lifestyle could be just the ticket they are looking for to avoid making plans for their inevitable future, alongside the convertible sports car and the Botox-filled face. Until, of course, something starts to go wrong.

Developers are happy to capitalize on baby boomer vanity because it means they can reduce their risk by selling the same product to both young and old buyers. I also completely understand this motive. Developing residential property is a big money, high risk proposition and every developer is worried about missing the market by building a project that no one wants to buy. I will discuss in the conclusion how Future Adaptive Building can reduce development risk, but for now it should be obvious how advantageous it would be to have an adaptive version of this unit that could start out with the young urban floorplan and then evolve into more age-appropriate layouts as and when needed.

To demonstrate how this might work and describe some of the design details in the FABmodular system, I will describe the speculative redesign of the unit with the FABmodular system. The goal is to create multiple layout options for a high quality age-in-place living environment that helps to build functional resilience for the older resident.

Configuring the FABframe

Following the bus modularity precedent of mass customization, the first step in redesigning the existing unit into a FAB house is to define the bus armature into which the FABmodular cabinet components will be inserted. I call this armature the FABframe, after Bernard Leupen’s recent theoretical work on adaptable architecture. Leupen approaches adaptability from the perspective of the permanent parts of a building.

“In my perspective... dwellings able to stand the test of time should proceed from the permanent, from that part of the dwelling that lasts longer. The permanent defines the space for change without passing comment on that change. This means designing for the unknown instead of predicting the unpredictable.”

Leupen proposes the idea of the “Frame,” which he defined as the durable elements of a house in which the various changes will evolve over time. The definition of the Frame determines the content within. At the same time, it frees up that content and allows it to change. “It is the unchangeable that creates conditions for changeability, the permanent that frees the temporary. This permanent aspect is the Frame and it defines the space within which change can occur.”

The FABframe builds on this theory and is an important part of FABmodular. The ability of the FABmodular system to adapt
to future change rests as much on the ability of the Frame to accommodate all of the potential changes as it does on the moveable cabinet modules. The FABframe is not just an empty shell with a rough-in of building services, as happens with open building commercial construction. In the language of modular mass customization, the bus armature is a critical part of the system and must be designed to easily accept the plug-and-play modules in order to ensure that the various floor plan adaptations can continue to be made over the life of the house.

In the case study example, the FABframe starts with the common walls that define the perimeter of the unit – the two party walls, the window wall opening out to the terrace, and the entry wall adjoining the public corridor. It also includes the permanent, conventionally constructed interior partitions around the laundry, the mechanical chase at the front entry, and the bathroom and kitchen service connections that do not, or cannot, change over time. In the case study example, a small adjustment was required to increase the contact surface on the exterior window wall to 26” in order to accommodate the widest possible cabinet that might be used to separate the living area and bedroom. In this example, the adjustments required to coordinate the contact surfaces are quite straightforward. However, in a larger, more complex, floor plan, the design of the FABframe can become much more involved because of the number of potential future cabinet locations.

**Configuring the Interior**

With the FABframe for the case study unit defined, the FABmodular cabinets can be deployed. The first iteration recreates the original floor plan of the case study unit. A series of 12” deep x 30” wide floor-to-ceiling cabinet modules creates the spatial separation for the bedroom. The bathroom is defined by a series of 24”deep x 30” wide wardrobe cabinets that face into both the bedroom and the hallway. The bathroom and kitchen cabinetry matches the original unit. 12” deep bookcase modules define the study and the bedroom.
In addition to the existing layout, there are six other possible floor plan strategies that can be deployed in this FABframe. Within these options, there are several choices to be made for each cabinet type, and an even larger number of choices for the cabinet interiors.

When combined with the more typical style and material choices for the cabinet finishes, the FABmodular system provides an extremely flexible strategy with a diverse range of options for custom-designing this house to the particular needs of a wide variety of people. I describe the co-design process and the FABmodular catalogue for this case study example in the next chapter. In the final chapter, I introduce the specific medical components of FAB+ into the case study example.

To illustrate the degree of flexibility that FABmodular brings to this unit, and how it can help older residents to age-in-place, I'll describe three of the possible spatial layouts. Any of the details in these examples could be deployed at the time of first construction if they matched the needs of the original purchaser. This satisfies the first performance objective of initial customization. They could also be created as an adaptation to the floor plan at any time during occupancy, thus meeting the second objective of continuous adaptability. Depending on the extent of the changes, additional cabinet modules may need to be purchased and there would also be a nominal cost for a contractor to make the alterations over the course of a one- or two-day period. These costs would be minimal compared to a conventional renovation and would involve very little disruption or damage. The result is a home that should be able to meet the resident’s current and future functional needs in terms of both lifestyle and health.

Alternate Layout 1

In the first floor plan option, the features of the original layout that were not ideally suited to an older resident have been changed to create a more age friendly home. The cabinetry around the study has been removed to open this space up to the kitchen and
increase its access to daylight. While this space could remain as a study, it would also make a good dining area for those wanting a more conventional table for dining, working, and hobbies. This reconfiguration also allows the island to expand to the full length of the kitchen, making it a more suitable workspace for daily meal preparation by two people. On the private side of the unit, additional clothes storage is provided by replacing the ensuite doorway with a wardrobe unit.

**Alternate Layout 2**

In this floor plan adaptation, the kitchen is relocated to the end of the unit so that the living and dining areas are combined into one large space. The dining table is placed beside the window wall for someone who spends a great deal of time at the table working or undertaking a hobby. A credenza module located on the party wall could be used to provide storage for any office equipment or hobby paraphernalia. Additional clothes storage has been provided by replacing some of the bookcase modules with wardrobe cabinets. The bathroom doorway has been relocated to the bedroom to create a true ensuite and additional general storage has been added in the hallway.

**Alternate Layout 3**

In the third option, the size of the kitchen has been expanded with a peninsula counter that faces out to the dining room table which has been moved away from the exterior wall. The bedroom doorway has been relocated to create a continuous wall of storage cabinetry. The bathroom has been enlarged and the sink counter expanded.

**Service Points + Contact Surfaces**

Achieving the level of adaptability afforded by the FABmodular system requires a level of preplanning of what I call the “service points" and “contact surfaces" in the FABframe. This ensures that all of the possible floor plan configurations can be
accommodated without requiring any renovation or modification to the permanent parts of the building.

I define a service point as the location in the plan at which the plumbing services connect with the FABmodular cabinets. Service points need to be carefully located in order to allow for any potential change in location of the kitchen and bathroom sinks. To maintain construction efficiency and control costs, the location of the service point needs to be standardized in a permanent location and not influenced by any of the initial customization choices made by the resident.

In conventional construction, the plumbing service is designed to line up with the location of the sinks. In a FABframe, the service points are also fixed but don’t necessarily align with any one deployment. Rather, the location is set to work with all possible sink locations. This flexibility is facilitated through a service chase built into the back of the kitchen and bathroom cabinets that allows the plumber to run variable length connections back to the standardized location of the service point.

The goal is to avoid having to alter the location of the plumbing rough-in to accommodate either the initial custom layout or a future change to the kitchen or bathroom location. Changing a mechanical rough-in location is an expensive and time-consuming job. But with careful planning, a single service point can work with multiple cabinet layouts. In the case study example, the location of the bathroom service point remained unchanged from the original plan. The addition of the second sink in the third floor plan layout can be accommodated through the service chase in the back of the bathroom cabinet. In the kitchen, the service point is located midway between the two optional locations for the sink. The plumbing connection for either sink location would run through the kitchen cabinet service chase.

Contact surfaces are the areas of wall, floor, and ceiling where a FABmodular cabinet may, at some point, be attached. As such, they need to be properly sized and kept free of any potential obstructions. This means ensuring that light switches, fixtures, and plugs, and well as vents, sprinklers, alarms, and structural drops are kept away from all contact surfaces. The design of the
PART II

FABframe must ensure that there is sufficient unobstructed areas on the walls, ceiling, and floor to accommodate all of the potential locations for the FABmodular cabinets.

This is a different way for architects to think about design. We are used to coordinating the location of the building’s mechanical systems to a single fixed, and relatively permanent, floor plan layout. As anyone who has renovated a home will understand, changing the physical layout of a house almost always involves a reconfiguration of ducting, plumbing, and electrical feeds. The FABframe has to accommodate changes in the physical layout without requiring any of these system alterations.

The logic of designing the FABframe with service points and contact surfaces plays another important role, that of telling future residents where the cabinet modules can go.

Knowledge in the World

Houses last a long time. The people who design, build and initially live in a FAB house will not be around to advise future generations of residents about the adaptability features of the home. Written instructions, web-based plans, or any other kind of what Don Norman calls “knowledge in the head” will probably not be sustained. Drawings are lost and, as we all know, digital formats change. Adaptive measures that require extensive operating instructions will fall into disuse over time if new residents are either unaware of their existence or don’t know how to use them.

The design of the FABframe naturally reveals to future residents the intentionality of the building’s adaptability. It is an example of what Norman calls “knowledge in the world.” This is a story told in a different language - by the logic of the Frame and the location of wall, floor, and ceiling surfaces that are sized to accommodate bookcase and wardrobe sized cabinets and kept clear of all obstructions. Future residents, or their designers, can “read” all of the house’s potential adaptability options by analyzing the floor plan of the FABframe.

The case study demonstrates how FABmodular’s interior building system allows individual residents to customize the initial layout of their unit to meet their specific lifestyle needs and health capacity. And, because the modular cabinet units are moveable and the FABframe is designed to accommodate multiple cabinet placements, each resident can also continuously adapt the layout in response to changes in circumstance. There should be little to no cost premium for this kind of adaptability, because the FABframe can be built in a conventional, standardized way and all of the FABmodular components are mass produced and installed with a process that fits into the normative processes of residential construction. Changes to the unit’s layout can be completed quickly and with very little cost or damage to the rest of the house.

Conclusion

FABmodular increases functional resilience to the stresses of growing old. It uses mass customization to allow residents to customize the initial functional layout of their home and overcome the longstanding dichotomy between one-off custom-designed homes and mass produced tract built houses. It builds on the bus modularity model of mass customization exemplified by the smartphone to enable residents to use a small number of component assets to continuously adapt the spatial layout of their homes to meet the changing needs that develop over the course of growing old.

The FABmodular system uses advanced built-to-order manufacturing strategies that can deliver this high level of flexibility and customization for the same cost as a conventionally built tract project. It effectively integrates into the typical design, sales, and construction practice of the residential construction industry and can be applied to any size, price point, or type of housing project, from single family houses to high rise apartments.

The initial customization and continuous adaptability offered by FABmodular benefits older individuals because it helps them cope with most of the unexpected changes in functional needs.
that arise from changes in lifestyle circumstance and physical capacity. This includes changes that may be dramatic in nature or rapid to develop.

The customization and adaptability are also of benefit to project developers and homebuilders who may be concerned about limiting the size of their market by focusing too exclusively on the needs of an older demographic. As I demonstrated in the case study example, this age-in-place residence can easily be configured into a fairly normative floor plan organization that appeals to a variety of market segments, including healthy young professional first time buyers, the staple of most large-scale housing developments in North America.

This flexibility represents an added benefit to the older homeowner who, when ready to move, can re-configure their age-in-place residence into a unit with much broader market appeal. It also means that older residents are not forced to live in a seniors only project because the specific requirements they need for functional, as well as emotional and physical, resilience can be added, at any point, to any of the units in a FAB-enabled project. The result is the potential for truly multi-generational housing.

FABmodular is the primary component of Future Adaptive Building’s three-part strategy to build age-in-place resilience in older individuals and enable them to live well, and independently, for an extended period of time. In the next chapter, I’ll discuss how the FABstudio platform empowers residents to participate in the co-design process of customizing the layout of their home using the FABmodular system.

29. Ibid., 9
30. Ibid., 10
31. Ibid., 16
32. Jackson, “Crabgrass Frontier,” Loc. 4620
33. Lacayo, “Suburban Legend William Levitt”
34. Hayden, “Building Suburbia,” 133
35. Jackson, “Crabgrass Frontier,” Loc. 4620
37. Hayden, “Building Suburbia,” 132
40. Flynn, “Custom Nation,” 11
42. Kratochvil, “Growing Modular,” 11
43. Flynn, “Custom Nation,” 24
45. Kratochvil, “Growing Modular,” 149
48. Ibid., 207
49. Leupen, “Frame and Generic Space,” 20
50. Ibid., 23
Independence is a right of adulthood. After being steward through childhood by family, teachers, coaches, and mentors, we earn the right to make our own decisions and be responsible for our actions. As we grow old, this level of personal control starts to erode. Decisions we once took for granted about where and how we live or what and when we do something are increasingly being made by others. This loss of agency can impact our personal dignity and sense of self. It can significantly affect long term well-being and degrade quality of life.

FABstudio helps to counteract this trend by empowering older individuals to have increased control over, and more involvement in, their domestic environment. This web-based platform ties into the FABmodular system and helps residents with the process of co-designing their home and co-managing its operation. FABstudio also builds on the pop culture interest in home design to connect residents into a broader community of other FAB house residents, with whom they can share experiences and assist each other in the FAB process, potentially developing new areas of purpose and meaning.

Research indicates that maintaining individual agency, or mastery over one’s environment, contributes to feelings of increased self-worth and emotional well-being in older individuals. It can also increase life expectancy. A 2002 study at Yale University found that seniors with positive self-perceptions of aging lived, on average, 7.5 years longer than those with less positive self-perceptions of aging. Positive self-perceptions of aging include feelings of independence, control, and agency.

“The effect of more positive self-perceptions of aging on survival is greater than the physiological measures of low systolic blood pressure and cholesterol, each of which is associated with a longer life span of 4 years or less. The survival advantage of more positive self-perceptions of aging is also greater than the independent contribution of lower body mass index, no history of smoking, and a tendency to exercise; each of these factors has been found to contribute between 1 and 3 years of added life.”

The house is a natural site for reinforcing this sense of power, purpose, and responsibility because of its significance in the lives of older individuals. According to housing theorist Avi Friedman, “One thing all people experience the older they become; as control over life decreases, as elements of certainty recede, as independence fades, the concept and reality of home assume increasing importance. When everything else seems to be falling away, the central position of home acquires added significance in life.”

Emotional Resilience
Performance Objectives

Emotional resilience is the ability to maintain a healthy sense of well-being and self-regard in the face of stress. For older individuals, much of this emotionally based stress comes from
a loss of control or independence and a failed sense of meaning or purpose. I define two performance objectives for FABstudio that can help to empower emotional resilience for aging-in-place. The first is Design Engagement, which helps older individuals to be more actively involved in the initial and ongoing design and management of their home. The second is Deep Participation, which provides opportunities to pursue a broader community of interest in design as a hobby.

Design engagement and deep participation contribute to emotional resilience by increasing what psychologist Hans-Werner Wahl’s calls “usability,” or a measure of how an older individual’s needs, desires, and goals are met through engagement with their environment. FABstudio helps people assert personal agency over their domestic environment and develop a sense of purpose by participating in the process of building-as-a-verb.

As I’ve noted several times in this document, I’ve always been interested in the double meaning of building as both a process and a product. I believe that participating in the act of design brings almost as much value to the client as the final built project. It’s therefore only natural that I would want to complement my development of an adaptive interior system for aging-in-place with a parallel strategy that uses design engagement and deep participation to provide emotional benefits to older individuals.

But why is this important? How does design engagement and deep participation contribute to the wellbeing of older people and actually improve the quality of life as we age? Answering these questions requires a look at another side of mass production’s legacy. This time, it’s through the lens of individual experience, rather than physical production, that I explore the negative impact that mass production has had on emotional and social wellbeing. As I will describe, we’re all affected by the fallout from mass production’s false promise to make life better by making it easy. In fact, it’s a plight we inflict on ourselves in middle-age as a way to cope with the stresses of an all-too-busy world. Continuing these bad habits into old age may be common, but we don’t have to follow that pattern. The time and space that open up when we grow old offer the potential to correct some of the youthful transgressions most of us have made in the name of efficiency and speed.

Aging offers an opportunity to resist the superficiality of mass consumption and discover the value of a more engaged and thoughtful way of life. The benefit of design engagement and deep participation in the planning process is that they offer a way for older individuals to create a fuller and more meaningful way of life and a greater sense of self than they may have had when they were young.

The theoretical explorations in this chapter are based on my previous work with the Slow Home Movement. They supplement the recent practice-based research into FABstudio that I described in Part I. The chapter begins with a re-examination of the legacy of 20th century mass production through the lens of individual experience rather than manufacturing. It concludes with a discussion of recent work in leisure theory and uses it to speculate on the design parameters of the apps that could be included in the FABstudio system.

It’s important to note that as of the writing of this document, FABstudio remains largely speculative. Development work is underway on a prototype of the Design App that residents will use to co-design their floor plan layouts with the FABmodular system. The remaining applications within FABstudio remain in the concept phase, and will be developed later in 2017. The essence of FABstudio does not lie in its software, however engaging it may turn out to be. Rather, it lies in the intentionality of the way in which it will be used, and the benefits to emotional resilience that accrue from this considered practice. To argue this case, I return to the dilemma of craft versus mass production to explore the emotional and social consequences of the world that mass production has created.

**Home Made Easy**

In the last chapter, I described mass production’s seductive power to make goods and services cheaper and easier for more people to obtain. A foundational component of mass production’s rise to cultural dominance was 20th century modernism’s key promise that technology would make life better by making it easier. The story goes something like this. The daily chores of cooking, cleaning, laundry, home maintenance, gardening, and child care are hard, unpleasant, and boring. Technology, in the
form of new products that we need to purchase and houses in which we will live, can free us from this burden and give us more time to pursue a richer, fuller, more meaningful quality of life. To be affordable, these new products, including the home itself, needed to be standardized and mass-produced, using the latest techniques of modern technology. It’s a simple trade-off for convenience instead of choice.

