



TIME FOR SPACE

*Typologically Flexible and
Resilient Buildings and
the emergence of the
Creative Dweller*

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SPACE

TYPOLOGICALLY FLEXIBLE AND
RESILIENT BUILDINGS AND THE EMERGENCE OF THE
CREATIVE DWELLER

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To Musse.

*You lived your life with compassion
and reached out to see beyond the obvious.
An inspiration to any architect.*



PREFACE

This research investigates how design thinking for living environments could be spatially developed so that the results would be resilient and continually serve people in the best possible manner. The thesis is based on my overall experience as a designer and researcher throughout my working career, and which has gradually matured towards a theoretical understanding of how housing could be understood and developed. The research questions for the research have originated from both practice and my questioning of everyday housing design production as it is implemented.

As I observed housing architecture and its spatial contexts it seemed that time had stood still for several decades. The housing design of the 1950s and early 1960s in Finland looked like a vision from a beautiful dream that had suddenly turned bad. I wanted to delve deep beneath the surface of housing production and understand why the many new ideas and spatial developments introduced by architects since that period did not actually migrate to the everyday physical built environment in the way that they had done in Finland in the formative years after the Second World War. That had been a period that made Finnish housing architecture internationally renowned and was also known for the high quality built environment epitomized, for example, in Tapiola.¹

I had been continuously drawn to the issues concerning sustainability since I began my licentiate thesis at the turn of the century. Whatever I did, be it in practice or research, sustainability was always present in some form, but not necessarily with the focus on energy as it mainly was in the building construction field. Even though, in one form or another, the issues of sustainability always came back to energy and natural resources, the journey from problems to prominent answers was for me too linear and simple, and also so dominant that it seemed to shut out all other approaches towards sustainability. However, other ways of approaching sustainability had started to surface in the discourse in a more multi-dimensional fashion. This research focuses particularly on social sustainability, which is nonetheless as unstable and volatile a concept as sustainability in general, and also requires continual redefinition. This thesis aims at broadening the understanding of sustainability to encompass socio-spatial viewpoints.

The continual development of design thinking can be seen in the physical environment of advanced building cultures. Many cities, such as Amsterdam, Graz, and Copenhagen that are all discussed here, have lived through a boom of architecture tourism that recognizes the development of architecture and its qualitative condition

¹ Tapiola Garden City in Espoo is one of the most internationally famous urban developments in Finland of its time. It was originally built in the 1950s and 1960s.

that can benefit cities but also people on a more personal level. This notion of development in architectural design thinking is also discussed in this study as a bipolar point of departure that dwells on creative design and its potential for inhabitants. It poses the question of what could exist and how it could be incorporated into everyday housing production in a way that could better serve the people, societies and ecosystems, and also allow the inhabitants to dwell creatively. This thesis is first and foremost about the necessary change in spatial production in Finland, and beyond that it considers the temporal dimensions of enduring architecture and how this kind of developmental tendency could be put into practice.

Though the research focuses on the Finnish context, the three different countries and cultures where I have studied architecture and planning, Austria, The Netherlands and England, have also been important for the research and have acted as a sounding board for studying developmental modes in housing architecture. I started my architectural studies in Austria at The Technical University of Graz at the beginning of the 1980s. Graz at that time was a haven of avant-garde architecture, but rather than being utopian in approach, the architectural practices had very strong ties to the construction industry, to their mutual benefit. The construction culture in Austria was then, and still is, skills-enhancing as regards both the building industry and the skills on construction sites. I learned in Graz that whatever kind of construction or detail you drew as an architect, it was never a problem on the construction site where the workers took pride in their accomplishments. The construction culture was more advanced in Austria than it was in Finland, where it was mostly tuned to prefabricated element construction instead of the site building culture that Austria applied. I must admit that it was partially a culture shock for me to continue my architectural studies in my own country after spending two years in Graz. I had learned in building construction lectures in Graz that sandwich element construction was an undeveloped and an unhealthy way of construction, but when I came back from Graz I discovered that it had been the most commonly used construction method for apartment buildings in Finland since the 1960s. When I continued my architectural studies at The Technical University of Helsinki in the 1980s, I also noticed that student work seemed more homogeneous than the student work in Graz. The teaching culture in Graz encouraged the students to develop their own voice in design, which created more diversity in student work. In Finland at that time we were taught the realities of “what is possible to do” in the existing building culture. This was the first time I was confronted with the systemic effects of the whole building culture, which had much wider impacts on society as a whole. Comparing the contexts of the building cultures in these two countries, it appeared to me that a developmental tendency in design and construction sprang from an advanced building culture and attitudes favouring quality in construction. It was not that the architectural design defined the scope of the developmental tendency in

building culture; on the contrary, it seemed to be rather the reverse.²

Another eye opener on systemic contexts in building culture, particularly on housing design and a developmental agenda in building culture, was a short period of post-graduate studies in the early 1990s at the Berlage Institute in Amsterdam. Although I was familiar with the Dutch achievements in housing design and its continually important position in benchmarking new housing architecture from my earlier architectural studies, I saw that the building culture in general was much more willing to take risks in developing new housing solutions than was the case in Finland. In the Netherlands there seemed to be an overall attitude toward building culture not to let it remain static but to allow it to evolve, and indeed it was expected to do so. Many of the ideas studied in this thesis that advance design thinking in housing also originate from the Netherlands. To me this came as no surprise. The continual experimental position in architecture and the acceptance of it in society, reflect visionary tendencies and a wider acceptance of the importance of the architectural quality for the wellbeing of people. Even though the housing construction culture has since changed in both countries, the experimental design approach still seems to prevail.

The third country and culture that I visited during my PhD studies also proved to be significant for this research. From 2008 to 2009 I spent nine months as an affiliate PhD researcher at University College London, at the Bartlett School of Planning. During that time I became familiar with British planning and housing design practices. I was amazed at how similar were the problems that both Finnish and British housing production faced, even though the contexts were and still are somewhat different. In Finland there is still very little research done on housing production and its developmental context. However, there is a considerable amount of research done in the UK on the subject as well as its shortcomings and the lack of innovation in the building sector.³ I found that this research could also benefit the Finnish context in questioning why there is such a minimal developmental tendency in everyday housing production. At the turn of the 21st century, immediately after much of this research had been done, an organization called CABA (Commission for Architecture and the

² Just when finishing this PhD a new research project called FIAT was about to become public that would survey the differences between Finnish and Austrian construction culture, particularly studying the causes for the expensive building in Finland compared to Austria. I was able to get hold of preliminary material from that research in an introductory seminar held in June 2016. Some of the findings of FIAT, referred to in this thesis, seems to confirm many of my assumptions about the building cultures in these two countries. The constructions costs are approximately 30% more in Finland even though the costs of construction materials and labour in both countries are very similar. (Rakli.fi 2016).

³ There is also other substantial research referred to in this thesis that originates in the UK.

Built Environment)⁴ was created in England, which increased the diversity of high quality housing schemes in the country, yet it still remained marginal.

During my working life I have been responsible for designing buildings and urban environments and have simultaneously been involved in research projects at Aalto University to do with the built environment and its development. Together with a colleague, I founded an architectural practice in the mid-1990s after having some success in architectural competitions. The European competition in 1992–1994 had been a first glimpse for me of how entangled building design and urban design are, and how important it is to recognize this fact to be able to design new living urban areas or to invigorate already declining area in the city.⁵ Building design and urban design are closely interconnected, although buildings and urban areas are generally considered to be different disciplines in the regulations and guidance responsible for the execution of the built environment from planning to construction, particularly in Finland. This connection is a significant issue in both my practice and my research.

Being involved with several lines of professional practice has offered me a wide spectrum of views and understanding, and the possibility to advance many ideas into something tangible, going beyond a general focus on the designer's table. The interaction with and between many disciplines and stakeholders in research projects has given me an understanding of architectural design as part of society and its capacity or lack of it to change the processes that produce the built environment. The principle objective of this thesis has been from the beginning to understand and define the factual frame in which design operates and to understand better the non-developmental character it possesses. To be able to tackle the issues as to how design could promote resilient development and the wellbeing of people and societies, means mapping the various contexts that relate to design as well the objectives the design should encompass to be resilient in the long run. This requires a wide array of matters to dwell on and understand the position of design in general to change the design thinking. Rather than being convergent, the thesis surveys the whole, including the boundary conditions and systemic locks to design development that make design reactive and repetitive in character. This has created the structure of the thesis, that is, approaching design from the essential viewpoints that are involved in designing buildings for living.

4 CABE was from 1999–2011 an NGO organization (non-departmental public body) funded by several departments of the UK government. It was merged into the Design Council on 1 April 2011. It was a governmental advisor on architecture, the built environment and public space in England. It championed well-designed buildings, spaces and places, ran public campaigns and provided expert, practical advice and it worked directly with architects, planners, designers and clients. (Designcouncil.org.uk 2017).

5 European is an international ideas competition in architecture and urban design for architects under 40, participated in by most European countries. I was in a group that won the European competition in Le Havre in France in 1994. The site was one of the old hubs and centers of the city of Le Havre, the half-moon square at its core called Rond Point. The task was to return its meaning as a living and breathing urban context after the degeneration caused by the new access road that had split the area in the city structure that had undermined the development of the area as a whole.

My point of departure as a practicing architect has brought me to somewhat different research questions from those of my colleagues in other fields of research. Positivist and reductionist tendencies in research and empirical research could not fully convey the questions I was asking when trying to define what could be possible. At the beginning I lacked the vocabulary to mediate my ideas and arguments using the tools which the more traditional research had developed over several centuries. It took me a while – and research experience – to consciously understand that knowledge can take many forms and manifestations, and the tradition of research is being continually developed. I believe that both lines of departure, as a practicing architect and as a researcher, have the potential to change the way we observe and do things. Research can delve much further into questioning the way things are, and give credibility and an aura of objectivity, which design cannot contain in a similar manner. Nevertheless, architectural design thinking can present new ideas and concrete solutions for developing housing, and question practices that are no longer functioning.

I once noticed, when giving a lecture on flexible housing in a seminar about the future of housing, that sitting in the audience was a majority of the stakeholders that influence housing design and production in one form or another in the Helsinki Metropolitan area and beyond. If the message is accepted it can travel fast. This state of affairs can act as its strength but also its limitation. Although ideas can expand quickly when general acceptance emerges, in the limited realm of housing production in a small country like Finland, it is rather difficult to create an ecosystem with a multifarious production agenda, which is generally the precondition for development. It is here where lies the potential of design research, which can take into consideration the concrete “solving the problem” approach for further development while at the same time it bases its viewpoint on research, as opposed to simply beliefs.

0.0 INTRODUCTION

0.1 TIME FOR SPACE

This thesis argues that the way the space is produced today might not be sustainable in the long run for housing in particular. This is due to the fact that purposely-built buildings and the way they are designed and produced today cannot easily adapt to unpredictable changes in society. They are not necessarily flexible in the right manner in the long run to accommodate differentiating needs and aspirations in flux. Continuous rebuilding to replace the existing building stock will end up wasting the limited natural resources as well as fostering unsustainable development of the built environment and societies. The focus of the thesis is in design and its contexts and how the design and production of buildings should be rethought from strategic starting points to enable a long-term resilient spatial production that can also promote the use of human resources to the full.

The thesis deals with the significance of the longevity of the building stock and the contexts it imposes on the development of spatial design and production. The overall objective of the thesis is the sociocultural, ecological and even economically sustainable development of building production that is also able to promote the wellbeing of the people. The long-term objective is to limit the use of natural resources in building construction. The wellbeing of people is very much intertwined with the production and use of space and the potential it offers for a multitude of uses without being able to predict what that use will consist of. Predicting the needs of use of space in a complex world becomes more difficult the longer the examined time span becomes.

The title of the thesis *Time for Space* has a twofold meaning which refers to how buildings can and should endure in their spatial character. The first meaning of the title emphasizes the longevity of space, and how it can be mediated and attained. The second meaning emphasizes the urgency of understanding the significance of space as criteria for all the different aspects of sustainability. The pronounced focus on technology and production process introduced by system building⁶ and the industrial period of housing production still prevails. The thesis will demonstrate how time for space – the longevity of building stock – is very much affected by *adaptable* and *flexible* use

⁶ System building refers to the industrial building process that uses prefabricated element construction for fast and easy building construction (Dictionary.com 2017).

of buildings⁷, and the meanings architecture can create in people over-generationally. The problem tackled in this thesis can be stated through the three main properties portrayed in the topic, namely time, space and its use.

TIME

Temporality, understood as the longevity of buildings, is a crucial aspect when viewing the use of resources, including all kinds of resources from natural to human. However, it demands a more in-depth understanding of buildings as processes, and understanding the key essence of adaptability and flexibility as ways of effectively promoting the prevalence of the building stock. The longevity of buildings is linked to sociocultural aspects and meanings that buildings can encompass for people. All this means understanding the whole of the built environment, from city to building, as a system that continually evolves, but also understanding buildings as multi-layered systems that have many different meanings and temporal levels of conduct (Brand 1994).⁸ During their lifespan, buildings are often extended and their uses changed, and if they are not able to accommodate that change and be meaningful for people one way or another, they are most likely going to be demolished.

However, today, particularly as a consequence of industrial building, the production of housing is merely seen as a replaceable and purpose-built end product (Pirinen 2014, Hankonen 1994), of which the lifespan of use is usually calculated as 50 years.⁹ Recycling is very often promoted as an answer to the problem of wasting resources, but until the production of any kind of products reaches the same level of metabolism as nature that creates no waste (McDonough & Braungart 2002), recycling cannot solve the problem of overconsuming. The natural resources are coming near to exhaustion at an accelerating pace (Starke 2013 : 26). Recycling building material, as it is understood today, cannot solve the problem of overconsumption of the planet's natural resources. It can even boost unsustainable tendencies in production. According to McDonough and Braungart (2002 : 59) such solutions vary in their seriousness, and a superficial understanding of recycling can even pacify people and stop them looking for in-depth, resilient solutions.

7 The actual contexts of adaptability and flexibility used in the thesis will be studied more in-depth later on. Here they are used as umbrella terms for adaptive and flexible characteristics that buildings can possess.

8 The temporal layers of conduct refer to parts of buildings that change in different pace. For example the technical building services change far more rapidly than the load bearing structure that usually prevails as long as the building (Brand 1994 : 12–17). There are today several life cycle assessment meters that give different spans for different parts of the building (Figbc.fi 2013).

9 This is the generally calculated average lifespan of use of a building. RT-kortti18–10922 (RT refers to Building Information Group Ltd, which is the leading provider of construction information in Finland).