This was a deal that made good sense at the time. After all, modern technology had just launched a man into space. As a young baby-boomer-boy, I remember it well -- pestering my mother to buy a container of Tang, the same drink NASA had developed for its astronauts. How could a powdered orange drink from outer space not be better than boring old orange juice? My mom certainly approved of the idea. With four small children, she liked the convenience of simply stirring a spoonful of crystals into a glass of tap water, thus avoiding the hassle, to say nothing of the mess, of squeezing fresh oranges every morning. Easy OJ, right? No problem.

Fast forward 50 years and that former little boy is now more than well aware of the Faustian deal we all made in the name of progress. In fact, orange juice, and the ambiguity that hovers around its reality, has become a pet peeve of mine. Despite my juvenile transgression, I have grown up to savour real orange juice – that is, real, “fresh-squeezed” orange juice. When my own children were still at home, Sunday breakfast was family time and the only occasion on which we made the effort to make orange juice by hand. Taking the time to buy and squeeze a dozen oranges was part of the family ritual that made the event particular and meaningful. It took effort and planning. Not a lot, but enough to notice and ensure that Sunday was the only day we drank orange juice. Sometimes the fruit was pale and the juice would be flat. Other times it would be glorious. Most often, it was just fresh OJ.

Whenever I travel, I always order fresh-squeezed off the menu. More often than not, in luxury hotels as much as in budget specials, the conversation goes something like this, “Are you sure it’s fresh-squeezed?” “Of course, sir!” “Did you actually see someone squeeze the oranges?” “No, not exactly.” “So how do you know it’s fresh-squeezed?” The inevitable reply, “Because it says so on the container.” I usually end up with just coffee.

What started in the 1960s as a cool way for kids to feel like astronauts and save their mothers a bit of time and hassle at breakfast has evolved into a situation where, for many people, the sovereign difference between the real and the mass-produced simulation is starting to disappear. Fresh-squeezed has gone from being an active descriptor to being a marketing label – from verb to noun. The problem isn’t just that real orange juice is hard to find. It’s that fewer and fewer people care enough to realize the sovereign difference between the real and the fake substitute.

This is not an isolated phenomenon. As I described in the last chapter, mass production, the child of modern technology, has become very good at replacing not only most craft-produced goods and services, but many natural products, like food, with inexpensive, commodified products. With the twenty-twenty hindsight of 70 years’ experience with this process, we now see that the trade-off was not so benign. The promise of modern technology and mass production came with a rather hefty price tag in terms of our relationship with the world and our sense of self. The philosopher Albert Borgmann, among others, describes the implications of this wholesale shift from a world of craft-made things to a world of mass produced substitutes.

“As a first step let us note that the notions of liberation and enrichment are joined in that of availability. Goods that are available to us enrich our lives and, if they are technologically available, they do so without imposing burdens on us. Something is available in this sense, if it has been rendered instantaneous, ubiquitous, safe, and easy.”

Consider my breakfast nemesis. Tang, or any other pre-packaged food, is instantaneously available; it takes only a moment to open the cupboard or fridge and grab the container. It’s ubiquitous; you can buy your favourite brand not only whenever you want but, thanks to grocery chain logistics, almost anywhere you travel. Safe? Quality control in the factory supposedly ensures that you won’t pour anything unsafe or unpalatable into your glass. Commodified juice will never taste as flat as some of the unripe fruit we sometimes used for our family breakfasts, but the trade-off is that it will also never be exceptional, either. The best we can hope for is that it’s always what we expect - the safety of mid-range sameness. Ease, of course, is guaranteed, with our
effort reduced to placing our glass in the automatic dishwasher and tossing the empty container into the recycling bin, where it becomes someone else’s problem.

This can, at first glance, seem like a good deal, particularly for older individuals who, because of physical and cognitive infirmities, may be looking for opportunities to make their lives simpler. However important this may be, it’s important to balance this desire for ease with an understanding of its cost, to both our degree of agency and control and to the sense of purpose and meaning in our lives.

Superficial Substitutes

Borgmann would call Tang and any other mass produced commodities “devices,” because they provide a single expected result, in Tang’s case an orange-flavoured beverage, in as easy and uncomplicated a manner as possible. A glass of real, fresh-squeezed orange juice is the exact opposite; a prime example of what Borgmann defines as a “thing.”

“A thing, in this sense in which I want to use the word here, is inseparable from its context, namely its world, and from our commerce with the thing and its world, namely, engagement. The experience of a thing is always and also a bodily and social engagement with the thing’s world… Physical engagement is not simply physical contact but the experience of the world through the manifold sensibility of the body. That sensibility is sharpened and strengthened in skill. Skill is intensive and refined world engagement. Skill in turn is bound up with social engagement. It molds the person and give the person character.”

In the not-so-distant past of my great grandparents’ generation, having any kind of orange juice required that you had easy access to an orange tree. Breakfast started with a trip to the garden to pick a couple of ripe pieces of fruit off the tree when they happened to be in season. That ability obviously required a deep and sustained relationship of cultivation and care to ensure that the tree continued to bear fruit.

Today, the journey to fresh-squeezed starts with a trip to the farmers’ market or, more likely, the grocery store. Even then, however, there is considerable involvement with the world of the orange. First, we have to select it, trying to remember what our grandmother taught us about divining the ripeness of fruit. We have to estimate how many oranges we will require for the number of glasses we need to serve. We need to take the time to cut the fruit and squeeze out the juice. Its color and flavour speak of the particular varietal of the fruit, the time of year it was picked, and the vagaries of the weather in the place it was grown, wherever in the world that may be. We get the sweet stickiness on our fingers, errant flecks on our shirt, and the occasional squirt in the eye. The whole event takes time and attention, if not a great deal of specialized culinary skill. There are pips and pulp in the glass that remind us that the juice comes from a piece of living vegetative matter, and the sweetness of the juice is part of a deal the tree makes with animals to help spread its seed. Finally there is the slightly arduous clean-up of equipment and disposal of the rinds before taking a well-earned sip.

My passion for fresh-squeezed orange juice is just one small example of a much broader phenomenon, where the real world of experience is accessed through our direct involvement in, and use of, Borgmann’s “things.” Unfortunately, this is becoming a rare event for many people. In the name of modernism’s golden promise to make life better, we have allowed the forces of mass production to transform more and more of our rich, varied, idiosyncratic world into a bland, shallow, standardized substitute. This has significant consequences for older individuals, who may already be struggling with the loss of self-identity that comes with retirement and decreasing levels of independence and control associated with physical and cognitive decline.

Consider the track-built house. As I’ve demonstrated throughout this document, it’s a shallow substitute for the custom-designed home. It’s designed and built to turn a profit as much, if not more than, it’s designed as a good place to live. It’s based on a standardized floor plan predicated on a generic set of functional needs, and typically ignores its site and local climate as much as it does the lifestyle of its potential residents. Seductive marketing images distract us from all of these realities with the promise of a happy, fulfilled life and it isn’t until we’ve moved in that we start to realize that the home of our dreams is actually more of a nightmare, with features we don’t need, rooms we don’t use, too much space in one area and not enough in the next, and a
lowest common denominator level of construction quality. As a concrete example, the case study project from the last chapter was marketed to older individuals as an age-in-place development. The website was filled with images of happy seniors drinking wine and laughing, and the sales centre was set up to impress without providing much in the way of substantive information. My analysis of the floor plan, however, revealed that the unit would most probably not meet the actual needs of an older homebuyer. Add to that problem, the lure of easy financing and a low down payment; in combination, producing a false sense of affordability by minimizing short-term economic stress and hiding the real cost of the transaction. A limited number of carefully selected optional features and finishes provide the illusion of choice, while ensuring that no one is able to stray too far from the expected norm. Individuality is reduced to a paint colour, value to a quantitative measure of unit size and floor level, with common agreement that more is always better. The whole process is orchestrated to be completed quickly and with very little opportunity to consider the actual suitability or functionality of the unit being purchased.

Choosing a new place to live is, for most people, and particularly older individuals, one of the most important and significant decisions in their lives. Too often the process is reduced to a quick financial transaction with a friendly, but ultimately disinterested, salesperson. In short, the production built house has become, to use Borgmann’s term, a device. One of the most significant places in a person’s life —“the premier instruments for satisfying the expectation of selfhood” —has been rendered instantaneous, ubiquitous, cheap and easy by an industrialized mass production based system that promises everything but delivers very little beyond the fleeting sense of satisfaction at the point of sale.

Like fat-free instant chocolate cake, abs without exercising, learning a second language in your sleep, or becoming the next pop star without really knowing how to sing, the tract-built house exhibits “the traits of a commerce with reality where the rootedness in the depth of things, i.e. in the irreplaceable context of time and place, has been dissolved.” In many cases, these industrialized commodities are popular for the very fact that they can be enjoyed as a mere end, unencumbered by means, making little demand on our skill, strength, or attention. After all, who wants to spend their precious time away from work preparing a meal from scratch or completing any sort of home maintenance?

Borgmann characterizes this as a shift from a worldview conditioned by deep relationships with things to a worldview dominated by shallow device commodities that are consumed individually without invoking, or becoming involved with, their context.

“When consuming a commodity, there is the point-like and inconsequential conflation of a sharply delimited human need with an equally context-less and closely fitting commodity... In a Big Mac the sequence of courses has been compacted into one object and the discipline of table manners has been reduced to grabbing and eating. The social context reaches no further than the pleasant faces and quick hands of the people who run the fast food outlet.”

In the same way that fast food unravels the deeper cultural context of cooking and dining, the mass production-based housing industry has transformed us from a nation of home-makers into one of home-buyers, all too ready to blindly consume the latest marketing image of a super-sized idyllic dream home as a vision of individualization. In such a world of strictly limited choices “notions of self and happiness are thus prone to disappear into categories of consumer products.” The example of the case study high rise unit underscores how the tract home experience mirrors this experience with fast food and illustrates how it can negatively impact emotional well-being.

The Craft-Based Alternative

Craft production, as I discussed in the last chapter, is the antithesis of this mass production/commodification mindset. Custom designed houses are unique, sophisticated responses to site, climate, materials, and the lives of the inhabitants. They engage the context of place, and the history of form. They respect the tradition of craft and rise to the promise of the new.

Working with an architect to design a house that fits your needs and the requirements of the site is a very rewarding task - but it is also difficult, time consuming, and expensive.
To use Borgmann’s terminology, a craft-produced architecturally designed home is a “thing,” not a “device.” Designing and building a house opens up the world of the house to architect and client alike. Time and again our clients have told us how deeply meaningful the design and construction process has been. Even though the home may look quite similar to its mass-produced cousins, and is probably indistinguishable in a real estate market comparison, the fact of its creation is embedded in the homeowner. In the same way that squeezing the oranges yourself makes the juice all the sweeter, creating your own custom home makes your home, and even you, just a little bit better.

But, as I’ve described previously, craft production is only an option for the very few in society who can afford the time and money to go through the process. Even if the final cost of a custom home is exactly the same as a production built model, the onerous process and cash flow requirements during construction precludes this option for many people. Fortunately, in food and in homes, there is an option that sits between the perfect and the processed.

Going Slow

The Slow Food Movement, as its name suggests, “stands for everything that McDonald’s does not; fresh local, seasonal produce, recipes handed down through generations; sustainable farming; artisanal production; and leisurely dining with family and friends.” Founded in Italy by Carlo Petrini in 1986, Slow Food is an international movement with a membership of more than 100,000. As of September 13, 2016, the Slow Food website listed that its mandate “opposes the standardization of taste and protects cultural identities tied to food and gastronomic traditions.”

Slow Food attempts to reverse the infantilization that occurs with fast food. It promotes a re-engagement with the culture of the table through individual everyday involvement with the selection, preparation and enjoyment of the things we eat. Slow Food isn’t about expensive ingredients, elaborate recipes, complex preparations, or fancy table manners, but rather good ingredients that are carefully prepared and enjoyed. Slow Food can be as simple as a self-prepared grilled cheese sandwich and salad, a from-scratch birthday cake, or your mother’s home-made chicken soup. To use Borgmann’s terminology, Slow Food treats food as a “focal thing” rather than a “device” and considers the acts of preparation and eating as “focal practices.”

“(Focal things) are concrete, tangible, and deep, admitting of no functional equivalents; they have a tradition, structure, and rhythm of their own. They are unprocurable and finally beyond our control. They engage us in the fullness of our capacities. And they thrive in a technological setting. A focal practice, generally, is the resolute and regular dedication to a focal thing. It sponsors discipline and skill which are exercised in a unity of achievement and enjoyment of mind, body and the world, of myself and others, and in a social union.”

The fresh oranges that we enjoyed on Sunday mornings were focal things and the joyful, steady experience of preparing the breakfast juice became, for my young family, a focal practice. As such, Slow Food is a verb as much, if not more, than it is a noun. At its core, it’s a disciplined way of obtaining, preparing and enjoying food. Replacing the superficial consumption of a commodity with a deep practice promotes a more intentional, directed way of being in the world and begins to counteract some of the infantilization we have suffered from an overdependence on market-driven consumption. The considered act of creating and enjoying our daily meals, however humble, is an act of individual engagement. Borgmann describes it as follows:

“The great meal of the day, be it at noon or in the evening, is a focal event par excellence. It gathers the scattered family around the table. And on the table it gathers together the most delectable things nature has brought forth. But it also recollects and presents a tradition, the immemorial experience of the race in identifying and cultivating edible plants, in domesticating and butchering animals; it brings into focus closer relations of national or regional customs, and more intimate traditions still of family recipes and dishes. It is evident how this living texture is being rent through the procurement of food as a commodity and the replacement of the culture of the table by the food industry. Once food has become freely available, it is only consistent that the gathering of the meal is shattered and disintegrates into snacks,
TV dinners, bites that are grabbed to be eaten; and eating itself is scattered around television shows, late and early meetings, activities, overtime work, and other business. This is increasingly the normal condition of technological eating. But it is within our power to clear a central space amid the clutter and distraction. We can begin with the simplicity of a meal that has a beginning, a middle, and an end and that breaks through the superficiality of convenience food in the simple steps of beginning with raw ingredients, preparing and transforming them, and bringing them to the table. In this way we can again become freeholders of our own culture.  

The dining table and the space in which it sits are an integral part of this focal event. The table centres the activity of eating as both a social and physical occurrence. Repeating the meal in the same place reminds us of past events and of friends and family come and gone. If, as often happens, the table is one that has been passed down through the family, it speaks of longer cycles of gathering and the collective history that it shares.

The idea of pursuing a more considered approach to life resonates with many older individuals and the slower pace of life that accompanies aging. For many, it may be the first time since childhood that they have the time and space to slow down and pay more attention to the world around them. A lack of time is the usual reason that we tell ourselves that it’s okay to eat fast food and participate in other types of fast behaviour. Who has time to cook and do things properly when we are so busy with work? That changes when we grow old. For many older individuals, time is something to fill rather than worry about spending. Pursuing a slower way of life, in whatever way is meaningful to each of us, can be a natural complement to aging. This can offer opportunities to create new kinds of purpose and meaning beyond the self-definitions of work and status that can dominate mid-life.

Borgmann describes other slow practices, such as martial arts, playing a musical instrument, fly-fishing, canoeing, and long distance running. They’re distinctive because they aren’t just a means to an end. We don’t canoe because we need to get somewhere, or fly-fish in order to have seafood for dinner. We gain personal satisfaction and happiness from the very act of canoeing and fly-fishing and all of the preparation, knowledge, and practice that happens before and after the event. I believe the same can be said for residential design. It, too, can be a focal practice, where the experience is almost as important as the final result.

Eight years ago, I coined the term Slow Home to describe this way of thinking about residential architecture. Like Slow Food, it isn’t about expensive materials, extravagant design, or complicated construction. Slow Home is an attitude and an activity, a verb as much as a noun. It engages the homeowner in an act of design that brings together good, sustainable materials, thoughtful design, and careful construction to make a home that celebrates and enables the simple patterns of daily living.

We have already seen how FABmodular’s mass customization system actualizes Slow Home’s goal of initial customization in residential projects of any type, size, or cost. FABstudio is the platform through which the residents of these homes participate in the slow focal practice of design, transforming them from passive consumers into active co-participants.

Based on FABmodular’s continuous adaptability, this engaged co-design process occurs at the time of initial inhabitation and each time the functional layout of the home needs to change. On a more regular and ongoing basis, FABstudio’s MANAGE app provides the opportunity for residents to also be more actively involved in the operation of their house. This includes control over mechanical, security, and communication systems as well as health-monitoring and age-friendly safety systems.

Design engagement is the first performance objective for enhancing age-in-place emotional resilience. It’s based on Borgmann’s proposition that the active pursuit of focal practices can help to counteract the superficiality of our too-fast, mass-produced world. The value of this co-design activity extends well beyond the tangible ‘building as a noun’ process of modifying the physical layout of the residence.

For older individuals, actively participating in the design of their home engenders feelings of control and accomplishment. Focusing on the pursuit of ‘building as a verb’ through design engagement helps to empower older residents with a sense of agency, purpose, and independence.
Deep Engagement

At the same time, and in much the same way, FABstudio can enable a deeper level of engagement with the broader idea of design. This occurs when the one-off design engagement process of customizing the layout of your own home expands into a more general pursuit of design as a hobby or form of leisure activity. This speaks to the second age-in-place performance objective of deep participation, because it builds a broader set of focal practices that have value in, and of, themselves, and not just as a means to an end. In this way, deep participation helps to give meaning and purpose to an older person’s life, in addition to the sense of agency and feeling of control created by design engagement. To understand how this might work, I turn to gardening, one of the great examples of a purpose-driven activity turned hobby, particularly for a good friend of mine.

Bob is 69 years old, and a retired architectural technologist. But that isn’t how he introduces himself. When he reaches out his hand in greeting, he announces, “I’m Bob – the gardener.” We live in a cold part of the world that only has about 90 days each year where the temperature continuously stays above freezing. That’s a very small window for growing anything but the hardiest of plants. Summer here is over so quickly that, in my mind, it hardly seems worth calling it summer. But that doesn’t bother my friend one bit.