It is also good to recognize that buildings are generally not just objects that can be demolished at once. In Finland, where the home ownership is rather high, near 70% (Stat.fi 2010), the possibility of pulling down buildings at one go generally applies to buildings that have single ownership. Buildings are usually repaired and “replaced” bit by bit (Brand 1994 : 12–13), which can also be very resource intensive. And there is another issue that is particularly linked to cities and buildings, namely the social and cultural dimensions that they create in their temporal existence. If buildings are seen as consumer products, it sees them in a very one-dimensional way, and also denies the over-generational cultural context they comprise. The hypothesis of this thesis has been that the background assumption of seeing buildings as replaceable consumer products, an attitude created in the industrial phase of housing production, is devastating for the sustainable development of the built environment.

Architecture is always comprised of past, present and future time. The past is the cultural and social context that has created our environment. It comprises forms that are always part of people’s cultural memory and ways of building, adopted in the process of developing the built environment. It is also the regulations, political decisions, guidelines, practices and existing resources that guide the production of built environments. The past forms a continuum of different kinds of path dependencies, shaping the different kinds of systems existing in societies. The future is thus usually made from a historical perspective. However, new images are created and developed in the present, which also directs the future. An important part of the architectural profession has been the production of new images and solutions for the future. The present time is also extremely important because all decisions are made in the present, thereby defining the attributes of the future far ahead. This is why the thesis also examines the context in which the design exists. That context has a great effect on how design solutions come into existence (Puustinen 2010; Krokfors 2010).

SPACE

As a result of seeing housing as a purpose-built replaceable consumer product, the space usually refers to a function-based comprehension of buildings that always stays the same. This research examines the parameters and attributes of adaptability and flexibility in the context of spatial configuration, something that is essential for accomplishing a long-term temporal perspective in buildings. The point in this research, however, is not so much to work out different kinds of typologies or study cases. Rather it approaches design from more systemic and strategic starting points, so that different typologies can emerge that can convey the continual change. The approach does not focus so much on outcomes but instead tries to develop new tools for understanding design so that buildings could adapt in a self-organizing manner to unpredictable needs over the whole lifespan of the building. Self-organization in the context of

built environment refers generally to the potential of a city to be organized through bottom-up processes that have not been preconceived in planning. The concept of typological flexibility that was introduced in my licentiate thesis (Krokfors 2006a) is developed further in this thesis. Typological flexibility refers to the idea of a building and its spatial configuration, which is epitomized as a design feature that enables unpredictable use of the building and space.

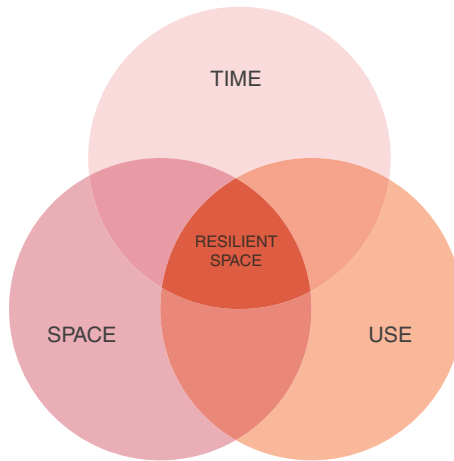
Because the spatial configuration of dwellings in modernism has usually been approached separately from the urban context (Heynen 1999 : 53), flexibility has generally been seen as a feature of singular dwellings and in the context of *transformability*. It has generally been used to refer to flexible architectural features in which the physical context of space can be transformed. In a long-term examination of space and its flexibility, the focus shifts, however, from the single dwelling and its boundaries to the whole building and to the urban structure. The interface between city and building plays a significant part in the self-organization of city and buildings, and in the thesis it is approached from the point of view of *multi-usability*.¹⁰ This refers to a space or spaces that can be used in several ways even without transforming the space in one way or another.

The configuration of space and its new understandings of *modularity* in buildings become then the core essence of adaptability and flexibility. The understanding of modularity is derived from *systems thinking*, which is also a significant feature in *resilience thinking*. They are both tackled more in-depth later on.¹¹ Modularity is a feature of all living systems that can be found as cells in organic systems. In ecology, modularity is considered one of the key factors supporting *resilience* (Heylingen 1999; Walker & Salt 2006). Resilience usually refers to a system's capacity to persist through its adaptable character and it also appears in social-ecological systems.¹² Modules that interact at a local level give rise to self-organization and *emergence*, which refers to a system's potential to create something totally new that cannot be seen or determined by the parameters of the system. Emergence is formed in the interaction between the parts in the system. When a system's components have enough independence and connections, resilience will increase, because any damage or lack of adaptability in one component will not necessarily affect other modules, or because a separate module may even replace the non-functioning ones (Heylingen 1999 : 9).

¹⁰ I have wanted to use the word multi-usability instead of the more common word multi-functionality because it portrays better the use of spaces by people rather than referring to functions of space.

¹¹ Systems thinking refers to the view of systems as a whole and it analyses the interactions in them, rather than isolating smaller and smaller parts of the system under study. Resilience thinking offers a different way of understanding the world and a new approach to managing all kinds of resources that springs from the systemic understanding of the world. (Walker & Salt 2006).

¹² Resilience as a concept is quite ambiguous and has been interpreted in various ways. Its main use has been in studying ecosystems and particularly social-ecological systems (Walker & Salt 2006).



Applied to built environments on a metaphorical level, modularity can be interpreted as spatial units in buildings, usually understood as dwellings or the units that compose them (Krokkfors 2010 : 219). Adaptability is very much connected with how these units interact in relation to each other. In many of the flexible solution developed for building construction, modularity plays a crucial part even if it is not always emphasized as such. Very often adaptability and flexibility are understood merely as a sort of generic character of the structure of the building. However, as Leupen (2006a : 121–145), among others, also points out, how spaces are configured to each other and how they relate to passage and are thus able to interact, has a crucial effect on how adaptability and flexibility work at the building level. The organization in the context of modularity then plays a crucial role. I call this kind of modularity *abstract modularity* that differs from modular construction. It is something that gives potential for change and choice in the use of space even though it does not necessarily yet exist as physical boundaries.

The main objective for this renewed understanding of modularity in the architectural field is connected to the use of space, and particularly to the *self-conditional*¹³ use of space. The focus in this thesis is on how space can promote people's self-conditional use of it. Self-conditionality is a word I have created especially as a concept for this thesis to refer to the way people can use space and co-create their spatial conditions from their own starting points. The idea is that people themselves are capable of identifying what they want from space and creating the spatial conditions they want.

¹³ The word springs from the apt Finnish word *omaehtoinen*, which captures the self-conditional attributes of people's own starting points for their use of space. The first part of the Finnish word – *oma* – means one's own and the second – *ehtoinen* – refers to the conditions given to something. I could not find entirely equivalent word in English that could characterize the appropriate Finnish word.

Fig. 1. The three main properties, time, space and use, which help to define resilient space.

USE

The function-based understanding of space holds many background assumptions as to how the space should and can be used. For promoting self-conditionality as an objective of space is not only to help people to live according to their own needs and aspirations but also to promote the sociocultural sustainability of urban areas as well as individual and communal wellbeing – that is, to enhance social capital¹⁴. The definition of the concept of flexibility is nonetheless very wide. To be able to better define the objectives of self-conditionality requires opening up the various background assumptions of the various ways of producing flexibility (see chapter III). The concept of *lived space* developed by Henri Lefebvre (1991) is seen as a key concept in defining the prerequisites for the self-conditionality of space. Lefebvre sees space in much wider and more profound terms than just as a location of certain use, and it is connected to the understanding of the concept of the *creative dweller* developed in this thesis. The creative dweller as a concept draws from the notion of how people can, through typologically flexible buildings with self-organizing qualities, define their ways of living from personal and even economic starting points in a much more profound way than is possible in the everyday housing of today. The concept of lived space and the understanding of the creative dweller will be studied more thoroughly in chapter III.

0.2

THE NICHE, HYPOTHESES AND OBJECTIVES OF THE RESEARCH – WORKING TOWARDS RESILIENT SPACE

The research concentrates on urban living solutions, because of its vast and continually growing scale, and because it is in cities that are crystallized the needs and problems societies face today at accelerating rates. In the context of housing design and its potential to produce innovations have been little studied. The most prominent scientific research on innovations in the housing sector has emphasised the organizational level of production companies, and how they have supported innovations (Ball 1999, Barlow 1998).¹⁵ Contextual innovations, like social and spatial innovations concerning the use of space in housing design, have usually been related to architectural practice and their respective commissions and agendas. The wider theoretical questions of what resilient housing design should focus on, and what aspects the innovations should promote in everyday housing design and production, have been minimally addressed. Even though

¹⁴ Social capital has no undisputed meaning which is commonly agreed. So its use is very much connected to the discipline and level of study in question (Socialcapitalresearch.com 2017). Its definition in this thesis is discussed in chapter I.

¹⁵ The research of Ball and Barlow has largely concentrated on technical innovations in the UK context, but it also tackles the root causes of why it has been in general so difficult to foster innovation in building construction sector.

significant research has been conducted on general objectives for flexibility in design, the meanings of adaptability and flexibility, and the kind of role they should play in the overall design agenda, has not yet been studied coherently – least of all as the strategic dimension of design that resilience implies.

CHANGING CONTEXT

The great changes happening in society as a result of climate change, the exhaustion of natural resources, as well as the ongoing sociocultural transformations have all given a new kind of legitimacy to critical views on the production of the built environment (Carmona 2009 : 48–49). Change has been apparent in the scientific realm for several decades already, but the wider public has also slowly woken up to the harsh realities of changes to everyday life now that the consequences of climate change can already be perceived through the living-room window. In the face of threatening environmental disaster, understanding its consequences, and finding solutions to it, is more urgent than ever before. Considering the built environment, changes in legislation and planning and building regulation have taken place rapidly all over the world, at least in those societies that have recognized the vast problems created by a changing environmental context. Guidance and regulation have, however, for obvious reasons, concentrated on immediate consequences, with an emphasis on energy efficiency and energy consumption, which are relatively easy to perceive and measure. Long-term, more indirect, and qualitative aspects that are more difficult to gauge and so harder to solve have been addressed through systems thinking (Senge 1990; McLoughlin 1969) and also recently in resilience thinking (Walker & Salt 2006), which treat socio-ecological systems like the built environment as a whole. Due to the enormous challenge we face today, many things that we have regarded as self-evident will have to be reinvented, and the way building construction is understood will have to change if long-term devastating consequences are to be averted. From a more optimistic stand point, this has also created a window of opportunity for rethinking processes and creating novel approaches to housing design and production. I have done that by interlinking design thinking, referring to creative design strategies that develop the design field, with systems thinking and resilience thinking.

A PARADIGMATIC SHIFT IN HOUSING DESIGN

Housing design, particularly how we perceive its spatial arrangements, has been fixed for decades in Finland, and not much has changed (Neuvonen 2006). The whirlpool of climate change, the exhaustion of natural capital, and ongoing social change in the accelerating migration towards cities, differentiating lifestyles, demographic changes as well as changes in family structures and working contexts – all this has been happening simultaneously – sets the scene for how we provide for people’s wellbeing in the production of space, today as well as in the future. Sustainable urban development has been largely about densifying urban areas and rethinking transport, whereas building construction has focused on energy efficiency and recycling, as well as on the use of renewable energy. Even though it is of paramount importance to solve immediate problems like the energy efficiency of regions and buildings as well as developing recycling further as a circular economy¹⁶, when the criteria for sustainable development are widened from ecological sustainability to the circuit of sociocultural and economic sustainability as well, the way we produce space becomes ever more important from the viewpoint of long-term development. The tension between current practices and the resilient development of building stock can be explained by the closed systemic situations that in turn spring from very short-term views and aspirations, and these, in the long run, do not promote the innovation and constant development that could deal with the tension. A significant question then arises as to how we can design buildings and a built environment that can adapt to change, also continuously recreating its conditions and meanings.

The technological approach as the ultimate vehicle for solving the problems of the built environment has been called into question by several urbanists, such as Lang (1994)¹⁷, and the social agenda has become a more and more accepted approach for developing resilient societies. In the end, it is people and their behaviour that define the social context of the built environment and its endurance. As a concept, social sustainability has had many interpretations since the introduction of the Brundland Commission’s report (Un-documents.net 1987), and has been linked in various ways to almost every aspect of human life. Its spatial dimensions – how space serves people – have focused on the urban scale and qualitative attributes like promoting a mixed social fabric, and designing for safety. Considering buildings, a diversity of housing solutions has been called for, but in the context of apartment buildings this has usually been understood as different sizes of dwellings. However, the system can be best affected by changing its initial settings, that is, the common presumptions and

¹⁶ Circular economy generally refers to economy that produces no waste and pollution that takes its insights from living systems (Ellenmacarthurfoundation.org 2017).

¹⁷ In the context of planning, Lang (1994) has argued against the approach to sustainability that sees the environment merely as a problem of the engineering sciences, which can only be solved by technology.

assumptions that the system is based on (Donellameadows.org 2017). The hypothesis of this thesis is that to be able to create a resilient built environment and building stock, we need to go much deeper into the roots of how, in the context of continual change, we define housing. We need to see beyond existing practices of spatial production. How we can approach and accomplish this objective is the essence of this thesis. Its focus is on the development of a design paradigm that, from given strategic starting points, promotes a continually adaptable and flexible as well as meaningful building stock.

THE DEVELOPING TENDENCY OF DESIGN AND PRODUCTION

In the rather fixed context of producing built environments, change of any kind has been rather challenging to achieve in Finland (Puustinen 2012). Even though the quality of housing production can be considered sufficient by a number of criteria in Finland compared to many other countries, it is arguable whether it will remain so in the future. Planning and control, as well as the overall housing production system, are still trying to predict the future in defining the functions of the buildings, dwelling sizes and the households in a very fixed manner (Puustinen 2012, Krokfors 2010).¹⁸

Although constant development is, of course, happening and many of the stakeholders are trying to do their best to promote positive development¹⁹, the system as a whole does not necessarily work for the objectives set by individual actors or sectors in the pursuit of producing high quality and resilient built environments. According to systems thinking, change in one part of the system cannot guarantee desired results in the overall complex system (Walker & Salt 2006 : 29). Change in system can even shift the balance towards unwanted outcomes or the accumulation of problems if one part starts to dominate the others (Heylingen 1999 : 23).