For Bob, gardening is not just a year-round endeavour, it’s a way of being. He’s told me that he enjoys the nine months of thinking and preparing as much as he does the short summer season in the backyard. Bob starts planning for next year’s growing season as soon as the snow starts to fall. There’s the sharpening and oiling of the tools, the horticultural society lunches, seed catalogue parties with friends, and countless hours spent online, researching, discussing, trading secrets, seeking advice, and answering questions. During the summer, he always seems to have a spade in his back pocket and a weed in his hand, spending as many hours in the dirt as his knees will allow. Bob’s garden is a world of deep knowledge, camaraderie, and effort, as much as it is a piece of his backyard.

Years ago I suspected that he cared more about gardening than he did his work as an architectural technologist. He usually called his work the way he “funded his seed habit.” Now that he’s retired, Bob is involved with some kind of gardening activity on a daily level.

A year ago, Bob suffered a fall that kept him on crutches for a year. Any sort of physical activity was out of the question, and his plants lay fallow for the season. But Bob’s garden still sustained him through this difficult period. In particular he became immersed in helping newcomers to untangle the mysteries of gardening. He told me that this online mentorship really helped him cope with his injuries. In many ways, he was just nurturing the growth of a new kind of seed -- the novice gardener.

Like many hobbyists, Bob puts a lot of time and energy into his passion - and almost all of himself. But he’ll be the first to tell you that the rewards far exceed the annual harvest. The personal benefits of gardening have also been well-documented. “Research involving active participation with nature through gardening demonstrated that this activity provides psychological benefits such as increased self-esteem, reduced stress levels and increased social interaction among those involved.” In a recent study of perceptions of life satisfaction, gardeners rated themselves higher than non-gardeners did in terms of energy level, zest for life, optimism, and physical self-concept.

Serious Leisure

Bob’s passion for gardening is an example of what sociologist Robert Stebbins calls Serious Leisure. It’s the first category in his taxonomy of leisure that also includes casual and project-based leisure.

“Serious leisure is the systematic pursuit of an amateur, hobbyist, or volunteer core activity that people find so substantial, interesting, and fulfilling that, in the typical case, they launch themselves on a (leisure) career centered on acquiring and expressing a combination of its special skills, knowledge, and experience.” This description refers to the same general qualitative characteristics that Borgmann uses to define a focal practice. Serious leisure requires “significant personal effort using specially acquired knowledge, training, and skill.” It resists the superficiality and mass commodification of experience that
pervades so much of contemporary culture and gives meaning, depth, and purpose to our lives.

“Eight durable benefits, or broad outcomes, of serious leisure have so far been identified, mostly from research on amateurs. They are self-actualization, self-enrichment, self-expression, regeneration or renewal of self, feelings of accomplishment, enhancement of self-image, social interaction and belongingness, and lasting physical products of the activity (e.g., a painting, scientific paper, or piece of furniture).” 67

These benefits could help to increase the quality of life and sense of well-being for older individuals. They describe why deep participation in a serious leisure activity is one of the two performance objectives for building emotional resilience. As Bob’s experience demonstrates, a serious leisure pursuit can bring depth and purpose to life that may emotionally sustain us in times of trouble.

From my experience with the Slow Home Movement, I believe that Stebbins’ idea of serious leisure applies to design as readily as it does to gardening, and all of the benefits that he describes can be applied to the FABstudio goal of building emotional resilience. Amateur residential design, what I call “thinking-like-an-architect,” is a close corollary to gardening. Both engage the intertwining of product and process and have similar foundations of knowledge, skills and history, as well as high art and vernacular traditions. They are also amateur versions of well-established professions.

I use Stebbins’ three categories of leisure -- project-based, casual, and serious -- to structure a description of FABstudio’s current state of development. Through this, I demonstrate how and why being engaged in the co-design of an older individual’s FAB house meets the performance objectives of design engagement and deep participation for age-in-place emotional resilience.

**Project-based Design Engagement**

According to Stebbins, “Project-based leisure is a short-term, moderately complicated, either one-shot or occasional, though infrequent, creative undertaking carried out in free time. It requires considerable planning, effort, and sometimes skill or knowledge, but for all that is neither serious leisure nor intended to develop into such.” 68 This describes fairly accurately the practical tasks that an older individual would undertake while co-designing the initial customization or continuous adaptations of their FABmodular interior.

Depending on the interests and abilities of the individual, this could involve varying levels of co-design involvement with a professional designer or trained advisor. In the process, the resident would acquire some new knowledge and skills and devote a moderate amount of effort over a short period of time. For many people, this would be the end of the design-as-leisure-experience. If there was a future need for a functional adaptation to the house, the resident would take up the FABstudio platform again and complete the reconfiguration through another project-based experience.

Project-based leisure for home improvement is wildly popular. In 2014, Canadians spent 41 per cent more on home renovations than they did on new home construction, and a significant amount of that money was spent at home improvement centres as part of a Do-it-Yourself (DIY) project. 69 Design is typically one part of a larger project involving the actual construction or desired improvement. For older individuals who may not have the capacity or desire to undertake a DIY construction project, a design-only form of project-based leisure that involves an exertion of the mind instead of the body could extend this broader social trend, and the benefits it provides, to older individuals.

Market research of mass customized products indicates that there are intangible benefits to the co-design process, over and above the benefits of the custom-designed product itself.

“Products co-designed by customers may also provide symbolic (intrinsic and social) benefits for (the user), resulting from the actual process of co-design rather than its outcome. Martin Shreier quotes, for example, a pride-of-ownership effect. Customers may co-create something by themselves, which may add value due to the sheer enthusiasm about the result. This effect relates to the desire for uniqueness, as discussed before, but here it is based on a unique task
and not the outcome. In addition to enjoyment, task accomplishment has a sense of creativity. Participating in a co-design process may be considered a highly creative problem-solving process by the individuals engaged in the task.*

This “I-did-it-myself” phenomenon occurs when the value of the mass customized product is “perceived as more attractive (i.e., when preference fit is higher) and when the customer feels that she has contributed more to the result.” By extension, the satisfaction that comes from accomplishing the successful co-design of your own home could result in an increased sense of independence, agency, and self-worth. This clearly fits within the design engagement performance objective for emotional resilience. The actual co-design process would be completed on the web-based FABstudio platform. It would be supported by a comprehensive online video library of residential design education content as well as “how-to-design” videos that offer basic instruction on the co-design process using the FABmodular system, and progress to more advanced topics such as case study examples, specific residential design strategies, and rules of thumb similar to those I developed for the Slow Home website.

In addition to the tangible benefits that accrue from the completion of the actual project, Stebbins indicates that project-based leisure “can in its own particular way bring together friends, neighbors, or relatives, or draw the individual participant into an organizational milieu.” The repeated engagement in a project-based leisure activity, for example undertaking a series of discrete improvement projects in a garden, or co-designing incremental improvements to the way a house functions, can sometimes lead to the development of a serious leisure hobby.

Casual Design Engagement

“Casual leisure is defined as an immediately, intrinsically rewarding, relatively short-lived pleasurable activity requiring little or no special training to enjoy it.” Casual gardeners, of whom I am one, enjoy the occasional flower show or garden tour, read the odd blog or glossy garden book, and pick up a few pre-planted flower pots each spring for the back deck. They have sufficient knowledge to carry on a brief gardening conversation at a party, and enough interest to know about the current trends but not necessarily to act on them. Casual gardeners can go for great periods of time without ever considering the colour of their thumb. They may occasionally become a project gardener but are happy to let their interest recede when the task at hand is complete.

Casual design activities are almost equally as common as gardening. Home design has become part of popular culture through television, magazines, and social media. Websites like Houzz, apartment therapy, and @inhabitat provide daily doses of residential design information for immediate consumption. Most of this is for entertainment, contributing to our house of dreams rather than guiding any actual design intervention. As with gardening, casual design activities are episodic, irregular, and relatively superficial, and provide entertainment more than knowledge or a tangible end product.

The FABstudio platform would support these casual design interests with a resource library of general residential design and specific age-in-place information, a catalogue of completed projects, and all of the instructional videos created for co-design with the FABmodular system. This information would only be available to residents in a FAB project and this kind of casual engagement would provide a common topic of interest that could help connect new residents in a FAB project with fellow neighbours as well as the broader community of all FAB house projects. Establishing or joining a social circle can be difficult to do in a new setting, such as a recently completed housing project. Even a superficial perusal of FABstudio’s design library content would provide a starting point for conversation, making it easier to establish new friendships and expand the social circle. Although this casual level of participation in design is not tremendously deep, it does have the potential to increase social connectivity and contribute to emotional resilience.

Stebbins identifies five potential benefits from casual leisure, but I believe the most pertinent to this “design as a hobby” discussion is the development of interpersonal relationships through a common topic of social conversation. New shared interests, such as those discovered through a casual interest in a pursuit like gardening, can foster personal psychological growth and enhance an individual’s sense of self.
Serious Design Engagement

For a small percentage of individuals living in a FAB house, the co-design experience could ignite an interest to pursue residential design as a serious leisure pursuit. Like the avid hobby gardener, these individuals would become involved in acquiring knowledge about, and skills in, residential design in general, and Future Adaptive Building in particular.

For serious gardeners like Bob, plants and planting are a way of life. The minutiae of their hobby fills their thoughts, and the manual tasks their hobby demands consume their weekends. Gardening is a part of their self-definition and gives them feelings of accomplishment and meaning. For the avid gardener, that which is grown is more than just vegetables and flowers. Like all focal practices or slow activities, the value of gardening is in the preparation, the process, and the perspiration, as much as the potatoes.

At first glance, it may not be obvious what design as a hobby would entail. For gardeners, there’s always another package of seeds, another piece of ground, and another season of growth. The co-design of your home is a more singular experience, or perhaps, more accurately, a series of widely spaced singular experiences as you adapt your space to your evolving needs. This sparse pattern of activity would not be enough to sustain the serious design hobbyist. My experience with design enthusiasts on the Slow Home website suggests that this limitation could be overcome by having the hobbyist participate as a mentor to help other residents with the design process of their FAB home, and as an active contributor or super-user to the FABstudio platform.

This could benefit the entire co-design process. Recent research indicates that satisfaction increases when a mass customized customer–toolkit relationship is augmented by input from peers. In one experiment involving the co-design of snow skis,

“Two controlled experiments were conducted in which 191 subjects used a mass customization toolkit to design their own individual skis. It is found that providing other users’ designs as potential starting points in the first phase stimulates the integration of existing solution chunks, which indicates more systematic problem solving behavior. Peer input also turned out to have positive effects in the third phase. Providing other customers’ opinions on interim design solutions stimulated favorable problem-solving behavior, namely, the integration of external feedback.”

The FABstudio platform would facilitate the connection of serious design enthusiasts with newcomers just starting the initial customization of their FABmodular interior. These super-users would provide mentorship in the form of assistance on the technical use of the software, advice on design choices and floor plan layout strategies, and information on broader age-in-place issues. My Slow Home experience suggests that this would be similar to the peer-to-peer learning and camaraderie that naturally occurs in the physical studio of a professional design school.

Serious design hobbyists would be encouraged to comment on and assist other users with their design, to post examples of their own home, and to share techniques and strategies for using FABmodular. I anticipate that this would one day extend to “hacking” strategies for creating unanticipated, novel uses of the modular cabinet system, as well. Some of these users might volunteer as content editors of the FABstudio’s design library and help ensure that the information remains up-to-date and relevant to their peer group. Finally, I anticipate that the FAB development team would reach out to this community of super-users for suggestions to continuously improve FAB as both a product and a process.

FABstudio could become a platform for serious enthusiasts to engage in a multi-dimensional pursuit of design as a hobby. This includes the opportunity to create a social circle with other users and provide mentorship to project-based and casual users. As such, it has the potential to significantly contribute to Stebbins’ eight benefits of serious leisure -- self-actualization, self-enrichment, self-expression, regeneration or renewal of self, feelings of accomplishment, enhancement of self-image, social interaction and belongingness, and lasting physical products of the activity.

These are the clear benefits of deep participation that would help build emotional resilience in older individuals. Sociological research indicates that the benefits of serious leisure resonate particularly well with older individuals and can lead to increased quality of life and well-being.
FABstudio in Practice

The majority of FABstudio does not yet exist. However, based on my previous experience with Slow Home Studio and the precedents of other mass customization configurator systems, I foresee a simple tablet-based digital interface that would provide a comprehensive set of tools for older individuals to pursue design as a hobby at any level, and in any way, that they choose. The interface for accessing the platform will be designed to accommodate a variety of different technical levels and cognitive abilities, a topic I will return to at the end of this chapter.

The centrepiece of FABstudio is the DESIGN App that residents would use to co-design the layout of their FABmodular interior. A beta version is currently in development and will be issued for user testing in early 2017.

DESIGN would be used to configure floor plan layouts using the FABmodular system. It would be used by older residents pursuing design on both a project-based and a serious level.

I anticipate that there would be four additional applications on the FABstudio platform – LIBRARY, COMMUNITY, MANAGE, and HEALTH. Each app would help facilitate not only the “building as a noun” pragmatics of co-designing the actual FABmodular installation, but also the “building as a verb” potential of pursuing design as a project-based, casual, or serious hobby.

The LIBRARY App would provide access to all of the design and age-in-place resources, including the instructional videos for how to use the DESIGN App. It would be the primary connection for older individuals who are casual design enthusiasts. LIBRARY would also be used as an information resource by project-based users. I anticipate that serious hobbyists would both make use of the content in the LIBRARY App and contribute to the development of new content.

The COMMUNITY App would connect FABstudio users into a community to share information and best practices, and provide peer-to-peer assistance for novice users of the FAB system. COMMUNITY would be of value to all three types of resident users. Serious users would generate most of the content, while project-based users would make practical use of the informal content and peer-to-peer learning offered by the serious hobbyists. Casual hobbyists would probably enjoy viewing the content.

The MANAGE App would give residents full operational control of the various building and smart systems in their own house. Variable levels of automation would make MANAGE useful to all residents, with serious hobbyists most likely to get “under the hood” and to manipulate the operation of the house at the most fundamental levels.

Finally, the HEALTH App would provide a digital interface for the medical vital signs and other monitoring and safety systems installed in the house. This could also be expanded to include electronic medical records, medication management tools, and any specific health-related information that the health care team would like the resident to access. HEALTH would also connect with the home’s security system and send notifications to family members, care professionals, or emergency medical personnel if the house detected a change in behaviour, a fall, or a serious medical event. I will discuss this in more detail in the following chapter on FAB+.

Using FABstudio

In addition to allowing existing FAB house residents to have independent access to the FAB system, the FABstudio platform would be integrated into the sales and marketing program of each FAB enabled residential project. The interface would be branded to match each project and include the base building conditions, base module type sets, algorithms guiding allowable design choices, and a pricing database tailored to the project. On-site sales staff would be trained in the use of FABstudio and would use DESIGN to enhance the sales process. Potential buyers in both the showroom and at home would use the app to experiment with layouts, build a relationship with the project, and gain confidence in the home-buying decisions they are about to undertake.

After the purchase has been confirmed, a series of checks and balances, involving expert review and potential one-to-one consultation with both designers and health care professionals,
would ensure that the planned configuration conforms with good
design practice, the requirements of the base building, and the
specific needs of the individual.

In addition to the forward-facing interface for residents, developer
sales staff, and potential homebuyers, FABstudio would also
include a full back-end system of pricing, order confirmation, and
integration with the project’s construction team and the cabinet
manufacturing system. When the purchase is complete and
the design finalized, this back-end system would interface with
the developer, base building contractor, and digital cabinetry
production line. Pricing would be sent to the developer, and
shop drawings to the base building architect and contractor. FAB
trade contractors would be responsible for the installation of the
complete interior for each unit. All of the components would be
delivered to site and a team of installers would work through the
building, unit by unit, to finish off each uniquely configured home.
As needs change, residents would return to the FABstudio
Platform and use it to co-design any adaptations that might
be required. The back-end configurator would automatically
determine the new location for each of the existing components
and determine what, if any, new pieces would be required. Shop
drawings and pricing would be sent to the resident for approval,
and the FAB installers would deliver any new components and
reconfigure the unit to the new layout.

The DESIGN App

From a mass customization point of view, the FABstudio Design
App is the configurator interface for the FABmodular system.
Configurator systems, which are also known as choice boards or
design systems, give access to the product catalogue, promote
learning, and provide a high quality, satisfying experience for the
user. According to Frank Piller, “Toolkits for customer co-design
might better describe the diverse activities taking place. In a
toolkit, different variants are represented, visualized, assessed,
and priced with an accompanying learning-by-doing process
for the user. The core idea is to engage customers into fast-
cycle, trial-and-error learning processes. By engaging in multiple
sequential experiments, customers can test the match between
the available options, a particular configuration of these options,
and their needs.”

This should sound very familiar to what we do as architects.
FABstudio mimics the residential design process we use at
Housebrand and incorporates the lessons I learned from the Slow
Home experience about public education and design advocacy.
The system is powered by the co-design methodologies used
in mass customization to ensure that the homeowner can have
this rich, individualized custom-design experience without
jeopardizing the economies of scale and scope that makes mass
customization work.

The DESIGN app would take potential residents through the
initial customization process in a step-by-step manner with
“a set of user friendly design tools that allow trial-and-error
experimentation processes and deliver immediate simulated
feedback on the outcome of design ideas. Once a satisfactory
design is found, the product specifications can be transferred
into the firm’s production system, and the custom product is
subsequently produced and delivered to the customer.”

The DESIGN app would also incorporate algorithms that would
adjust available layout options on the basis of input from the
homeowner’s health care team. In this way, for example, a
person with arthritis that prevents them from raising their arms
above a certain height would only be shown kitchen layout
options that had counter height pantry and dish storage. A
person identified as having mobility issues and in need of grab
bars would only see the modular options that incorporated these
assists. The algorithms would help ensure that the spatial layouts
are appropriate for the resident’s specific health needs.