Housing in Finland is guided by regulations and standards. They have, however, taken the very detailed approach of optimizing the components rather than considering the built environment as a whole. The holistic approach that resilient thinking advocates does not exist yet. The whole is seen through its parts, forming a kind of

¹⁸ In Finland, guidance and regulation rely heavily on bureaucratic processes and agendas that do not always contribute to the resilient quality of the environment particularly when interpreted in the systemic contexts of the production of built environment. How the different factors responsible for the built environment affect each other in the mill of systemic contexts has enormous impact on housing outcomes and on how urban areas develop.

¹⁹ Working group events of the URBA research project (2007–2010 in YTK, Technical University of Helsinki) revealed the frustration many stakeholders felt over their inability to affect the workings of the overall system. Similar results emerged also in the interviews (Interview 2) conducted during 2010–2011 in Finland.

a “click together” viewpoint (Capra 2002 : 4–14)²⁰. However, the clicking together of good components does not necessarily lead to resilient built environments.²¹ Even though the system is heavily controlled and guided – and partly because of this – the overall system cannot truly produce the desired outcomes and diversity as its intrinsic character (Puustinen and Kangasoja 2009).

The biggest problem in the present form of guidance by standards is that the standards are based on existing models of housing, and because of this, guidance also unintentionally strengthens existing models and limits the development of new housing solutions. The systemic learning that is a characteristic of all complex systems (Senge 1990) does not take place because the system reproduces itself constantly (Krokfors 2006b). This is not to belittle the need for guidance and regulation, which is crucial for producing high quality and resilient environments in general.²² It is more of a question of the form and focus of the guidance and control (Puustinen 2010, Krokfors 2010).

The aim of this research is to promote a constantly developing tendency both in design and production, something that can respond to the cumulative challenges we are facing. New energy consumption objectives, such as nearly zero-energy buildings, will be fulfilled quite soon in new building construction, at least in Finland, and will most likely become part of everyday building.²³ After these objectives are met, the scope will most likely push more forcefully for qualitative and instrumental objectives of sustainable development. One of the main motives for doing this research has been to widen the understanding of sustainable development to include spatial criteria and to increase understanding of the crucial role the quality of buildings plays in resilient development.

The developmental tendency should be part of the intrinsic character of housing design and production, and it should be self-correcting to enable continual development and foster the emergence of new ideas, solutions and innovations. The basic hypothesis of this research is that design in its more autonomous role within the production processes could have a significant role to play as an enabler of this kind of development.

²⁰ The basic understanding of systems thinking is that the system is more than the sum of its parts as opposed to reductionist and linear thinking. The words used here, “click together”, is not actually used by Capra in his book referenced (*Hidden Connections* 2002), but it is used by John McCrone in his article on Capra’s book in the Guardian (Guardian.co.uk 2002). I found McCrone’s choice of words very apt in describing the Finnish regulation and guidance system linked to the built environment.

²¹ The standards in current guidance are usually tied to measurements or attached to other measured attributes, which do not work through clear and understandable objectives imposed on the built environment (Krokfors 2010 : 223–242).

²² There are enough bad examples of the lack of regulation in the history of Finnish housing production, particularly if one looks at the results of the so-called regional construction period of the 1960s and 1970s when regulation was minimal.

²³ EPBD (Energy Performance of Buildings Directive) demands that all new public buildings should be near zero-energy level by January 31st 2017. All buildings should be near zero-energy buildings by December 31st 2020 (Rakennusteollisuus.fi 2017).

THE UTILIZATION OF DESIGN POTENTIAL

The designed spatial configuration is very much connected to design objectives. Since the era of system building, the influence of the architectural profession on housing design has weakened, with architects working within a very limited framework (Vos, M. 2000; Pawley 1998; Bosma, K., Van Hoogstraten, D.; Hankonen 1994). Architects' contribution to the formation of new and innovative housing solutions has, in practice, been very marginal and has had little effect on the general development of housing according to the interview material of practising architects in Finland and in the UK I conducted in connection to this thesis. It has been difficult for architects to include in their projects much developmental potential, though admittedly there are weak signs of new kinds of developments where the architects' potential is more fully recognized, for example in co-housing initiatives in Finland.²⁴

At the core of the profession of architecture is its holistic approach to design and capacity to create new solutions for emerging problems. Architectural design capital also means the ability to create solutions that go beyond the perceived properties of existing reality. A need for spatial development has not been seen to produce any extra value for the producers of singular developments, which has been the dominant view in recent decades, according to interview material among architects I conducted. Due to the closed character of the housing production markets, development has not been perceived as necessary and has very often been considered risky to profitable business (Ball 1999 : 10). As producers have become, to a great extent, those who define the context of housing, the architects' role has diminished and they have been lacking influence in the context of housing production (Bosma et al. 2000).

One of the main objectives of this research is to bring out the relevance of architects' core professional competence for the resilient development of society so that this currently very modestly used spatial design potential could be better utilized and resourced. At least in Finland, even though the production of built environments lies in the hands of many actors, their knowledge and skills, in practice it is the architect, whether guided or not, who ultimately creates the physical context for most urban life. That is why it matters how the architects' potential as spatial innovators is enabled as part of design development, and how they can work as interpreters of people's and societies' needs in the best possible manner. Promoting design potential and its strategic dimension for resilient building is as much a question of new interpretations of housing design as of communicating and developing that interpretation in the processes responsible for the built environment.

²⁴ This tendency has been furthered by the changing agendas of cities and by new players currently entering the housing sector in Finland (Krokfors 2012).

UNDERSTANDING THE CONCEPT OF RESILIENT SPACE – LONGEVITY AND ADAPTABILITY

Resilience, as a concept, already entered the field of ecology in 1960s with the rise of systems thinking, but lately it has been more forcefully applied to understanding cities and their development (Davoudi 2012). Promoting resilience in the built environment has recently gained support among scholars and planners and it has already started to replace sustainability in everyday discourses (Davoudi 2012: 299). Even though its context has very different interpretations, resilience as a concept generally refers to a system's capacity to persist through change. Paradoxically, the ability to persist as well as change is part of its intrinsic character (Davoudi 2012 : 304).

Generally, resilience has been understood as different types of resilience, such as *engineering resilience*²⁵, which refers to systems returning to equilibrium after upheaval (Holling 1973, 1986) or as *ecological resilience*, which refers to “the magnitude of the disturbance that can be absorbed before the system changes its structure” (Holling 1996 : 33). Lately, an understanding of *evolutionary resilience* has also emerged (Davoudi 2012, Simmie & Martin 2010), which has started a “[...] paradigm shift in how scientists think about the world” (Davoudi 2012 : 302). It challenges the idea of equilibrium and sees that a system can change over time without an external disturbance (Scheffer 2009). Put differently, it is understood that a socio-ecological system does not return to normality, but instead has the ability to change, adapt and transform, in response to stresses (Davoudi 2012 : 302; Carpenter, Westley & Turner 2005). This can happen without a proportional or linear relationship between cause and effect (Davoudi 2012 : 302). Evolutionary resilience is very much linked to systems thinking, in which systems are conceived as “complex, non-linear, and self-organizing, permeated by uncertainty and discontinuities” (Berkes & Folke 1998 : 12). The understanding of evolutionary resilience has allowed new forms of planning to emerge which recognize the fact that “past behaviour of the system is no longer a reliable predictor of future behaviour, even when the circumstances are similar” (Duit et al. 2010 : 367).

The multiplicity of understandings and approaches to resilience also point to something essential about the concept: resilience is not something fixed, but is in a continual state of becoming (Davoudi 2012 : 304). Davoudi (2012) sees a growing need to shift the focus in planning from being locked in contexts towards being prepared for innovative transformations in the face of inherent uncertainties. But, it can also be seen to foster the potential for something totally new to emerge, which cannot be predicted from a system's initial presumptions (Heylingen 1999). It is this potential

²⁵ This is also called socio-ecological resilience (Folke, Carpenter, Walker, Scheffer, Chapin, & Rockström. 2010).

for adaptability and emergence, connected to space and its use, that is the key issue of this research.

The hypothesis of the research is that space, and its production, offer the potential for new kinds of activity through the adaptive and transformative character of buildings. It understands the responsiveness of space to changing social and cultural contexts, and views buildings as being in a continual state of flux that at the same time promotes peoples' wellbeing and sustainability. It argues that sociocultural and ecological sustainability are very much interwoven with each other, something that is not yet fully recognized in Finnish building design guidance and practices. It also argues that the way space serves people and the way people experience their environment also has immense effects in ecological terms. The connection between sociocultural and ecological sustainability will be studied more thoroughly in chapter I.

MOVING THROUGH SCALES AND TIME – UNDERSTANDING THE SYSTEMIC CHARACTER OF THE BUILT ENVIRONMENT

Socio-ecological systems by definition operate simultaneously on multiple scales and cycles in various time frames (Gunderson and Holling 2002). To be resilient in the long term, a socio-ecological system, like a built environment, should be adaptive at different scales of its existence, and take into consideration the very different timespans of change (Walker & Salt 2006).

However, until recently the focus of resilience in spatial production has been mainly debated at the urban scale, and the linkage to actual buildings and their spatial solutions has not actually been studied in a coherent manner. Currently, urban design and building design are approached as different disciplines, even though both promote sustainable solutions. Although the city is already understood as a social context connected to social sustainability, the focus in building design guidance is still very much on energy efficiency and the use of sustainable construction materials. Even though there is a generally accepted understanding among scholars about the importance of adaptability in building solutions (Carmona 2009), it has not yet fully migrated to the guidance and production practices of the built environment in Finland or, indeed, in many other countries. The production of the built environment as a whole has become ossified, due to the contextual understanding of housing and its systemic connections in the production of built environment, which are responsible for this problematic situation to a considerable degree. This will be studied more profoundly in chapters I and II.

Nevertheless, the focus of this research is not to study the processes per se, but to show what kind of effect they have on housing design and how difficult it is to promote adaptable resilient solutions in this context. The importance of studying the processes arises from the fact that even though there is much prominent research done

on flexible housing in Finland (Tarpio 2015; Krokfors 2010; 2006a; Tarpio & Tiuri 2001; Tiuri 1997; Kahri 1993), as well as significant research conducted internationally on flexibility (Schneider & Till 2007; Leupen 2006a; Leupen, Heijne, & van Zwol. 2005),²⁶ and there are also flexible design approaches that have been developed by practicing architects for several decades worldwide, practical applications are still very marginal. Many of the new approaches have also stayed as one-off experiments without becoming a salient part of housing production in Finland (Krokfors 2010 : 237)²⁷. There are many reasons for this situation that, in the Finnish context, this research has identified, but the main point of the inquiry is to shed light on the production processes from the point of view of design.

The thesis raises the question of whether the presumptions in the context of today's housing design and production processes are the right ones, and whether they are adequate in moving between scales from urban design to building design and becoming resilient solutions for the long term. In the context of sustainable practice, the division of urban design and building design into different disciplines has a much more profound effect on the resilience of space than is generally understood. This split is even apparent in how flexibility is perceived within building and dwelling design. Vast amounts of flexible solutions deal with flexible construction at the scale of the individual dwelling, yet this usually has only minimal effects on other scales, for instance buildings or the urban area. This rather confined and hierarchical view of flexibility addresses people's more immediate needs within the perimeters of their dwelling, but it is a limited approach for considering possible changes and spatial resources at the societal level. This thesis studies the essence and potential of resilient buildings and space, and it recognizes the continually changing social contexts as significant for establishing the criteria for sustainable resilient development at all scales of the built environment.

²⁶ The focus in Finland of researching flexibility and its potential to promote people's different aspirations over space has from the 1990s onwards until the mid-2000s (by Kahri, Tiuri and Tarpio) focused on *open building* solutions originating from N.J. Habraken's theory of the 1960s. Kahri, as a practicing architect, has also extensively written until today on flexibility in general in the context of housing and has been a prominent promotor of flexibility in housing design. Tiuri, a practicing architect as well, has applied her theoretical stance in housing design projects as well. In that way they all have been pioneers in promoting open building in Finland and introducing new understanding of flexibility to Finland. In my licentiate thesis of 2006 I wanted to widen the focus of how flexibility is tackled in Finland by studying the different approaches and theories behind flexibility and viewing flexibility on the typological level of the whole building. In Tarpio's PhD study of 2015 he studied comprehensively the different ideas and manifestations of flexibility both internationally and springing from Finnish cultural contexts. Influential thinking on flexibility published internationally in recent years has been by Leupen (2006) and Schneider and Till (2007) in their comprehensive studies on flexibility. They have also been influential in my research on flexibility in this thesis.

²⁷ Conclusions of the *URBA flexibility working group* acting within the URBA research project in the Technical University of Helsinki (now known as Aalto University).

SOCIO-SPATIAL SUSTAINABILITY – THE KEY TO LONGEVITY

The main hypothesis in the thesis is that the socio-spatial sustainability is the key to the longevity of buildings and should be considered as an objective in building guidance and control. New research on greenhouse gas emissions from construction has fostered an understanding of ecological sustainability that highlights the longevity of the building stock (Säynäjoki 2014). To be ecologically sound and recover from the energy consumption peak of the construction phase, the built environment should endure much longer than is expected today (Säynäjoki, Heinonen & Junnila 2012). Besides, the planet cannot sustain the ongoing use of natural resources (Starke 2013 : 26), a factor that puts extra emphasis on the persistence of buildings through time. Although the efficiency of use of raw materials has improved 30% during the last decade, the use of natural resources has increased one and a half times in the same period. In just one decade, humanity's use of natural resources and ecosystem services has increased by 1.6 planets' worth, which means we are consuming beyond the planet's capacity (Overshoorday.org 2016). Actual building construction causes more than one third of all greenhouse gases (Unep.org 2009). Even though the emissions of greenhouse gases in building construction are generally considered less of a problem compared to those emitted during the use of the buildings, the construction phase emissions are becoming an increasingly vital issue in life cycle assessment (Säynäjoki et al. 2012 : 7). A building's age thus becomes important also from the ecological point of view of using energy.