Conclusion

At the most basic of levels, FABstudio is the interface that older
individuals use to manipulate the FABmodular system in order to
create a home that is continuously customized to their needs. As
I’ve argued in the previous chapter, this increases the residents’
functional resilience as they face the many lifestyle and health
changes that occur in old age. In this chapter, I describe how
FABstudio can also enable a second order of benefits that
come from being involved in the process of design, rather than
just the product that the design creates. This involvement can
happen at the level of design engagement in the purpose-driven
activity of co-designing your own home, as well as through the deep participation of pursuing design as a form of serious leisure. Both of these help foster emotional resilience through feelings of control and a sense of agency, and help increase life's meaning and purpose.

For example, one of the most difficult stages of growing old is having to move out of the family home and into a more age-friendly residence. Leaving behind familiar spaces and long-term memories for something new and different is typically very stressful, even traumatic for older individuals. The FABstudio process can help make this transition easier to manage because the individual is moving into a home that they had an active role in creating. Instead of seeing the move as a loss, or a narrowing of life's choices, the opportunity and excitement of being involved in the co-design of their new home can be a positive step towards creating a new future. For a smaller group of older individuals, the benefits of this process may blossom into a serious leisure activity that gives the additional benefits of a sense of belonging and purpose. Deborah Rutman and Jonathan Freedman's study of older individuals anticipating relocation found that the ability to maintain independence and the ability to exercise control over their environment are as highly rated descriptors of home as meaning, comfort, familiarity, and security. 79

FABstudio is the second component of Future Adaptive Building's three-part strategy to build age-in-place resilience in older individuals. In the next chapter, I'll discuss how the FAB+ components seamlessly integrate into the FABmodular layout to enable increasing levels of medical support without jeopardizing the essential domestic character of the home.

51. Levy, "Longevity Increased by Positive Self-Perceptions of Aging," 268
52. Friedman, "Peeking Through the Keyhole," 125
53. Borgmann, Albert, Technology and the Character of Contemporary Life," 41
54. Borgmann, Albert, Technology and the Character of Contemporary Life," 42
55. Archer, "Architecture and Suburbia," 292
56. Borgmann, Albert, Technology and the Character of Contemporary Life," 51
57. Ibid., 205
59. Honoree, "In Praise of Slow." 5.
60. http://www.slowfood.com
61. Borgmann, Albert, Technology and the Character of Contemporary Life," 219
62. Ibid., 204
63. Waliczek, "The Influence of Gardening Activities," 1360
64. Ibid., 1363
66. Ibid., loc. 464
67. Ibid., loc. 470
68. Ibid., loc. 1109
69. Marr, "Canadians Spending More on Fixing Homes"
70. Piroozfar, "Mass Customization and Architecture." 25
71. Franke, "The I Designed It Myself Effect," 137
72. Stebbins, "Serious Leisure," loc. 1152
73. Stebbins, "Serious Leisure," loc. 335
74. Hutchison, "Gifts of the Ordinary," 5
75. Franke, "Complementing Mass Customization Toolkits," 548
76. Mannell, "High Investment Activity and Life Satisfaction," 130
77. Piroozfar, "Mass Customization and Architecture." 25
78. Franke, "Complementing Mass Customization Toolkits," 547
79. Rutman, "Anticipating Relocation"
Growing old isn’t easy. Aging-in-place isn’t just about retirement freedom and the promise of new hobbies. Advancing years bring with them the inevitability of decline. One way or another, we have to face the probability of increasing disability and disease and the prospect of our own demise. Some of us will stay healthy and vigorous for most of our senior years, while others will experience various combinations of physical disability that limit movement and reach, cognitive challenges that threaten memory and capacity, and chronic illness and terminal disease that require advanced medical care.

FAB+ helps older individuals cope with these challenges while they continue to live well at home. The FAB+ system helps to ensure that the home maintains a high quality domestic environment that’s only minimally impacted by the intrusion of increasing levels of physical support and medical care.

FAB+ is the third component of Future Adaptive Building. At the most basic level of tangible building components, FAB+ is a series of physical safety systems and specialized medical care modules that can be added into the FABmodular interior layout on an as-needed basis. These include grab bars to protect residents against falls and cabinets where they can store medical equipment and supplies. FAB+ also encompasses strategies for integrating the spatial requirements of caregiving into the social realm of domestic life. These typically require subtle modifications to the size and spatial boundaries of a room in order to make it easier to deliver homecare to the resident. Finally, FAB+ also involves adaptations to the digital realm of FABstudio to help compensate for changes in cognitive capacity.

This chapter builds on my collaborative research experience at the University of Calgary’s Design Research Innovation Lab and the practice-based research at Housebrand that I described in Part I.

I begin with a theoretical investigation into the “geography of care,” and examine the disputed terrain between this medical realm of the modern healthcare industry and the world of the resident, what I call the “geography of the domestic.” After developing a taxonomy, or landscape, of the medical support conditions required to age-in-place, I switch from the “what” of health care to the “how” of seamlessly negotiating these external factors into the domestic space of the home. The chapter concludes with a speculative application of the FAB+ system in the case study project from the previous two chapters.

It’s important to note that, like FABstudio, much of the FAB+ system remains to be executed. The mobility and functional disability components have been prototyped in the early models of the Laneway house. Some of these are being implemented in Laneway III for in-situ testing in early 2017.

The integration of the advanced medical equipment and vital signs monitoring remain in the concept phase and will be developed in close coordination with medical researchers in late 2017.
Physical Resilience

Performance Objectives

Physical resilience is the ability to manage the stresses associated with physical and cognitive decline, chronic disease, and critical illness. FAB+ is based on two performance objectives that build physical resilience for effective aging-in-place. The first performance objective is Tailored Support, which is the ability of the house to provide the specific medical and health-related assistance required by the resident as, and when, needed. The second performance objective is Seamless Accommodation, which ensures that the necessary health-related supports are integrated into the home with minimal disruption to its domesticity.

Tailored supports include physical accommodations for mobility and other forms of functional disability, cognitive supports in both the physical environment of the home and its operations, and the provision of medical equipment and regimes of care for both chronic disease and critical illness. Seamless accommodation includes the preservation of the home’s essential domestic quality, minimizing the impact of health technology on the rhythms of daily life for the resident, as well as the ability of home-health providers to deliver care. These performance objectives are met through changes to the physical nature of the home, or “building as a noun”, as well as to the digital interface controlling its design and operation, or “building as a verb.”

In many ways, for the resident, coping with the physical and cognitive impairments associated with aging is a much broader task than maintaining functional and emotional resilience. For example, if an older person doesn’t have the physical capacity to live independently, there is not much point worrying about the layout of spaces or becoming involved in a community of co-designers. As anyone who has ever suffered from a significant ailment or physical impairment knows, life very quickly becomes refracted through the lens of illness or disability.

At the same time, the tactics required for an older person to maintain physical resilience are much smaller than those required to maintain functional and emotional resilience. The environmental adaptations are usually more modest and intimate in scale. Increasing physical resilience in a resident relies on a minute level of fine-tuning of the house so that it can better accommodate a highly individualized set of needs that change as health conditions continue to evolve.

The FAB+ system is designed to manage both the large and small scales of physical resilience. Through its tailored support and seamless accommodation performance objectives, it helps to enable older residents to continue to live well and independently in the face of increasing medical needs.

Disrupting Home

My brother-in-law came to live with us in 2014 when his cancer had advanced to the point that he could no longer manage living in his own house, and we had a guest-room and bath in our basement. He arrived with a box of portable oxygen cylinders, two full-size oxygen concentrators, several hundred feet of air tubing, an antibiotic intravenous pump and IV pole, boxes of syringes, bandages, 12 separate medications that needed to be taken at different times of the day and with various regimes for food and drink before and after each dose. Within an hour of his arrival, there was a spider’s web of oxygen tubing snaking through the basement, along the staircase and the main floor of our house. It quickly became clear that this was going to be a new kind of domestic experience. The bedroom that had easily held all of my teenage daughter’s busy life quickly felt small and cramped when filled with all of this equipment, as well as an added work surface for medication and medical supplies.

As the disease progressed and he developed mobility issues, the bathroom became a dangerous and difficult place for him to use – particularly when a home caregiver had to assist him with personal care. When it became too taxing for him to walk upstairs, much of our family life moved down to his bedroom, which felt even smaller when four to six people gathered nightly to talk and watch television. With increasing cognitive decline, he began to forget that he had taken his pills and we had to store and organize the medicines and supplies in a different room. Eventually we assumed responsibility for managing his multiple medications, which, by this time, included daily injections.

But it wasn’t just the physical layout of the house that was challenging. Attached to all of the sophisticated medical
technology and medication was a cohort of health care staff, including physicians, nurses, aides, blood work technicians, physiotherapists, and personal care helpers. These people weren’t visiting for pleasure. My brother-in-law’s bedroom, bathroom, and even our kitchen and living room were transformed into places where these professionals worked. I was surprised to see how this changed the power dynamic in the house, not just for the patient, but for all of us.

For the last few weeks of life, my brother-in-law was transferred to a hospice. This was a residentially styled facility that didn’t feel like a health care institution. After having witnessed the difficulty of having significant levels of care provided in a domestic setting, I was surprised to see how big a difference a few small changes in room size, spatial layout, and storage detailing could make in the ability to provide nursing care. In hindsight, had I been able to make these adaptations to our home, I am confident that my brother-in-law could have remained with us until the end.

Bringing Care Home

The provision of significant levels of care in the home is becoming more common, particularly as governments look for ways to curb the skyrocketing cost of health care. It’s certainly not a new phenomenon, however. For most of human history, care of the sick and dying occurred at home. As late as the 19th century, “when families hired physicians or nurses, professional care was delivered in the patient’s home, most often with the assistance of female family members, neighbors or occasionally a servant.”

Looking after a person who was sick or dying was part of domestic life, “guided by family traditions and the advice found in the medical or nursing manuals of the day.”

Hospitals were originally created to care for the homeless, the poor, and others who did not have access to the social support and resources of family. This slowly started to change, and “by the 1920s, hospitals were recast from a place of last resort for the urban poor into a medical center for everyone.” By the end of the 20th century, the acute care hospital had become the preeminent place for sickness, and home was relegated to the place you went when “there was nothing more that could be done.”

More recently, the pendulum has started to swing back in the other direction, and the home is beginning to once again play a larger and more significant role in the care of the ill and aged. But this comes with a proviso.

“Because the intervening century has made profound changes not only in health but also in how we see ourselves, we should not be deceived into thinking that the return to home will be some nostalgic image we hold of the past. Into the homes of the 21st century will go the products of the last 100 years of technology and therapeutics. These are not isolated artifacts but intimate parts of our health care described as an interconnected, institutionalized system of profit, research, patient care, and physician reproduction.”

Home health care in the 21st century extends well beyond the visits of a district nurse. It now includes services from various levels of the health care system, including registered nurses, licensed practical nurses, nursing aides, occupational and physical therapists, nutritionists, specialist technicians, and personal care providers as well as medical equipment and supplies, monitoring technologies, and diagnostic devices. The technology is increasingly being digitally connected to provide a continuous data stream of information back to the health care team and web-based consults into the home are becoming more common. “Technological home care may resemble a miniature intensive care unit or small clinic where a family in their home manages ventilation, oxygen, nutrition support, dialysis, venous or intra-spinal infusion and cardiopulmonary monitoring.”

While this advanced technology is a pre-requisite for many older adults to remain living independently, “it also imposes heavy restrictions that are intimately interwoven with the characteristics of the disease itself and with the patient’s own life trajectory.”

Contested Agency

The result is an uneasy collision between the institution of modern medicine and the cultural norms of home. Much of this has to do with agency. In a hospital setting, the physical environment is a standardized work environment under the sole control of the health care system. As anyone who has been admitted to
hospital knows, patients are “guests” of the institution and have very little control over their environment, what they eat, what they do, and what is done to them. When our medical situation is critical, we’re more than happy to cede this control to a system that will do its best to keep us alive. When the conditions are chronic and long-term, as they often are in old age, this trade-off is more questionable. The situation becomes particularly problematic when care shifts to the private setting of home.

In a home environment, the power dynamics between resident and caregiver are more fluid. “Although the patients are the ‘owners’ of their homes, the nurses are the ‘owners’ of medical knowledge and thereby maintain a position of power in their relationship with patients. The result is an asymmetrical relationship as patients may move in and out of the roles of being the active partner and the passive recipient of health care, depending on circumstances.”

In some ways, this situation parallels the broader cultural shift from craft to mass production and consumption that I’ve discussed in the previous two chapters. Medicine has not been immune to the false promise of modernism. Many critics have observed the problems that have emerged over the past 60 years of modern medicine. Examples include the transition from individual family physicians to health care industry workers, the commodification of services by insurance companies, a focus on illness rather than well-being, and a heavy reliance on testing and quantifiable analysis for diagnosis rather than long-term personal relationships.

The rising popularity of holistic and alternative medical practice is part of a so-called “slow medicine” movement that seeks to address these problems. Recent work on the moral geography of care suggests that home health care could be at the vanguard of this new approach to medical care.

The Moral Geography of Home

Writing about the ethics of home care nursing, Joan Liaschenko first developed the idea of a “moral geography of home care” in 2001.

“I take the moral geography of home care to be the nature and quality of the relationships necessary to sustain the person in that particular place. The number and level of these relationships can be complex, including relationships between those who reside in the particular residence, between the care providers and the patient, and between the care providers and the others who live there. They also include the relationships between the individual care provider and other providers and between the care provider and the agency in general.”

Liaschenko’s work illuminates the contested terrain in the social space of the house that results from this clash of control and agency confusion between the resident and the care worker. Her use of a spatial metaphor to describe this clash is particularly apt. We all have a spatial intelligence based on cultural norms that helps us negotiate the public/private boundaries of buildings. For example, when invited into a stranger’s house as a guest, we have no hesitation walking into the living room or kitchen. We also have a common understanding of the location in the plan where the “public” zone ends, and beyond which we no longer feel free to go without permission. We would typically ask permission before going into the guest bathroom, and only visit the bedrooms and other bathrooms when accompanied by the resident. Closets and cupboards are a no-go zone.

Consider how transgressive the actions of a home care worker feel, to both the nurse and the resident, when bathrooms and bedrooms become places of work and objects of use must be retrieved from various cupboards. Fortunately, architects are quite adept at manipulating public/private boundaries. One of the important tasks of the FAB+ system is to re-articulate these boundaries in a manner that allows care workers to complete their tasks without diminishing the dignity and control of the resident.

For example, in the Laneway House II project described in Part I, the bathroom is segmented into two compartments to refocus the privacy boundary associated with the entire bathroom into just the toilet and shower compartment. The space for the bathroom sink and counter is recast into a more public type of domestic space. This spatial negotiation allows the resident to maintain agency over who is allowed into the private bathroom...
area, while still enabling the home care worker to feel comfortable using the space in front of the sink.

Other examples of this kind of social negotiation between resident and health care industry in the Laneway House II project include the use of standardized medical modules and a locked supply cabinet that are clearly the purview of the health care professional. The resident is empowered with the ability to decide where these cabinets are located and the design of their exterior finishes and cabinet style. On the digital side, health industry technology continuously collects the vital signs data of the resident, but the information is owned by the resident. He or she can then designate how it’s distributed and to whom it’s provided.

This close reading of the Laneway House project indicates that there’s more at stake here than just the “moral” geography of care. In fact, there’s a multi-dimensional geography for caregiving that encompasses not just the social realm but also the physical and digital realms. This parallels a similar “geography of the domestic.” As I’ve demonstrated in the last two chapters, our homes are also a complex composition of physical, social, and digital realms. Conceptually overlaying these two landscapes – those of care and the domestic -- reveals the areas of tension and dispute that arise between the medical world of equipment, people, and information, and a residential world defined by the right to privacy, dignity, and control. This contested terrain is not a unidimensional condition where the needs of health care overwhelm the rights of the individual. The rights of the resident also undermine the efficient delivery of care, and the rights of medical professionals to complete their work efficiently and effectively. The contested terrain of home health care is accurately understood as a dense and nuanced interplay of two parallel conditions.

The nursing theorist Gavin Andrews describes the situation. “Home is traditionally characterized by a particular set of purposes, events and social interactions. In this respect, health care and nursing potentially alter these events and thus the intention, or ‘aboutness’ of a home. In both cases, nursing affects the meaning and function of a place and the opposite is also true, that a place changes the meaning and function of nursing.” The ability of
the resident to successfully negotiate these contested conditions is a prerequisite for the successful implementation of home care and the building of physical resilience in the older resident. The two age-in-place performance objectives – tailored support and seamless accommodation -- describe the “what” and the “how” by which this negotiation occurs.

**Tailored Support**

Fig 90 maps out the geography of care encompassed by the FAB+ system. Each element is a point of potential healthcare support that could be provided to an older individual. I deliberately use the term “support,” because of its architectural reading as a structural component. Each support point within the geography of care is an available strategy for enabling physical resilience.

The social realm of care includes all of the various types of formal caregivers who are employees of the healthcare industry. The Conference Board estimates that total spending on home and community care in 2010 was between $8.9 -10.5 billion (CDN), accounting for between 4.6 and 5.5 per cent of total health spending in Canada. An equally significant, but often overlooked, type of care is the unpaid informal support provided by family members, spouses, and community volunteers. Over three million Canadians are estimated to have provided some level of unpaid service to home care recipients during 2007, with the amount of care exceeding 1.5 billion hours, more than 10 times the number of paid hours.

The physical care realm consists of the technologies that caregivers and residents use to provide medical therapies such as oxygen, renal, intravenous, and parenteral nutrition. Also included are the various accommodations required for daily living, including accessibility, mobility, functional and cognitive accommodations, and physical exercise.

The digital realm of care includes all of the medical monitoring and sensing technologies, as well as the accommodations made in FABstudio to manage the digital interface for the co-design and co-manage activities.