Structural issues and materials are naturally very important considerations in promoting resilient development, but the key to the longevity of building space is very much linked to use and the potential for very different kinds of uses to emerge. We have, however, no idea how people will want to live in 100 years or even in shorter time spans, or what kind of societies will exist in the future. We can easily perceive this unpredictability if we look back. Even though the demolition of buildings built in the 1960s and 1970s, or even later than that, is usually linked to their bad technical quality, buildings from that period have also been pulled down because they cannot easily adapt to new aspirations.²⁸ What changes are the needs as well as the contexts where buildings exist. Even if the structural qualities might still have been fit to withstand several decades of use, the buildings' spatial contexts have been too fixed

²⁸ For example, in Jyväskylä the old student housing building in Kortepohja was part of a competition brief. The property holder wished for it to be demolished, because of its small unit sizes. The configurational and structural context does not support any other typologies than traditional student housing, which are difficult to transform to anything else (Europan.fi 2017). In *Rakennuslehti*, one of the leading newspapers in the Finnish building sector, Kalervo Haverinen, the CEO of Kunta-asunnot (Municipality Dwellings), stated (September 17th 2009) that the demolition of 1960s and 1970s buildings is also affected by the fact that the dwellings are too big for the current trend of building smaller dwellings. The same article also stated that the demolition of buildings is increasing. According to ARA (The Housing Finance and Development Centre of Finland), in 2009 the number of permissions for demolishing buildings had almost doubled compared to the previous year (Kortelainen 2009 : 16).

to certain purposes and so cannot adapt to new circumstances either at the urban or the building scale. What makes cities and buildings tick is the people.

It is, however, important to acknowledge that human behaviour set free does not always promote ecological sustainability.²⁹ Responding to the needs of people can be the very opposite of striving for sustainable development. Satisfying different kinds of aspirations has great impact on the development of the city structure and energy consumption. At the core of an industrial society are values of freedom and the possibility to choose. Freedom of choice and sustainable development can be mutually exclusive unless there is change in people's thinking and habits and a capacity to accommodate those emerging new habits. This means setting clear new objectives for the built environment and its production processes, and overhauling how we develop housing design. Following the devastating news on climate change and natural resource depletion point to gloomy consequences, so it is extremely important to define the objectives we impose on design and processes, and particularly to work out what kind of questions we need to ask in order to create adequate new approaches. In a pluralistic world based on very different viewpoints and objectives can lead to very different paths of development. The aim of this research is to fill the gaps, and in a coherent manner, open up and value new viewpoints for questioning and further development.

STRATEGIC AND SYSTEMIC DESIGN DIMENSION – RECONFIGURING THE BACKGROUND ASSUMPTIONS OF DESIGN

In a consumer society, the fulfilment of the sustainable development agenda has been largely seen to be accomplished by redirecting consumer behaviour into consuming more sustainable products and recycling them. Yet this relies on the very same dynamic of consuming that has been the main cause of the environmental problems we face today. The pace at which natural resources have been exploited to make new consumer products has, however, accelerated and the problem is very much linked to consumerism as a background assumption affecting all kinds of action. The persistent belief in endless growth and the endless exploitability of natural resources can be traced to the development of consumerism (Meadows, Behrens & Randers 1972).

Even though housing is also considered to be a consumer product, housing solutions, unlike other consumer products, are very homogeneous in Finland, because of the closed markets and other features of the housing production. Therefore, meaningful choices concerning housing cannot be made because real choices do not exist due to the homogeneity of the housing markets (Gimbley & Tyvimaa 2014; Rask, Timonen &

²⁹ Design that takes into consideration all the aspirations of people can, from the point of view of nature, be catastrophic if people start consuming more goods and live lives that use more non-renewable energy (Lang 1994).

Väliniemi 2008). When looking at the overall housing market and the limited choices it offers today, people appear as passive end-users, whose influence on products and producers will only be realized if there are major collective shifts to direct production. It is like a vicious circle in which nothing can be changed unless enough people make the same choice, but that choice is difficult to make if it does not exist. The homogeneous existing housing production, which Gimbler and Tyvimaa (2014)³⁰ refer to, is usually directed at the average person that nobody precisely represents. The lack of competition in housing production fosters a lack of choice and accelerating costs (Gimble & Tyvimaa 2014 : 354). And on the other hand, the high cost of housing takes resources away from other fields of societal activity, which are usually seen as a precondition for wellbeing (Ashcroft 2012; Braund & Ashcroft 2012).³¹ The creation of the built environment has been largely based on “one solution fits all” production based on an understanding of what is considered good living and housing, which also operates as a qualifier for regulation and control (Puustinen 2010). Universal housing models have been the basis of both production objectives as well as regulation, which admittedly guarantees a certain level of quality, but cannot truly help efforts to develop a built environment that might actually reach beyond the stated minimum criteria. At the same time, this kind of creation of a “least bad” built environment that fulfils minimum standards requires considerable investment of resources in many ways. In the long term the cost of and the responsibility for the built environment will fall onto society and its members – and the planet we inhabit.

What if people’s role as creators of their own living conditions were more immediate, and what if this role were also seen as an asset and resource in itself, advancing their spatial choices both on the individual level as well as in the wider societal context as part of the resilient development of the built environment? What if the impacts of individual actions were not only instrumentalized through consumption, but were direct and proactive, allowing people to create something new and meaningful – new social and material contexts – which would have immediate impact and manifest itself also beyond consumer habits in much wider contexts and meanings in the society? Consumer choices would not then be the only basis for understanding the production

30 Gimble and Tyvimaa (2014) argue that housing production in Finland does not represent the occupiers’ preferences. They use hierarchical cluster analysis based on their data collected via questionnaires to determine whether different combinations of housing attributes are important to groups of residents. They have described clusters of Finnish people at different phases of the life cycle and with different preferences related to their recreational activities and financial expenditures (Gimble and Tyvimaa 2014 : 351).

31 This point of view was also introduced in the documentary *Four Horsemen* directed by Ross Ashcroft, which interviewed several prominent economists and writers. Among them were Joseph Stiglitz, former chief economist at the World Bank; Noam Chomsky, linguistics professor; John Perkins, author of *Confessions of an Economic Hit Man*; Herman Daly, economics professor; and Max Keiser, tv host and former trader. The film was released in the UK on 14 March 2012. It was also turned into book by Mark Braund and Ross Ashcroft (Braund & Ashcroft 2012)

of the built environment and its sustainability. The hypotheses of this research is that as an interpreter of the different aspirations and needs of people, and as an enabler of people's activity, the built environment can have significant impact on achieving balanced and sustainable ecological, societal as well as financial development. To be able to understand and spatially accommodate this kind of social change, and even promote it in a balanced manner, the paradigm that sees people as passive consumers in housing markets caught up in an accelerating pace of overall consumption must be rethought.

According to the economist Tim Jackson (2009), the traditional solution to the problem of continual growth based on consuming, is to invoke to the concept of *disconnection*, in which goods and services are designed in a new way and the production processes are changed. The amount of production depends less on the amount of material input while making work efforts more effective has a big role to play. This disconnection can be conceptually divided into *absolute* and *relative*. *Absolute disconnection* is quantitative disconnection, which can be reached when the resource impact decreases, regardless of production. *Relative disconnection*, on the other hand, refers to the capacity to make more with less in order to get more economic action with less environmental damage: more goods and services with fewer resources and lower emissions. Relative disconnection thus means doing things more efficiently. According to Jackson, the problem in relative disconnection is its slowness and inadequacy. In spite of operations directed at ameliorating disconnection, the whole carbon intensity of the world economy has grown alarmingly in recent years. For disconnection to offer a solution to the problem of growth, the use of resources should be more effective and should occur at the same rate as the growth of production (Jackson 2009 : 89). According to Jackson, efficiency has to continuously improve with economic growth, so that the overall load does not grow. He sees that this goal, only achievable with difficulty, demands absolute disconnection, something for which there is no evidence. Jackson emphasizes that what is needed are significant changes in technology and in economic policies, and there should be a narrowing of consumer demand and an enormous international effort for reducing the intensity of resource use, in order to avoid the collapse of natural resources and stay within the limits set by the environment. He argues that the belief that technology can save us has arisen because we have not been able to limit population growth or increasing income inequality (Jackson 2009 : 100). Absolute disconnection and economic growth without negative environmental impacts is, according to Jackson, wishful thinking based on the existing research and evidence without intervening in the grounds of the system of market economy (Jackson 2009 : 109).