Fortunately, not all of these points of care are required at any given time for any particular resident. Rather, each older person’s health and ability profile determines which specific supports are required. These requirements will change as time moves on and health conditions evolve. These points of care are similar to the distributed multi-functionality model of the smartphone that formed the basis of the FABmodular system of cabinetry assets. In the same way that different sub-sets of assets (microphone,

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![Fig. 89 Distributed Multi-Functionality Model of FAB+ Supports](image-url)
Chapter 5: FAB+

Fig. 90 Geography of Care Concept Model

Older Resident

Medical Monitoring
- Functional Support
- Dietary Support
- Physical Therapy
- Social Work

Daily Living
- Eating
- Cooking
- Cleaning
- Personal Care

Physical Space
- Mobility Support
- Intravenous Therapy
- Oxygen Therapy

Digital Space
- Tele-medicine
- Electro-Cardiogram
- Gait

Social Space
- Friends
- Family
- Spouse

Imperial Care
- Homecare Aid
- Registered Nurse
- Occupational Therapist
- Medical Technicians

Fig. 90 Geography of Care Concept Model
light, speaker, etc.) coalesce into different apps (phone, camera, heart monitor, etc.), the particular points of care coalesce into a network of tailored support strategies individualized to the needs of the older resident. For example, a person with mild arthritis, using a wheelchair, and suffering from chronic obstructive pulmonary disease, requires a different combination of tailored supports than someone with early dementia, renal failure, and moderate mobility issues.

A Finer Grained Adjustment

Earlier in this document, I used the Person-Environment Fit diagram from the Ecological Theory of Aging to describe how Future Adaptive Building can adjust the demands of the home to fit the changing capacity of the older resident. An example of this within FAB+ is the addition of grab bars in the kitchen to modify the physical environment of a resident with mobility challenges. But the reverse is also true. The medically oriented tailored supports actually help to increase the capacity of the person, instead of the environment. For example, an oxygen therapy module makes it easier for a resident suffering from COPD to stand at the kitchen and cook. FAB+ combines both kinds of adaptation. At the FAB+ level, maintaining a good fit between the person and his or her environment is as much about adjusting the individual as it is the environment. The result is a carefully orchestrated set of tailored supports that combine environmental adjustments and health enhancements to help increase the physical resilience of the older resident.

The tailored supports provided by the FAB+ system create a finer grain adjustment to the Person - Environment fit than the broader scale of functional and spatial adaptations enabled by FABmodular. Fig. 91 zooms in on a portion of the original P-E fit diagram to illustrate the gap that the FAB+ system addresses. The scalar relationship between FAB+ and FABmodular is similar to the relationship between clothing and architecture. A shirt and a building envelope both offer layers of protection to keep us warm and dry. The enclosure of the shirt offers a closer and more intimate form of protection that complements and works within the enclosure of the building. In the same way, the FAB+ system works within the FABmodular system of spatial adaptability to provide a more intimately fine-tuned level of support to the stresses of growing old.

Fig. 91 FAB+ Contribution to Person-Environment Fit
Seamlessly Tailored

It's interesting to note that both the tailored support and seamless accommodation performance objectives of FAB+ use words that originate in the world of clothing. "Tailoring" and "seamless" refer to the adaptation process of fitting a piece of cloth to a particular body. Tailoring is an act, driven by the intention to transcend the one-size-fits-all tendencies of mass produced clothing. Seamlessness is a strategy within the realm of tailoring that describes the particular goal of obscuring, perhaps even making invisible, the work of the tailor, so as not to distract from the beauty of the finished garment.

This is a useful way to think about the distinction between the two performance objectives of physical resilience. Tailored support refers to the "what" of physical resilience. By this, I mean the specific set of social, physical, and digital aids that can help an older individual to age-in-place in the face of increasing physical, cognitive, and health issues. Seamless accommodation is the "how" of physical resilience, which refers to the way in which this tailored set of supports fits into the broader domestic world of the house. Seamless accommodation is the essential flip side of tailored support within Future Adaptive Building's broad objective of enabling well-being as people age-in-place.

Seamless accommodation, as a performance objective, negotiates the relationship between the geography of care and the geography of the domestic. It operates in the space between these two landscapes and is a strategy for resolving the conflicts that emerge in this disputed terrain. This is a two-way street. In addition to trying to make the medical interventions as unobtrusive and pervasive as possible so as not to disrupt the workings of the house, seamless accommodation also means recognizing the professional needs of the care providers to ensure that they have a place to work that is safe, efficient, and effective. At a more intangible level, seamless accommodation is about articulating and reinforcing the agency roles of resident and care provider so that the older individual has an appropriate level of dominion over his or her healthcare and home without jeopardizing the ability of the workers to provide the necessary levels of social support and medical care.

The work of nursing researcher Jan Angus suggests a framework for developing this dualistic notion of seamlessly accommodating both domestic life and professional care. In a 2005 ethnographic study, Angus and her team examined the physical, symbolic, and experiential aspects of receiving long-term care at home. “Although all of the care recipients and their family caregivers indicated a strong preference for home care over institutional care, their experiences and practices within their homes were disrupted and reconfigured by the insertion of logics emanating from the healthcare field.”

She observed that “illness and home-care service provision disrupted the intimate, co-constitutive relationship between self and home. The physical manifestations of illness, such as mobility limitations and diminished capacity for self-care, prompted an increasingly deliberative approach to occupancy of the home. This loss of an assumptive flow to everyday activity disrupted a practical sense long sedimented in the relationship between care recipients' bodies and the spaces and meanings of home.”

Angus identified two themes - the politics of aesthetics, and transcending the limitations of the home - that serve as an effective framework for describing the seamless accommodation performance objective for enhancing physical resilience.

The Aesthetics of Healthcare

It should surprise no one that Angus identified as an issue, the substantive difference between the design intentions of a healthcare space and those of a home.

“Driven by logics of expedience, cleanliness, standardisation and fiscal restriction, they (health care workers) are less focused on preserving comfort and sensory enjoyment than on the efficient execution of specific functions and procedures. Objects associated with healthcare are not decorative. They are constructed from materials that are durable, easy to clean and maintain. Their uses are concerned with bodily functions, which are usually secluded from sight, and they link the user with illness, infirmity and indignity.”
Medical equipment may one day be redesigned to better visually and physically fit into a home environment. In the meantime, FAB+ resolves the discordant aesthetics of healthcare by managing its location and storage in the home. Seamless accommodation means having purpose-designed storage cabinets for large items like dialysis machines and oxygen concentrators, moderately scaled items such as oxygen tubing and boxes of swabs or gloves, and small-scale items such as pill boxes and syringes. These medical storage cabinets integrate into the FABmodular system. When not in use, the equipment and its associated paraphernalia are concealed behind doors that match the rest of the house interior.

Seamless accommodation also means that functional disability aids, like the integrated grab bar system, are designed to visually and functionally integrate into the FABmodular system. Similarly, FAB+ wheelchair access modifications can be made to the bathroom and kitchen layout without disrupting the domestic feel of the home, by simply moving some of the FABmodular components to increase the floor area and swapping out the sink cabinets with a wheelchair accessible model.

Transcending the Limitations of Home

Angus also identified the tensions that arise when home care workers, in their delivery of care, must transgress the commonly understood privacy domestic boundaries for bathroom and bedroom spaces.

"While it is initially apparent that the physical structures of most homes and of rooms within homes are intended to bar intrusion and to delimit – or create boundaries around – the most intimate spaces, these arrangements become problematic and subtly altered when long-term home care is required. Most contemporary homes are not designed to accommodate the needs of the chronically ill and their care providers. Over time, the possibilities and limitations of the home shift with the health status, mobility and needs of the occupant(s). The significance of the home may similarly change – its meaning acquires new ambivalence and is continuously reconstituted. There is no coherent or fixed identity of place in such instances but a progressive one that nevertheless grounds itself in a powerful attachment to the dwelling." 86

This is a social issue defined by cultural norms about privacy. Designing the home to redefine privacy boundaries is the most effective way to eliminate these kinds of uncomfortable transgressions.

I’ve already described how the Laneway House bathroom is designed to be both a semi-public space of care and a private space for the resident. FAB+, in conjunction with the continuous adaptability of the FABmodular system, enables the privacy boundaries of the bathroom and the bedroom to be reconfigured if, or when, it becomes necessary.

Privacy boundary transgressions can also be much smaller and more intimate. For example, managing incontinence is not just a biological issue. While adult diapers can effectively deal with the primary issue, their storage and disposal remains a significant problem. Seamless accommodation means reducing the embarrassment and potential humiliation with a purpose-designed FAB+ storage cabinet that hides the boxes of supplies as well as refuse storage in a unit that matches the rest of the bathroom.

Transcending limitations can also include adjusting the size of the bedroom to seamlessly accommodate increased levels of care. Adjusting the location of the FABmodular cabinets increases the size of the room and creates more working-space around the bed. Purpose designed FAB+ bedside storage units also provide more open and closed storage space for the bed-ridden resident than a typical bedside table usually provides.

Such micro-level accommodations for a sedentary condition may also be needed in living areas. Many older residents spend the majority of their day in a living room chair. Angus observed that "the habitual placement of objects and resources by those with activity limitations is partially a matter of convenience but constitutes what Swenson refers to as a ‘center of reach’, or what others describe as a secure location from which to connect oneself with other people and other sites." 96

To accommodate situations like this, a specialized FAB+ chair-side storage cabinet can be quickly and easily integrated into the furniture layout of any FAB house.
Digital Accommodations

Until now, I’ve focused the discussion of tailored support and seamless accommodation on the physical and social realms of the house. But the virtual environment of FABstudio will also seamlessly accommodate different levels of physical and cognitive capacity, as well as technical ability. Seamless accommodation also extends to adjusting complexity of the visual interface and setting limits to the level of control.

The idea of digital adaptability is familiar territory for the developers of mass customization configurators such as the FABstudio DESIGN app. Manufacturing research shows that mass customization toolkits are proven to be most effective when the degree of fit of the product to the user’s needs is as high as possible, and the design effort required to achieve that result is as low as possible. To gain any benefit, the user must be able to perform the task without getting lost or frustrated. Researchers use the term “flow” to describe this matching of system challenge to user capability. “Flow is the process of optimal experience achieved when motivated users perceive a balance between their skills and the challenge at hand during an interaction process.”

For example, to ensure that flow is achieved across the spectrum of ability, the DESIGN App will be configured to accommodate varying levels of cognitive and technological ability. For some, a fully engaged process might start with a blank slate of base building parameters and proceed through a guided set of steps to identify priorities, develop an optimal spatial layout, choose appropriate functional cabinetry, and finally, select desired finishes. For those with more limited capacity, the interface would change to a “needs matching strategy in which software automatically builds configurations for customers by matching models of their needs with characteristics of existing solution spaces (i.e. sets of options). Then customers only have to evaluate the predefined configurations, which saves considerable effort and time in the search process.” For those with very limited capacity, the design work would be completed by a family member or design consultant, and the options shown to the resident for comment and approval.

Cognitive Support

Some degree of cognitive deterioration commonly occurs with aging. As just described, mild levels of decline can be accommodated with adjustments to Flow in both physical and digital space. Dementia is a much more serious manifestation that can seriously impact the ability of someone to successfully age-in-place. “Dementia is a symptom of several acquired, progressive, life-limiting disorders that erase memory and alter the person’s usual way of interacting with the world. Alzheimer’s disease is the most common progressive dimension.” Worldwide, the number of people living with dementia is expected to double every twenty years to 65.7 million in 2030 and 115.4 million in 2050.

Although all older adults have an increased risk of home-based accident and injury, those with dementia are at an even greater risk because the disease causes additional cognitive and functional impairments. Research has shown that family members and informal caregivers “may lack insight into how cognitive deficits impact the way people with dementia navigate their environments.” A lack of understanding about how to make the home safer is the most commonly stated barrier preventing caregivers from making appropriate physical accommodations for dementia.

Researcher Ann Hurley and her collaborators developed a Home Safety/Injury Model to help address this concern. The model is based on Social Cognitive Theory and places the person with dementia in a relationship to what they call a safety platform. “The safety platform constitutes a reasonably protected haven for the person with dementia through making the physical environment safer and increasing caregiver competence.” The model bears a striking resemblance to the ecological theory of aging. In Hurley’s model, the reduced cognitive capacity of the person is compensated for by an expanded definition of environment that encompasses both the physical environment and regimes of care, particularly by family members and other informal caregivers. As the disease progresses, changes to either, or both, the physical and caregiving environment ensure
that the best P-E (Person-Environment) fit is maintained. In other words, the combination of physical and caregiving contexts provides the affordance of safety and wellbeing for people with dementia.

FAB+ incorporates Hurley’s strategy and accommodates cognitive support using mobility, stability, and functional disability aids as well as minor adaptations to the modular cabinetry. These adaptations include the addition of locks on any/all components and memory aids on cabinet doors. To address the knowledge gap with family caregivers, FABstudio will have a meta-level algorithm based on a Home Safety Dementia Checklist to help guide the layout design process to reduce complexity, ensure clear pathways, and reduce tripping hazards. The algorithm will also apply to the operational management of the home, including adjustments to the water temperature, restricting appliance functionality, disabling thermostats, and activating perimeter security.

Cognitive issues, ranging from mild to severe, necessarily start to shift homeowner agency to family caregivers. The degree of this shift depends on the level of impairment and its deterioration over time. Managing the transfer of control so that it consistently matches the ability of the homeowner helps to retain physical resilience. FAB, as both physical components and co-design strategy, helps the homeowner, family caregivers, and the health care team to manage this transfer of responsibility in as seamless, safe, and compassionate a manner as possible.

**Integrating Remote Monitoring**

No discussion of home health care for aging-in-place would be complete without mention of the recent explosion in home health monitoring and home-automation technologies. Advances in digital technology have spawned a new branch of science called “Gerontechnology” that creates advanced tools to help older individuals live independently. The term “smart home” refers to a residence that has been enabled with these technologies to increase safety and reduce health risks.

“Smart homes can include all kinds of technologies, from unspecific sensors for comfort, energy efficiency, safety (such as cooking gas detection with automatic shut-off and water temperature sensors) and security, to connectedness technology (e.g. a portal that provides members with web access to health and social information, and visiophonic communication). Depending on the objectives, it can also use activity monitoring (e.g. pressure sensors in the bed or on the floor, ultrasonic or infrared sensors, and locator badges), systems for fall detection and prevention (such as automatic lighting), reminder/promoting technologies (audio, video), physiological monitoring (e.g. weight, temperature), BPSD monitoring (video, audio, infrared sensors, magnetic switches).”

Home health monitoring can provide a much-needed early warning system to alert caregivers and the health care team to changes in vital signs that precede dramatic medical events. These include built-in weigh scales to monitor for rapid weight gain or loss, sensored floors that monitor gait and stability and wearable technologies that that help monitor levels of hydration. Almost all of current Gerontechnology is compact, portable, and wireless-enabled. It’s specifically designed to be installed in any existing domestic environment. As such, FAB+ doesn’t require any physical modifications in order to accommodate these systems. From a design and construction point of view, these technologies are like home entertainment systems – third party products that are specified by the architect in consultation with an expert vendor and installed immediately prior to project completion.

Research has demonstrated the positive impact of these technologies on health outcomes. “The evidence supports that home health-monitoring technologies for cognitive decline and mental health reduce symptoms of depression and visits to the emergency department in older adults with chronic illness.” At the same time, there are privacy concerns for the resident and security concerns about the collected data. Other barriers that currently limit a broader level of implementation include, “complexity of the technologies (installation, training, maintenance, lack of interconnectivity between the different systems and interoperability to guarantee continuity of information), high costs, low acceptance from end-users (usability, intrusiveness), inadequate comprehension of user needs (technology-push rather than demand-pull approach), and sometimes ethical issues (stigmatization, intrusiveness).”
The FAB+ system overcomes many of these limitations. As with other FAB+ components, members of the health care team can input meta-level specifications on the necessary types of Gerontechnology that should be installed in the house. To reduce complexity and reinforce homeowner agency, FABstudio includes a graphic interface that coordinates the operation and management of these approved systems and integrates all of the controls into one easy-to-use location.

FAB+ in Practice

To tangibly illustrate how the performance objectives of tailored support and seamless accommodation enable increased physical resilience for older residents, I conclude this chapter with three speculative deployments of the FAB+ system in the case study high rise residence.

The first is a slight modification of the case study layout developed in the FABmodular chapter to adapt the home to accommodate mobility and stability concerns, as well as functional disabilities to bend down and reach up. The second layout extends the modifications to create a layout that’s fully wheelchair-accessible. The final layout adapts the unit to accommodate the provision of significant health care to a bed-ridden resident.

These three options provide specific deployments of a general system. The FAB+ details described in the case study could be combined into any required customized configuration. As the resident ages and his or her health care needs evolve, the FAB+ accommodations can also shift. A particular resident could conceivably require all three example layouts in succession over time. And, when the resident’s tenure in the home is complete, the interior can be quickly and easily reset to the needs of another older individual.

Layout 4 – Mobility and Functional Disability

Mobility and stability issues increase with age and are a major cause of falls. To mitigate this risk, many older individuals use
canes (35%) and walkers (27%). The integrated grab bar system in FAB+ can provide sufficient support to allow these people to leave these aids at the front door. Sections of grab bar can be easily locked into a continuous support hidden within the cabinetry to provide stability and walking assistance in functional areas such as the kitchen and bathroom.

The grab bar is integrated into the design of the cabinetry and visually reads as a towel bar rather than a medical device. The grab bar also works with the interior support system on the exterior of all FAB cabinets to provide additional handrail support, for example, beside the bed or at the front entry. Depending on the size and spatial layout of the house, the grab bar can also be deployed in hallways and other circulation zones to provide continuous runs of support.

In the case study example, the FAB+ grab bars have been deployed at the front entry, along the central millwork cabinetry wall, as well as in the kitchen, dining area and bathroom.

The combination of front entry and central millwork deployment creates a continuous run handhold support in the main circulation zone of the house. A horizontal window mullion set at 36" above the floor allows the grab bars to be connected along the bedroom and living room window walls.

The FAB+ grab bar system can be specified in FABstudio in two different ways. At a meta-level, an occupational therapist can specify a global pre-set prior to the resident starting the design of his or her interior. Selecting this feature at the meta-level ensures that all design configurations created by the homeowner include the grab bar detail by default.

If the need for mobility support develops after the initial design configuration, the resident, working in collaboration with the occupational therapist, can add them at any time in the future.

The layout also includes the addition of a sliding glass room divider in the bathroom to separate the private area of the toilet and shower from the bathroom sink zone. This provides a fall protection wall when using the sink, and shifts the privacy boundary of the bathroom to the toilet and shower area, in a manner similar to the Laneway House II project.

### Enabling Exercise and Physical Therapy

As mobility deteriorates, older individuals tend to reduce or discontinue previous outside activities and spend more time at home. Regular exercise programs such as group fitness and swimming often fall victim to this change in behaviour. This can lead to a further decline in physical performance. Studies show that lack of exercise in seniors is associated with future disability, morbidity, nursing home admissions, and death.

A British study of occupational therapists delivering physical therapy in home environments looked at the views of both the patients and the therapists to determine the acceptability of this model of service delivery. From the patient’s perspective, convenience, comfort, and a feeling of relaxation were the primary advantages of receiving therapy at home. From the therapist’s perspective, all of the subjects saw the opportunity to design more individualized programs based on their assessment of the home environment to be an advantage. A major disadvantage from the patient’s point of view when receiving occupational therapy at home was the lack of appropriate equipment and sufficient space to work. “Equipment found within the hospital setting was considered ‘more effective’, ‘better’ and ‘safer’.”

To overcome this obstacle, the FAB+ system will include a series of dedicated exercise modules that provide storage for mats and weights, as well as built-in flexibility- and strength-training equipment tailored to an individual’s specific fitness regime.

In the case study unit, the end wardrobe cabinet has been switched out to a physical therapy unit. The cabinet opens onto the circulation zone, which has sufficient clear space in front to accommodate a yoga mat and a physical therapy helper. The result is a light-filled exercise space that seamlessly disappears when the therapy is complete.

In FABstudio, the occupational therapist will be able to specify, at a meta-level, which module is most appropriate for the resident. The resident would co-design the placement of the module in the location of their choice. Algorithms in the system restrict placement of the modules to only those areas in the floor plan that have sufficient floor area for the type of exercise program enabled by the module.
Adapting for Functional Disability

The ability to reach up or bend down to access storage is the most common physical limitation, after mobility, that negatively affects the way that older individuals use their home. As we age, we lose height because of a shrinkage of cartilage in the spine. This averages 5% for men and 6% for women. When combined with decreasing range of motion in our shoulders and elbows, as well as a loss of upper body strength, the comfortable zone of reach for above-counter storage becomes much smaller as we age. At the same time, arthritis, lower back stiffness, limited knee movement, and loss of leg strength reduce our ability to access under-counter storage. Both upper and lower counter reach is even more significantly restricted for those in wheelchairs.

In the case study example, the kitchen peninsula counter layout option from the FABmodular chapter has been replaced with a tall pantry storage cabinet to increase the amount of waist-height storage. Depending on the resident’s preference, a portion of this storage capacity could face out to the dining area. In the modular wardrobe units, the interiors would be fitted with a combination of pull-down hanging rods and waist-height drawers. All of the cabinet doors could be equipped with mechanically powered openers and touch-latch mechanisms to compensate for diminished hand strength and advanced arthritis.

In FABstudio, the health care team can activate a meta-level setting to ensure that only reach-appropriate cabinet types and locations can be selected during the co-design process with a resident who has functional disability issues. Should reach issues emerge at any time after the initial design has been deployed, the modular cabinets in the kitchen, bathroom, and bedrooms can be easily replaced or adjusted in height to suit the evolving ergonomic requirements of the user.

Layout 5 – Wheelchair Accessibility

There’s a common misconception that an age-friendly house should be designed according to the accessibility standards for wheelchair use. While “adults 65 years of age and over are 4 times more likely than the total population to use wheelchairs,” a recent Canadian study indicates that only 4.6 per cent of seniors living in the community used a wheelchair. It’s interesting, and also somewhat disturbing, that this number jumps to 50 per cent for those seniors in institutionalized care.
The small number of wheelchair users compared to those requiring mobility and stability aids has important implications for age-in-place residential design. The dimensions of a wheelchair require much larger areas of open space for maneuverability, but this additional space is highly problematic for the majority of the older population who use canes and walkers. As demonstrated in the previous section, frail and unsteady individuals benefit from having furniture and architectural elements such as cabinets close at hand to use for support as they move through a space. A FAB house accommodates both needs through an adjustable spatial layout. The modifications are easily accomplished and completely reversible should the homeowner only require a wheelchair for a limited period of time, for example, during recovery from a fall or medical procedure.

To make the bathroom of the case study unit wheelchair accessible, the bathroom door is located off the circulation zone rather than the bedroom to maximize the amount of manoeuvring space in front of the door. The size of the bathroom cabinetry units has been reduced to create a larger floor area in the bathroom for turning the chair. The modular sink cabinet can be easily switched out with either a lower height unit designed for wheelchair use, or a mechanically controlled sit-stand countertop, whose height can be adjusted to accommodate the needs of different members of the household. Removing the glass shower panel between the toilet and the shower makes both the toilet and the shower accessible by wheelchair.

In the bedroom, the wardrobe cabinets adjacent to the living area have been replaced with narrow bookcase modules to increase the floor area of the bedroom and to make it easier to manoeuvre a wheelchair beside the bed.

In the kitchen, the counter adjacent to the hallway has been removed to create easy wheelchair access to the kitchen and open up the floor area by the front entry. If this layout was required at the time of initial layout, a global pre-set by the health care team would restrict the cabinetry options to those specifically intended for wheelchair use. If the need for a wheelchair were to arise after the initial deployment, the traditional cabinet units could be easily and quickly switched out.
Layout 6 – Advanced Care at Home

The final layout contemplates a situation in which the resident is largely bed-ridden and requires medical equipment to support increasingly complex regimes of nursing care. The location of the bedroom and living room have been swapped so that the best, and largest, space in the unit is devoted to the care bed. The kitchen is located in the middle of the plan to create a secondary bedroom space at the back of the unit for a spouse or live-in caregiver. The bathroom is wheelchair accessible.

The bedroom has a series of FAB+ medical cabinets located on either side of the bed. A false panel at the headboard provides a service space for any required tubing or equipment. These units would be specified by the resident’s health care team, based on the therapies and treatment that are required. The cabinets would have the same the architectural character as the other FABmodular components so that the medical technology blends as seamlessly as possible into the domestic space of the house. The standardized configuration provides care workers with a standardized set of health care tools to create a more familiar and efficient work environment.

Depending on the health needs of the resident, these could include one or more of the following: a respiratory module containing oxygen supplementation, non-invasive positive pressure ventilation (CPAP and BiPAP), and nebulized medications; a renal module containing equipment for home hemodialysis or peritoneal dialysis; a feeding module containing an IV support and ancillary equipment required for a nocturnal enteral feeding system via a nasogastric tube. The FAB+ system also includes two cabinet modules for storing general homecare supplies and equipment. If necessary, all of the medical cabinets can be locked for the exclusive use of homecare professionals.

In addition to accommodating the medical equipment in the FAB+ modules, the large bedroom space helps homecare workers to more effectively do their jobs. The open connection to the small living area redefines the privacy boundaries of a traditional bedroom and makes it easier and more acceptable for family members and visitors to spend time with the resident in a setting that is both living area and bedroom.

FABstudio provides an opportunity for the homeowner, his or her family, and the resident’s health care team to open up a conversation about how best to integrate these increased regimes of care into the home. The familiarity of the platform confers a level of control to homeowners that can reduce stress and help them through the difficult decision-making process of introducing more intrusive levels of medical care into their house.

Conclusion

FAB+ is the third component of Future Adaptive Building’s three-part strategy to build age-in-place resilience in older individuals. It helps to increase their physical resilience to the stresses of growing old as a complement to the functional resilience provided by FABmodular, and the emotional resilience enabled by FABstudio.

FAB+ is based on a geography of care model that organizes the various forms of medical support into three different realms – social, physical, and digital. Social supports are the informal and formal caregivers who offer assistance with daily living, physical exercise, and various types of medical therapies for both chronic disease and acute illness. Physical supports include modifications to the built environment to compensate for mobility problems and functional disabilities, as well as the specific medical equipment and supplies required for advanced levels of care. Digital supports include the operation of the smart home system that manages the home’s operation, the collection of sensing and health monitoring data, and the management of appliance safety controls for cognitively challenged residents.

With the FAB+ system, each resident receives a tailored selection of these support services to seamlessly accommodate their evolving health needs. Seamless accommodation reduces the friction that normally exists between the objects and procedures of health care and the domestic qualities of home. In the social realm, this is accomplished by managing the privacy boundaries in the house to ensure that the bathroom and the bedroom are perceived as acceptable places for homecare workers to work. In the physical realm, it includes changes to the organizational layout of the house and the size and shape of rooms to accommodate varying levels of care and physical disability.
It also includes the use of FAB+ cabinetry to store medical equipment and supplies in an unobtrusive manner that overrides the aesthetics of healthcare. In the digital realm, seamless accommodation is about managing the FABstudio interface to maximize flow for residents at a variety of levels of technical and cognitive competence.

Enabling physical resilience through the performance objectives of tailored support and seamless accommodation is not just about making the house safe when we become frail, or enabling health technologies to look after us as we become sick. Liaschenko argues that the goal of home care is “not merely in helping patients to stay alive or even healthy but in helping them to have a life. To have a life is to have a sense of agency, to occupy social and political space, to live a temporally structured existence, and to die. Protecting and fostering patient agency not only are part of this, but they are central to all the others.”

Within the broader concept of health as overall well-being and not just the absence of disease, tailored support and seamless accommodation help to ensure that older residents maintain a sense of independence, agency, dignity, and self-worth in the face of an increasing need for home health care.

80. Buhler-Wilkerson, “No Place Like Home,” 1
81. Ibid., 1
82. Ibid., 167
83. Liaschenko “The Moral Geography of Home Care,” 22
84. Ibid., 17
85. Smith, “Technology and Home Care,” 137
86. Lehoux, “The Use of Technology at Home,” 641
87. Öresland, “Nurses as Guests or Professionals in Home Health Care,” 380
88. Liaschenko, “The Moral Geography of Care Work,” 126
89. Andrews, “Locating a Geography of Nursing,” 244
90. Hermus, “Home and Community Care in Canada,” 25
91. Ibid
92. Angus, “The personal significance of home,” 161
93. Ibid., 182
94. Ibid., 171
95. Ibid., 178
96. Ibid., 180
98. Ibid
100. Horvath, “Clinical Trial of a Home Safety Toolkit for Alzheimer’s Disease,” 1
101. Ibid., 1
102. Hurley, “Promoting Safer Home Environments,” 47
103. Plau, “Aging Society and Gerontechnology” 108
104. Liu, Lili, “Smart Homes and Home Health Monitoring Technologies,” 55
105. Plau, “Aging Society and Gerontechnology,” 97
106. Clarke, “The Use of Mobility Devices Among Institutionalized Older Adults,” 612
108. Rogers, “Designing for an Aging Population,” 151
109. Clarke, “Wheelchair use among Community-Dwelling Older Adults,” 191-198
110. Clarke, “The Use of Mobility Devices Among Institutionalized Older Adults,” 612
111. Liaschenko, “The Moral Geography of Home Care,” 24
Conclusion

Situating Future Adaptive Building

The past empowers the present, and the groping footsteps leading to this present mark the pathways to the future.

-Mary Catherine Bateson

Future Adaptive Building is a new way of designing and building houses for an older population. It’s based on an ecological theory of aging that focuses on optimizing the relationship, or fit, between an older person and his or her environment. Resilience is a measure of how well this Person-Environment system manages the stress of change. Older individuals often experience dramatic, sudden, and unexpected changes in lifestyle, health, and physical and cognitive capacity. Living in a FAB-enabled home helps an older person to increase his or her functional, emotional, and physical resilience to the stress caused by the changes associated with growing old.

In Part I, I look back over a journey through my first 26 years of practice and the past four years of doctoral research. Running through all of this work is an unwavering belief in the power of a well-designed, beautifully modest home to improve the quality of everyday domestic life. A great home is about simple pleasures carefully enjoyed, rather than an extravagance of size, cost, or formal expression. This attitude forms the core of my approach to age-in-place design. Like eyeglasses, Future Adaptive Building seamlessly adds practical and medical assists into the home without diminishing its beauty, functionality, or essential domestic character.

But these are generalities. This review of my work also revealed five ideas, or touchstones, that helped shape the development of Future Adaptive Building and situate it within the narrative arc of my experience.

The first touchstone, identified in my early furniture work, is theoretical. These first built projects helped develop my overarching interest in using architecture to build a relationship between people, objects, and space. Design is an articulation and enabling of these relationships at least as much as it is the invention of built form. Housing became the natural venue for me to explore this intimate relationship between person and space. Affordance theory and the ecological theory of aging resonate with this design interest and connect it into the age-in-place agenda.

The second touchstone, emerging from my development of Housebrand, is more operational. I understood from my early attempts in private practice that the conventional models of “doing architecture” don’t usually connect with the real world of normative housing. Housebrand’s business model demonstrates the power of reaching beyond professional boundaries to aggregate diverse multi-disciplinary expertise into a single, coherent service-based process. The success of Housebrand is an important precedent for the interdisciplinary connections to medicine, nursing, and biomedical engineering, which contribute to the ongoing development of the FAB+ system.

The third touchstone, connected to the tailored home idea for renovating homes, is tactical in nature. The development of the tailored home strategy led me to decouple the interior layout from the exterior building shell. This helped me understand that the normative practice and process of layered wood frame construction is more of a cultural convention than a material limitation. Seeing the exterior shell as the permanent context or frame within which multiple interiors could be designed and built contributed to the notion of a continuously adaptable home.
The fourth touchstone connected to my development of the Slow Home movement, is strategic. The Slow Home experience taught me about the potential to employ design education as a form of public advocacy. FABstudio is a direct descendent of this “building as verb” idea. The lessons learned about how co-design can empower people to become more engaged with their domestic environment led to FABstudio’s role of building agency, independence, and purpose in the lives of older people.

The fifth and final touchstone is tactical. It builds on the dualistic notion of building shell and frame and emerged during my more recent analysis of smartphones. The conceptual framework of the smartphone illuminated a new way of thinking about the way in which objects of use can be designed, made, and used. The powerful flexibility of this assets-based model led to an exploration of modular mass customization, which became the basis for both the FABmodule and FAB+ systems.

In addition to the context of personal history, Future Adaptive Building is also situated in four broader frames of reference - the cultural manifestations of aging, the history of adaptable architecture, the realities of construction, and the financial demands of project development. The balance of the chapter examines each of these in turn.

By looking at FAB against the backdrop of aging as a socio-cultural phenomenon, I contextualize Future Adaptive Building within a growing stream of baby boom popular culture, articulating a new vision for growing old. Shifting the frame to architecture, I situate FAB within the 20th century history of adaptable architecture and the conventions of wood frame construction. The chapter concludes with brief speculation on how the application of FAB in practice could be situated in a time-based theory of construction, and the rigorous financial expectations of housing development.

**Situating FAB in Aging**

Future Adaptive Building sits within the cultural landscape of 21st century aging. Intertwined with the biological realities of growing old are the psycho-social realities of how we, both individually and collectively, come to terms with the inevitability of our mortality. Baby boomers are looking for new ways to age that do not involve the indignities that many older people have suffered over the past several decades. As a demographic cohort, we may not know what we want, but we definitely know that we don’t want to grow old like our grandparents and parents.

In the early 1980s, my grandmother was “put” in a nursing home by my parents because she could no longer manage to live in her apartment alone. This was, and still remains, the normal course of events for most people. My grandmother didn’t want to go to a place where nothing was familiar, which offered her little to do except watch TV and wait for the next meal of overcooked food. She missed her old home and, even more so, the independence that came with it – the ability to decide what and when she ate, when she got dressed, and when she went to bed.

The necessity of my grandmother’s move was driven more by the poor design of her apartment than the failing state of her health. Like most homes, her apartment was intended for someone who didn’t have trouble getting in and out of a bathtub, who thought nothing of reaching to an upper kitchen cabinet shelf for a cup or dish, and who didn’t need to be constantly connected to an oxygen concentrator through many feet of flexible tubing. I remember being shocked at the depressingly low quality of life this great woman had to endure in the last decade of her life. Nursing homes like hers have been labeled “warehouses” for the old and “junkyards” for the dying. US Representative David Pryor went so far as to proclaim them “halfway houses between society and the cemetery.”

The situation was equally distressing when it was my parents’ turn to grow old. Perhaps reminded of the challenges their own parents had faced, both my mother and father were determined to stay in the family home until the end. But again, their house was ill-suited to this goal. Originally purchased for a family with four growing children, the house was now over-sized for an aging two-person household. There were bedrooms that were never used, and living spaces that now sat neglected. The most frustrating, and dangerous, aspect of their living situation was that despite all of this excess space, they still had to manage a steep flight of stairs to take a shower or bathe. Looking back, I see that, in their minds, their determination to stay out of a
nursing home overshadowed the option of moving to a more suitable, but still independent, home. Over the years, their house started to deteriorate and, despite the provision of housekeeping and homecare services, became a depressing, hollowed-out version of itself; the kind of place neighborhood kids make fun of and avoid at Halloween. I think my siblings and I were blinded by the forcefulness of my father’s personality and his single-minded determination that the two of them would stay in their home, despite my mother’s dementia. We couldn’t see how untenable the situation had become until it was too late to do anything. By then, both had become too frail to cope with starting over in a new environment.

Neither of these are good examples of a successful conclusion to a well-lived life. They’re also not isolated stories. Since I started focusing my academic work on age-in-place housing, there’s hardly a person I’ve met who doesn’t have at least one story about a grandparent, parent, spouse, sibling, or friend whose final chapter did not go well. While many of these centre on some horror of long-term institutionalized care, almost as many are about loved ones trying to live independently but running into difficulties because their home wasn’t designed to suit the generalized needs of an older resident, or the specialized requirements of their individual situation.

Baby boomers do not want to go down this same road. The Flower Power cohort that redefined youth culture in the 1960s and 70s is now set to redefine what it means to grow old.

“The aging of the baby boom generation is noteworthy not only because of its size, but also because its members’ social and demographic profile contrasts sharply with earlier generations. Baby boomers are more highly educated, have a higher percentage of women in the labor force, are more likely to occupy professional and managerial positions, and are more racially and ethnically diverse than their predecessors. There are other differences between the generations. Higher rates of separation and divorce, and lower rates of marriage, mean that fewer baby boomers today belong to married-couple households, and more may experience greater financial hardship as a result. Compared to earlier generations, baby boomers also have fewer children.”  

In a study of Australian baby boomers, Susan Quine and Stacy Carter argue that in retirement, “boomers may refuse to accept that they are ‘old’, may be more ethnically heterogeneous, more selfish, socially polarized, demanding and belligerent, and less accepting, trusting, and conforming than their parents’ generation. They may prioritize being in control, freedom of expression and individuality, and may remain economically conservative but socially moderate swing voters. Boomers are commonly thought to ‘expect more’ from retirement than their parents’ generation.”

In their book, ‘The Third Act: A Baby Boomer’s Guide to Finishing Well,’ Dr. William Cook Jr. and Grant Fairley liken this period of life to the “sweet sorrow associated with the third act of a play. The intermission usually warns us that more than half the experience is over. When the curtain rises on the third act, you know that the journey with the characters and the story of the play will soon be done.” Cook and Fairley are part of a growing number of writers that includes psychologists, social workers, anthropologists, and celebrities like Gloria Steinem and Jane Fonda, who are advising baby boomers on how to re-think growing old.

Fonda, who showed us how to be an activist in the 1960s and spawned an exercise revolution in the 1980s, once again charts a path for her generation by recasting the theatrical metaphor of the Third Act into something more affirmational. “Envisioned this way, longevity becomes…like a symphony with echoes of different times recurring with slight modifications, as in music, across the life arc. Except that we don’t have the sheet music to this new symphony. We – today’s boomers and seniors – are the pioneer generations, the ones who need to compose together a template for how to maximize the potential of this amazing gift of time, so as to become whole, fully realized people over the longer life arc.” Fonda, crediting Rudolf Arnheim, uses the arch and the staircase to represent two conceptions of aging.

“One diagram, the arch, represents a biological concept, taking us from childhood to a middle peak of maturity, followed by a decline into infirmity. The other, a staircase, shows our potential for upward progression toward wisdom, spiritual growth, learning – toward, in other words, consciousness and soul...
Our youth-obsessed culture encourages us to focus on the arch – age as physical decline – more than on the stairway – age as potential for continued development and ascent. But it is the stairway that points to life’s later promise, even in the face of physical decline."  

I think Fonda’s use of architectural metaphors are particularly interesting because they invite the individual into the argument. The arch and the staircase are spatio-physical things in the world instead of abstract geometric shapes. The meaning of the metaphor is revealed through their imagined use. Both take us somewhere, and the journey is as important as the destination. Fonda is suggesting that growing old is not just an isolated physical event, or even a state of mind. It is also an active interaction with the world. And that world has elements that can assist us with our journey.

The social anthropologist Mary Catherine Bateson is even more explicit in the use of an architectural metaphor to describe the psychological process of growing old. She argues that we should consider the potential of life past the age of 65 to be like adding a new room to your house.

“[The first thing you will discover when you add] a room to a house is that add is generally the wrong word, because the way you use all the rest of the house, the way you live and organize your time and even your relationships, will be affected by the change. Existing rooms will be used differently, sounds will echo in new ways, community and privacy will have new meanings. Gaps will open where familiar items have been shifted to the new space and new acquisitions will fill them. The new room is not simply tacked on to the east or west side of the house, it represents a new configuration of the entire building and the lives it shelters.”

Bateson extends the spatial metaphor with the suggestion that each of us is responsible for designing the kind of room we want to add. For some it could serve a new need; an activity or purpose that we weren’t aware of when we first inhabited the house, such as an exercise room. For others, this metaphoric room could help us to do something that we have been interested in for a long time but have not been able to pursue as deeply as we might have liked. Her example here is of a new library space that gathers together and orders all of the books we have accumulated over the course of our lives.

“The aging today has become an improvisational art form calling for imagination and willingness to learn. Increased longevity will challenge us not only to revise expectations but also to discover unexpected possibilities, arranging life in new and satisfying patterns, and to explore how newly perceived possibilities relate to earlier life choices. In the process we will encounter gradual – or sometimes sudden – shifts of consciousness and identity that accompany the awareness of the new situation.”
For baby boomers to achieve the full potential of their own “Third Acts,” the housing industry is going to have to develop more substantive options for independent living than have been offered in the past. As the leading edge of the boomer generation starts to enter the middle stage of old age in the next five years, the market demand for age-in-place options will increase to the point where developers and homebuilders will begin to take notice. This will have significant ramifications for the housing industry. Current predictions suggest that by 2030, four out of every five new households will be formed by people over 65 and older individuals will account for 80 per cent of the housing demand.

This demographic has a variety of specific domestic needs that are different from the buyer profile on which most homes are currently designed and built. The size of this market is a mixed blessing. On the one hand, it will drive innovation, as more and more people try to capitalize on the grey tsunami about to sweep over the housing market. On the other hand, there’s a clear possibility that, like most initiatives in housing, the innovation will be driven to the benefit of private self-interest rather than common public good. As discussed in a previous chapter, what I call the fast housing industry is adept at creating “designed-to-be-sold” products that promise everything and deliver little beyond problems and disappointment for the resident. For the general population of homebuyers, this is unfortunate, but for more vulnerable populations like older individuals, the implications are much more significant. The empty promises made in slick advertising campaigns could trick older people into making poor choices that affect their well-being and health, pushing them into dependent living and institutionalized care before those options are actually necessary.

The issue is not helped by the fact that most legitimate research on age-in-place housing focuses on instrumental safety-based design considerations. These include grab bars, zero step showers, high toilets, slip-resistant flooring, bright lighting, and high-contrast materials. More recently, there’s been a lot of attention paid to the development and implementation of Gerontechnologies that automate the home and monitor activity. Although safety and technology solutions like these are important, they primarily deal with only one dimension of age-in-place design – the prevention of harm. Future Adaptive Building is situated within this cultural landscape of age-in-place housing. On preliminary reflection at least, the FAB strategy appears to address many of the concerns identified by the baby boom generation by helping each resident to enact his or her own highly individualized strategy for aging-in-place.

Founded on the broader World Health Organization’s definition of health as a generalized state of well-being and not just the absence of disease, FAB resists the limitations of instrumental design thinking without sacrificing safety. FAB+ uses the idea of Tailored Support and Seamless Accommodation to help manage the relationship between older individuals and their environment in a more holistic way that builds self-confidence and independence at the same time as it enables appropriate levels of care.

Future Adaptive Building uses advanced mass customization strategies to subvert the negative consequences of standardization in mass produced tract housing without reducing developer profitability or increasing construction time. Through Initial Customization and Continuous Adaptation, the FABmodular system helps older residents to better manage the many changes that occur with aging.

Finally, the Future Adaptive Building approach to aging-in-place provides a platform for older individuals to contemplate the aspirational goals of Bateson and Fonda. FABstudio provides opportunities for Design Control and Community Participation that help empower older residents to expand their expectations and, in some cases, pursue a purposeful life through design.

**Situating FAB in Architecture**

Future Adaptive Building is also situated within the historical context of modern architecture. No design is completed in a vacuum, and although the development of FAB was not explicitly guided by historical precedent, it participates in a continuum of ideas about flexible and adaptable housing. Of particular significance is the work of a smaller subset of architects who, over the past 60 years, have been interested in using adaptability as an act of resistance; as a strategy for introducing the resident,
and his or her specific needs, back into the world of mass produced tract housing. The majority of these precedents are European, and grounded in a political belief system and social agenda around the production of housing "in which architects are ethically bound to work with, and not just for, others."  

Habraken and Re-Engaging The Resident

The Dutch architect John Habraken is perhaps the best-known proponent of this approach to adaptable housing. His work is a reaction to the anonymity and lack of user involvement in post-war mass housing projects. In 1961, he published the book “Supports: An Alternative to Mass Housing," in which he argued for the "return of consultation and involvement on the part of the users." Habraken’s criticism resonates with my own sentiments about the positive role that building-as-a-verb can play in people’s lives.

“... the fact is that in MH (mass housing) everyone is conditioned to the dwelling as a ‘thing’, and to producing this ‘thing’. All that is done, written or said, betrayed this remarkable preoccupation. The simple assertion that the dwelling is the result of a process, and that it is this process which requires our attention in the first place, finds no hearing. Everyone wants to build dwellings, regardless of what is meant by the term; no one is prepared to regard housing in the light of a social activating preceding house building, especially insofar as this activity conditions the act of building.”

Habraken proposes a system of building that can accommodate both the “dwelling as thing” and the “dwelling as process.” The word “Supports" in the title of his book “is used as much as a social metaphor as it is a physical reality.” Habraken’s theory separates the design and construction of a building into two distinct components.

The first component is what he calls a “Support Structure,” which he describes as “a construction which allows the provision of dwellings which can be built, altered and taken down, independently of the others.” The second component is the interior of the home, which is designed and built separately and in collaboration with the resident.

Of particular relevance to the development of both FABmodular and FABstudio is Habraken’s fictional description of a young couple undertaking what would now be called a co-design process, conducted as part of a retail experience with a company that custom-designs, fabricates, and installs new homes into one of his Support Structures.

After selecting the location of their home within a recently completed support structure building, the couple starts the process of designing their own residential infill.

“With the help from a representative of the firm an effective arrangement of a dwelling is decided upon. Because support structures have long since become common property and their housing technique perfected, the dwelling question can be totally formed out of prefabricated elements. The representative invites our customers to return in a fortnight. The dwelling will then be ready for inspection in the showrooms. At the appointed time, they see a full-scale model of their dwelling. They walk about in it, test doors and window, visit kitchen and bathroom, try the usefulness of rooms and cupboards. After suggesting a few alterations, (they) decide to buy. The manufacturer transports the parts to the support structure, where the dwelling is finally assembled in a short time.”

Habraken’s Support Structure was often misinterpreted as being synonymous with the skeletal structure of a building. Schneider and Till describe how Habraken famously crossed out an image of Le Corbusier’s Dom-ino frame, stating that a support structure was a complete work of architecture and not a neutral skeleton.

“A support structure is quite a different matter from the skeleton construction of a large building, although to the superficial spectator there may appear to be similarities. The skeleton is entirely tied to the single project of which it forms part. It can be realized only when the new building, and all that is connected with it, has been worked out in detail. A support structure, on the other hand, is built in the knowledge that we cannot predict what is going to happen to it. The more variety housing can assume in the support structure, the better. It is therefore not an uncompleted building, but in itself a wholly complete one.”
This idea has certainly come to pass in commercial construction. An office building is, for most intents and purposes, an infrastructure or framework, into which each individual tenant is able to undertake the design and construction of a customized interior office space. At the same time, the base building is a complete piece of architecture that contributes to the urban fabric at the large scale of skyline and the small scale of streetscape. It operates as a fully functioning building, with or without tenant improvements, an effect too often seen whenever a city experiences an economic downturn.

In 1964, Habraken created the Stichting Architecten Research (SAR) Foundation in collaboration with the Royal Institute of Dutch Architects and nine other architectural firms, to extend his research into mass housing alternatives. This included the introduction of “modular coordination” as “a means of harmoniously integrating decisions regarding the dimensioning and positioning of both spatial and built components.”

Open Building

In the following four decades, Habraken’s idea of a common base building that’s separated out from the individual tenant fit-out inspired a bifurcated design and construction model called Open Building that dominates the commercial construction industry. As I have previously described, in Open Building, the base building consists of the structure, exterior skin, and building systems, and the fit-out consists of the interior partitions, millwork, and finishes required by each individual occupant. In commercial construction, it’s not uncommon for the designers and contractors of the base building to be completely separate from the construction professionals who work with the tenants to build-out each interior space. Although each office or retail outlet in one of these projects is not strictly a modular component, the base building most certainly acts as the armature on which each of the tenant improvements is made.

Stephen Kendall, a leading advocate of Open Building, is particularly interested in applying the principles of Open Building to residential development.

“In an Open Building approach, a multi-unit building is made in such a way that a variety of occupant preferences is normal and costs a developer no more than making all units the same. Here, households share a high quality base building with a long life. The base architecture enables variety at the level of the individual dwelling unit. Each can have a fit-out suited specifically to its budget constraints and preferences.”

Despite the fact that it’s now the norm for commercial construction around the world, Open Building, and Habraken’s original vision, have not found wide application in the normative housing industry. The little adaptable housing that has been
completed has largely been demonstration projects undertaken by committed architects for enlightened clients. A selection of case study examples from this body of work helps to situate Future Adaptive Building within this historic context.

**Montereau by Les Freres Arsene-Henry**

In the 1970s, architects such as Luc and Xavier Arsene-Henry of France took up Habraken’s social cause, seeing adaptability as a means to a larger end, and not an end in itself. Schneider and Till argue that for architects of this generation, “flexibility as a mode of construction is in the service of flexibility in terms of a social and political imperative, allowing users to participate in the design process and enabling them to affirm their housing ‘unit’ as home.”

Montereau is a 10-storey apartment building in France by Les Freres Arsene-Henry. Each floor has four identical rectangular apartment units emanating from a common core. The units are defined by two solid interior party walls and two exterior glass walls. A small service core is strategically located just off-centre in each unit. Residents designed their own layout based on a 90cm planning grid.

The building’s design foregrounded user participation during the initial inhabitation of the project and provided a high degree of flexibility in floor plan layout. In terms of future adaptability, the clear distinction between the base building structure and the resident specific fit-out indicate that the entire interior can be changed, as needed. However, because the interior is still conventionally constructed as a fixed set of walls, the ease and cost of making these changes is problematic.

Montereau, as with many early flexible housing projects, provides the initial resident with a completely open and unfinished space. This is a strict application of the commercial building typology and provides the maximum degree of resident input. However, there are several limitations to this “blank slate” approach that limit its applicability. First, the primary opportunity for user involvement goes to the first resident of each space, who is able to make all of the decisions regarding the configuration of the unit. Unlike commercial tenancies, the economic realities of the housing market preclude a complete demolition and rebuilding of the

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Fig. 97 Montereau Floor Plan
space each time a new resident moves in. In this case, the degree of initial open-endedness can even become a long term liability, if the first resident creates a poorly designed or eccentrically configured home that is problematic for subsequent residents. Finally, the interior fit-outs are conventionally constructed making them just as difficult to adapt as the interior of any other home.

**Funktionsneutrale Räume**

by Walter Stamm

Walter Stamm’s 1987 project in Winterthur, Switzerland, has a base building that includes not just the exterior structure and cladding but a series of fixed interior walls and service chases. These elements are organized in two rows, running perpendicular to the solid perimeter walls. Stamm inserts the bathrooms and kitchens in between these two rows, leaving the outside zones of space to be flexibly defined by the residents. Of particular note is the flexibility provided with the staircase, which can either become part of the common circulation core or be integrated into a two-storey unit to provide private circulation. The result is that the four-storey building can be organized as a series of single or double units per floor, or as two sets of two-storey units. According to Schneider and Till, the smallest possible unit within this base building design is just over 34m² and the largest is 245m².

The advantage of this approach is that the inherent logic of the articulated base building layout remains evident throughout the life of the building. It is an example of “knowledge in the world.” The initial residents configure the secondary partitions to create the layout that fits their needs. When it’s time for either the original resident or someone new to make a change, the project’s design detailing clearly indicates not only what the adaptable components are, but where else they might go. This allows for a finer grain of alteration that does not have to involve a wholesale renovation of the entire unit.

The disadvantage of this strategy is that the components for the resident-controlled infill elements are still built with conventional construction materials and techniques. As in Montereau, they’re not easy or inexpensive to change outside of a major renovation to the entire unit. This reduces the feasibility for small scale incremental adaptations.
Dapperbuurt by Duiker van der Torre

This 1989 project in Amsterdam has 49 apartments over three floors. Each unit is roughly square in shape, with windows on the two opposing sides. The floor plan is completely open, except for a central core containing a bathroom, service core, and kitchen counter, and an entry hall in the front corner. Three sliding walls that can be concealed inside pockets within the central core, can be extended in varying combinations to define the open space into varying configurations of one-to-four separate rooms, in order to meet varying needs on a short or longer term basis.

The project is explicitly designed to accommodate a delimited level of future adaptability, with no effort or cost. Through the system of sliding walls, every resident, from the first onwards, has an equal opportunity to adapt the layout to best suit his or her needs, on either a short- or long-term basis. A disadvantage of this system, and others like it, is that the degree of change is quite limited. In addition, the sliding walls feel impermanent and temporary, with only limited acoustic and light separation.

New House 194X by William Wurster

At the end of World War II, 15 years before Habraken published his book, William Wurster, a California-based residential architect, took a different strategy to future adaptability in his entry to “The New House 194X” ideas competition, sponsored by The Architectural Forum trade journal. It’s one of the few, and earliest, North American examples of adaptable housing. Wurster proposed an adaptable two-storey single detached house as a new housing typology for postwar North America. The main floor consists of an entry, utility room and covered car port. A central stair leads up to a second floor open plan space of 36’ by 54’.

Wurster encloses the bathrooms with conventional interior walls and proposes a collection of moveable cabinets to define the remaining spaces in the home.

This obscure unbuilt project, existing only as a series of small axonometric drawings, predates by several decades Habraken’s book, and the multi-family European projects that his theory influenced. Like Stam’s project, Wurster also incorporated an
articulated base building shell that suggests the various locations where the user-defined components could be located. The significant difference in this proposal is that some of the spatial definition is provided by free-standing cabinetry units. This introduces an entirely different order of adaptability, because some elements of the layout can be altered without involving any kind of major construction work. Adaptability can range from a very modest adjustment in one small part of the plan to a complete reworking of the layout. The simplicity of the system allows continuous user participation throughout the life of the project.

Wurster’s project has several advantages over the previous case study. The open-ended nature of the system allows the floor plan to undergo more substantive change and the cabinets are more solid and sturdy than the sliding walls. The influence of this project on the development of Future Adaptive Building’s use of space-defining cabinetry is self-evident.

Like Habraken, Wurster’s interest in adaptability was driven by a social agenda. He even authored a 1943 book, entitled “A Flexible House for Happier Living.” It’s interesting to note that the motivation for his interests in adaptability lay more in enabling personal expression and freedom rather than in an opposition to mass housing, one of Habraken’s themes. Wurster’s book and the competition entry are part of the post-war zeitgeist driving other home-of-the-future initiatives, such as the Case Study House Program and Eichler Homes in the U.S., Span Buildings in the U.K., and the Ideal Home Program in Australia.

As with most mid-century North American residential architects, Wurster’s ideas and idealism for a new kind of domestic space were ignored by the burgeoning mass home-building industry that would go on to create our landscape of cookie-cutter tract houses. Twenty years later, the publication of Habraken’s theory would also fail to change the trajectory of multi-family housing away from the standardization of floor plans and extremely limited resident involvement.

If the ideas generated by Habraken and the other architects whose work I’ve included here had been picked up by the broader residential construction industry, we would be living in a very different world, and this research, and perhaps my career, would have had a different focus. But, as I’ve discussed earlier, mass production’s seductive mid-20th century promise of greater affordability and availability was too great to resist for the residential construction industry, and almost every part of our culture.

Although Future Adaptive Building is cast as an age-in-place solution, on reflection, it’s clear that it’s fighting the same battles that began with Wurster and Habraken, and for many of the same reasons. FAB also utilizes almost all the same design-based strategies employed by earlier architects. The innovation that holds the promise for FAB to finally deliver on the potential of adaptable housing is operational, more than it is architectural.

Mass customization is changing the cultural narrative of 20th century mass production. The smartphone defines a new way of thinking about design, fabrication, and use that might finally integrate the long-standing goals of adaptable housing with the production realities of tract housing. FABmodular, FABstudio, and FAB+ are children of a new way of thinking about an old architectural problem.
Situating FAB in Construction

Future Adaptive Building is also situated in the world of construction. I’ve already discussed, at some length, the history of mass production and the promise of mass customization to revolutionize the way things in our world, such as houses, are designed and built. In this reflection, I therefore take a different tack to situate FAB within a more speculative approach to the theory of building.

In his 1994 book, “How Buildings Learn: What Happens after They’re Built,” American writer Stewart Brand argues for a new way of thinking about the construction process. This time-based theory of building borrows heavily from Habraken’s notion of a support structure and building infill. Brand proposes to examine buildings as a whole; not just as a whole in space but as a whole in time. “Whereas architecture may strive to be permanent, a building is always building and rebuilding. The idea is crystalline, the fact fluid. Could the idea be revised to match the fact?”

Brand proposes a revised model of layered construction that better accommodates future change. His six-layer model is organized by rates of change rather than by technical function or trade group.

The outside layer is the Site, which is made up of the geographic location and lot. Brand argues that the Site is eternal, at least in terms of the time scale of a building. The second layer is Structure, and consists of the foundation and structural walls, columns, and floors. The life of the Structure usually defines the longevity of the building. For a single family house, that’s typically 80-100 years. The third layer is Skin, or the outside, weatherproof layer of the home. The exterior Skin lasts about 25 years, so the typical house will have three or four new skins over its life. The fourth layer is Services, and it contains all of the mechanical, electrical, plumbing, and technological systems in the house. Services has a lifespan of about 15 years, and a house will typically have 4-5 Service replacements during its life.

Brand calls the fifth layer Space Plan, referring to the interior layout of walls, ceilings, cabinetry, floor and wall finishes. The rate of change in this layer is more widely varied. Kitchen and bathroom cabinets have a service life of 15-20 years; flooring and other finishes last 10-15 years. Walls don’t wear out, but the spatial organization they define does become obsolete. I would anticipate that the average rate of change of the Space Plan layer is 10-15 years. This means that a house can be expected to go through five to 10 major alterations over the course of its life. The final layer in Brand’s schematic is Stuff, which includes “Chairs, desks, phones, pictures, kitchen appliances, lamps, hairbrushes; all the things that switch around daily to monthly. Furniture is called ‘mobilia’ in Italian for good reason.”

Brand argues that buildings should be detailed, so that these layers remain separate from each other, in order to accommodate their different rates of change or replacement.

“An adaptive building has to allow slippage between the differently-paced systems of site, structure, skin, services, space plan, and stuff. Otherwise the slow systems block the flow of the quick ones, and the quick ones tear up the slow ones with their constant change. Embedding the systems together may look efficient at first, but over time it is the opposite, and destructive as well.”
It’s interesting to reflect on how Future Adaptive Building is situated within this time-based theory of building. To explore this further, I use Brand’s nomenclature to diagram the Open Building model of commercial and residential construction and compare it to the FABmodular system.

For an Open Building commercial project, the Structure, Skin, and Services layers are situated in the Base Building section and the Space Plan and Stuff layers constitute the fit-out section. This is because, in a commercial project, the tenant space is typically delivered as a raw shell with no interior finishes. The tenants, in essence, bring their interiors with them, in much the same way that they provide the furniture and other office equipment in the Stuff layer. Increasingly, these interiors are designed and fabricated using complete office interior systems of moveable partitions that can be adapted by the tenant, as needed, over time.

In an Open Building residential project, the situation is quite different. The Structure, Skin, and Services layers are still located in the Base Building section. As I discussed earlier, Kendall demonstrates how the initial resident of each unit could customize the design of his or her interior. However, unlike the commercial example, the base building contractor would still be responsible for delivering the interior, and it would be built into the base building as a permanent construction. This means that in a residential Open Building project, Brand’s Space Plan layer technically shifts over into the Base Building section once the building is completed, leaving only the Stuff layer of furniture and household goods in the fit-out section. This is the same situation that’s found in a conventionally constructed building, and disrupts Brand’s goal of allowing for slippage planes between each of the time-based layers. Open Residential Building, as exemplified by the three European case study precedents, offers a customized interior to the first owner that is no more adaptable for future residents than a conventionally built project.

In a FAB project, the Base Building contains the Structure, Skin, and Services layers plus all of the fixed interior walls and finishes that make up the rest of the FABframe. I created the Space Plan I layer to group these permanent interior elements. These typically include the walls defining the bathrooms and mechanical spaces, and, in larger homes, the staircase and hallways. The flooring and wall finishes (paint and tile) are also part of Space Plan.
Plan I, because they form the permanent base onto which the FABmodular components are placed. The Space Plan II layer contains all of the FABmodular and FAB+ components that the resident can re-arrange to modify the layout of their unit. Space Plan I is part of the FABframe that the builder and developer are responsible to construct. Space Plan II and Stuff are the two layers that the resident has control over, both at the time of first completion, and over the life of the home.

As I’ve described previously, the interface between the cabinet modules (in Space Plan II) and the finished surfaces of the base building (in Space Plan I) require special design consideration to facilitate the relocation of the cabinets after the building is complete. In Brand’s terminology, the joint detail between the cabinet modules and the finished base building walls and ceilings must allow for the temporal slippage from different rates of change without diminishing the essential architectural performance requirement for privacy.

Future Adaptive Building is situated in sympathetic proximity to Brand’s time-based theory of construction. His proposal, developed in the early days of mass customization and well before the smartphone’s disruption of material culture, in many ways preceded the technical capacity to realize this kind of disaggregated approach to fabrication. Future Adaptive Building can potentially leverage the new potential of mass customization to realize Brand’s theory within the scale and scope of mass tract housing.

Situating FAB in Development

Finally, Future Adaptive Building is also situated in the financial world of real estate development. Clients, architects, contractors, developers, financiers, and homebuyers will only be interested if FAB enabled projects can be delivered at a competitive price and in a manner that is at least as efficient as current methods.

Mass customization is the promised key to making this vision a reality. “Economies of scale are gained through the components rather than the products; economies of scope are gained by using the modular components over and over in different products; and customization is gained by the myriad of products that can be configured.”

This is not unfamiliar territory in the commercial and institutional side of the construction industry. Several large multi-national manufacturers offer comprehensive mass customized office partitioning and furniture systems that are well-established and widely used in commercial projects. Architects design the interior office fit-outs using the proprietary system of components and construction managers sub-contract their installation. These projects are competitively priced, and the flexibility of the system allows for future adaptability, which adds value for the tenant.

Residential developers and contractors have yet to be convinced of the financial benefits of mass customized construction practice, perhaps because the value proposition of the product sales model of residential development is different from the leasing model used with commercial projects. Residential development is largely governed by maximizing short-term profitability, reducing upfront risk, and creating market differentiation to drive sales.

Stephen Kendall’s conceptual model for illustrating how Open Building addresses these three performance objectives offers an interesting methodology for situating Future Adaptive Building within the context of real estate development.
In a conventional development, housing developers must make an educated guess at what combination of size, price, layout, details and finishing options their buyers are going to want. Small projects developers have to anticipate this need two years into the future. For large projects, the time lag could exceed seven years. Given the volatility of the marketplace, there’s a significant risk that developers will miss this future market with a project designed for yesterday’s buyer.

Developers use market research and focus groups, combined with the knowledge of what worked last time and more than a little intuition, to try and anticipate the state of the market and the needs of homebuyers a number of years in the future. All of this tends to stifle choice and innovation. In Fig.103, Stephen Kendall describes this mismatch between supply and demand and how it affects the developer’s bottom line.

“Households with differing preferences and economic possibilities are offered largely uniform, standard quality dwellings determined by market research. Some households find themselves paying for more than they want or can really afford, while other households have to accept less than they want or could afford. For the first group, the housing supply provides excess quality; for the latter group, the housing supply provides less than they could afford, resulting in unused purchasing power.” 141

None of this is good news for either the industry or its customers. On the one side, there’s frustration in trying to predict what a future market will want and translating that educated guess into a limited number of residential design options that are then mass produced. On the other side, and as I have already described at length, there are a large number of older homebuyers who find the resulting lack of choice not just frustrating, but potentially dangerous. This is the typical design-as-shopping-experience of a homebuyer, who will have to settle for a finished unit that most probably only partially fits his or her needs. The initial design is standardized, the resident has no involvement in the design process, and the interior is very difficult to adapt to any future change.

Kendall illustrates in Fig 104 how Open Building can address this issue. “Here households share a high quality base building with a long life. The base architecture enables variety at the level of the individual dwelling unit. Each can have a fit-out suited specifically to its budget constraints and preferences.” 142 The developer mitigates risk by not having to guess which interior fit-outs will be
popular. They only build what each homebuyer wants. The result is a project that will potentially sell-out quicker and with each unit’s price optimized to the capacity of each buyer.

In this situation, the resident co-designs the unit by customizing the spatial layout before it’s permanently fixed into place within the base building. This is the conventional model of residential open building employed in the three historic examples of adaptable building. Each unit is open-ended at the outset and co-designed by the first resident. After the initial construction, however, the unit is no more amenable to subsequent change and adaptation than the mass produced option.

In Fig. 105, I extrapolate Kendall’s diagrams to examine the value proposition of the distributed bus modularity strategy of mass customization used in the FAB system. The tenant fit-out is sub-divided into FABmodular and FAB+ components. Over time, each of these value components can expand and contract as individual homeowners adjust their homes to meet their changing needs.

While this on-going adaptability feature does not directly increase the bottom-line profitability of the original sale, the Continuous Adaptability and Tailored Support provided by the FABmodular and FAB+ systems represents a significant market differentiator for a project focused on older homebuyers. This provides a tangible marketing benefit to the developer, driving more buyers to the project and decreasing the sales cycle. This market differentiation comes at no cost to the developer. Unlike the addition of a tangible amenity such as a gym or large common area, which is a sunk cost for the developer, the age-in-place features are paid for by the buyer, either at the time of purchase or at some point in the future.

On reflection, this analysis suggests that Future Adaptive Building could provide significant benefits to developers and owners. The FABmodular system can increase profitability and reduce the risk of the project missing the market by ensuring that every sale is fine-tuned to the financial capacity and functional needs of each individual buyer. This same modular strategy also creates an important market differentiator of increased resilience to future change, which would be particularly attractive to the growing number of older homebuyers.

Looking Forward

As this research draws to a close, I find myself at a professional crossroads. An architectural idea is only as good as the impact it makes in the real-world lives of ordinary people. As interesting as the proposed FAB strategy for aging-in-place may be, most of the real work remains to be done. Actualizing the principles of Future Adaptive Building across a range of housing types, project scales, and market segments, requires a deep engagement in the mass production side of the housing industry.

This is new territory for me. Taking on this challenge would require a fundamental reconsideration of the nature of our practice. Although I have actualized Future Adaptive Building for aging-in-place several times in our single family projects as well as in the Laneway House prototype, realizing its full potential depends on moving up in building scale and down in unit price. This is not something that Housebrand, in its current comprehensive practice model, could realistically undertake.

In the accompanying exhibition, I include case study projects demonstrating how Future Adaptive Building for aging-in-place could be applied to a variety of different housing typologies within the market-driven world of residential development. Creating a detailed model of practice for implementing these kinds of projects on a broader scale is beyond the scope of this research project. I anticipate, however, that it will be the next step I take on this journey.

112. Butler, “Being Old in America,” 263
113. Frey, “Baby Boomers and the New Demographics of America’s Seniors,” 29
114. Quine, “Australian Baby Boomers’ Expectations,” 5
116. Ibid., loc. 318
117. Ibid., loc. 321
118. Bateson, “Composing a Further Life,” loc. 218
119. Ibid., loc. 220
120. Ibid., loc. 338
121. Hermus, “Home and Community Care in Canada,” 26
122. Schneider, “Flexible Housing,” 29
123. Habraken, “Supports,” 3
124. Ibid., 17
125. Schneider, “Flexible Housing,” 167
126. Habraken, “Supports,” 60
127. Ibid
128. Schneider, “Flexible Housing,” 166
129. Habraken, “Supports,” 61
130. Leupen, “Frame and Generic Space,” 163
131. Kendall, “Residential Open Building,” 11
132. Till, “Flexible Housing,” 83
133. Schneider, “Flexible Housing,” 29
134. Till, “Flexible Housing,” 100
135. Till, “Flexible Housing,” 103
136. Till, “Flexible Housing,” 67
138. Ibid., 13
139. Ibid., 20
142. Ibid.
All of us are going to die and leave behind a legacy composed of, amongst other elements, the decisions we’ve made, the actions we’ve taken, and the physical things we’ve accumulated. When my mother realized that she was starting to experience some of the same early symptoms of dementia that had afflicted her father, she quietly started to put her house in order. This included sorting through a lifetime of memories stored in photographs, family heirlooms, favourite recipes, and the miscellany of many decades of family life. In her typical loving and extremely pragmatic way, she gave to each of her four children two boxes filled with those things, some special and some mundane, that she thought we would like and/or need. The rest she gave to charity, but slowly, so my father wouldn’t really notice. My mom didn’t want to leave her children with the burden of having to do all of this when she was gone. She left her mind, and, ultimately, her body, after ensuring that she had taken care of all her worldly concerns.

My father, on the other hand, made wills, lots of them. Instead of divesting himself of the future, he strove to control it. He left behind endless instructions about how his world of things should be managed and maintained. Even though he was a physician, I’m not sure he ever really believed he was going to die. When he did, suddenly but very peacefully at the age of 85, at home, six months before my mother passed away in a care facility, he left behind a life running almost at full throttle. It has taken our family many years to bring his world of things to some sort of conclusion.

Our experience with my father’s estate highlighted the foresight shown by my mother’s quiet approach, even as dementia was robbing her of everything else. Her generous last gift of “taking care of everything” for her children spoke more to us about love, life, and legacy than anything in the boxes of stuff we were given, or the cheques from our father’s estate.

Wills direct the disposition of our estate. Our homes are usually the largest financial component of what we leave to our children, as either a place to live or an asset to sell. Ensuring that this home is left in the best possible condition is not just kind and generous, but makes good financial sense, as well. However, this can sometimes be hard to achieve. The makeshift renovations made to bathrooms, bedrooms, kitchens, living spaces, and entryways in order to transform the typical tract home into something a little more age-friendly can leave serious scars on the quality of the home, and its owner’s bottom line. None of this is good news for the older homeowner trying to tie up everything for his or her kids.

Future Adaptive Building offers an alternative. The same strategy of modular mass customization that allows the house to be easily adapted to match the ever-evolving needs of old age can just as easily be used to undo these modifications when the need no longer exists. Think of it as a kind of architectural “ctrl-alt-del.” The ability to “re-boot” the house empowers older residents with the knowledge that, when the time comes, their home can be reset back to its original configuration, or to whatever layout the next resident desires, with a minimum of fuss and cost. This final act of adaptability, completed after the older person has gone, is a gift to the future that provides emotional resilience and peace of mind to the aging homeowner.

EPILOGUE

Legacy

It is necessary to meditate early, and often, on the art of dying to succeed later in doing it properly just once.

-Umberto Eco


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