As Jackson (2009) points out, fixing national economies is also just part of the problem. For sustainable development it is also very important to deal with the societal logic of consumerism. Changing this logic cannot rely solely on individual choices.

Even though the will for change is growing, it is almost impossible for people to choose a sustainable way of living, no matter how much they want it. Even highly motivated people experience conflicts in their attempts to cut free of the chains of the consumer society. To expand this kind of action to the whole of society is impossible without changes in social structure. Jackson is thus calling for social innovations to be able to take into consideration the limits of growth and the responsibility of the state for changing the social logic of societies. (Jackson 2009 : 178–179, 185). According to Jackson, this means attending to the social aspects of living, to psychological and material preconditions like the physiological wellbeing of people and to the sustainability of residential communities (Jackson 2009 : 69).

Jackson sees that even though the disconnection of using natural resources by promoting immaterial services does not necessarily promote growth at a large scale, they are important for the creation of social capital. The services that, for example, promote local and communal enterprises, repair and maintenance, local culture, slow food, etc., usually mean a large work effort that employs people, in which labour productivity is poor (Jackson 2009 : 154–155). However, Jackson sees that we have to give up the presumption that the growth of material consumption is the only possible foundation for stable economic development. He thinks that a better attribute could be “flexibility” to be able to resist shocks and internal conflicts. Jackson is promoting an ecological macroeconomics, which can resist these external shocks and internal conflicts, ones that cause chaos during recession periods. Ecological macroeconomics entails new ecological investments that take into consideration the limits of natural resources. This means rethinking the concepts of profitability and productivity to make them better serve the long term objectives. (Jackson 2009 : 165–166). This thinking applied to economics that Jackson promotes can also be found in resilience thinking.

The key to promoting resilient development in the built environment is very much linked to how we understand the concepts of efficiency and choice (Walker & Salt 2006) – also in spatial terms. Whereas in the concept of disconnection where products are continually produced more effectively, which Jackson sees as a myth for solving the current problems, more fundamental change is needed to effectively tackle the root causes of non-resilient development. In resilience thinking, the potential for different kinds of development scenarios to emerge plays a key role.

A resilient social-ecological system has a greater capacity to avoid unwelcome surprises (regime shifts) in the face of external disturbances, and so has a greater capacity to continue to provide with us the goods and services that support our quality of life. (Walker & Salt 2006 : 37)

When this choice of development scenarios is lacking or when it is only working at certain scales, resilience is very quickly lost. Such efficiency thinking is deeply rooted

in housing production. This choice in the context of the built environment in buildings is interpreted in this thesis as how people can make the best of their living situations and even enhance them through space.

UNDERSTANDING EFFICIENCY IN BUILDING

As a basis for sustainability, the concepts of efficiency and optimization are very often seen as a solution even though they have been responsible for the problems we are globally facing now (Walker & Salt 2006). According to Walker and Salt (2006), the widely shared understanding of efficiency does not necessarily promote resilient development but can even hinder it, because the demand for efficiency is usually based on very short-term financial profit. This also applies to housing production. For example, housing in Finland is designed very efficiently in terms of use of space, in fact, in an increasingly compact manner, not necessarily for sustainable reasons but because of the construction costs of dwellings and the demands on profits for saleable square metres (Krokkfors 2016b). Dwellings are getting more and more efficient spatially in the sense of fitting more rooms into fewer square metres inside a dwelling. However, at the same time this is making them less flexible and resilient.

As an answer to this ongoing problem, minimum dwellings have also been promoted as one solution (Hedman 2011). A minimum design ideology³² has popped up since the dawn of modernism at constant intervals in architectural discourse for different reasons, because of the efficiency demand. Minimum dwellings have also been recently promoted for the sake of energy efficiency. However, developing minimum criteria for dwellings – making the module of a housing unit, the dwelling, more effective – does not necessarily in the end promote resilient development in apartment buildings if we look at the bigger picture. The lack of flexibility that the production of minimum dwellings might foster could even be seen to work against resilient building. The whole issue of size and efficiency of a single dwelling unit – for all dwellings – could be rephrased as a new kind of assessment of questions. For resilient development as a whole it is more appropriate to ask about and define efficiency by thinking how housing design and the concept of dwelling might be developed so that people could access the spatial resources they need or can afford at different times of life, which could also promote resilient development in wider societal contexts. Adaptability could then enable dwellings to be reconfigured – adapted – into different sizes following aspirations and market situations.

³² The theme of the second CIAM conference was *Die Wohnung für das Existenzminimum (The Minimum Subsistence Dwelling)*. The focus was on design solutions to solve the problem of high rents for low wage earners. (Aarchitectureandurbanism.blogspot.fi 2011). The same theme was dwelled on more in-depth by Walter Gropius (1929) in *Sociological Premises for the Minimum Dwelling of Urban Industrial People* and Karl Teige (1932) in *The Minimum Dwelling* (published in English 2002).

Small dwellings, whose use is often temporary, could exist in the existing building stock even where they were not purposely built as such and stay as such forever. In the long term spatial resiliency should be accomplished without needing to define the parameters of dwelling so precisely, since the unpredictability of needs could lead to demolition if the need for certain kinds of spatial configuration were to decrease. This means giving up some preconceived ways of thinking in housing design, notably seeing dwellings as the fixed units of housing construction and objects of optimization. Instead, the new problem setting requires understanding of the systemic character of the built environment, and developing the strategic understanding of design also on a building level. This way resilient choices can be continuously developed in housing production even when future needs are unknown.

Freedom of choice and the objectives of resilient development do not need to be necessarily mutually incompatible. The possibility that people could reach the goals of sustainable development from their own starting points can be accomplished simultaneously in the production of the built environment by rethinking housing; the units and scales as well as the uses it tackles. Instead of just optimizing the singular unit, the whole context of understanding efficiency and optimization could be developed at all scales. It is a study of presence and becoming at the same time.

RETHINKING THE UNDERSTANDING OF RESOURCES – SAVING RESOURCES BY CREATING NEW RESOURCES

As Jackson (2009) points out, there is a need to find other ways to achieve balanced economic growth, to understand it from new starting points. When it comes to the resources connected to the building sector, it certainly means new ways of producing built environments, but also different ways of defining and understanding resources. Because buildings will always be needed, it should happen in such a way that those resources that are used will promote the best possible use of buildings. This is a question of seeing space as an enduring resource not only for economic profit, but as something for creating long-term wellbeing and social capital, something that can also promote the emergence of new resources in society. This means seeing people in the context of using space as a resource, so that the saving of resources through resilient building might even lead to the emergence of new kind of immaterial and material resources.



The human being is a psychophysical being whose behaviour can be reactive or proactive, which is to say actively seeking to affect one's circumstances.³³ This is linked to the accumulation of social capital as well. The understanding of architecture as a holistic environment, which affects us all, has begun to be taken for granted among designers and many researchers. Phenomenology and environmental psychology have enhanced our comprehension of how space affects people both at the mental and physical levels, and they have an established position in the theoretical discourse on architecture. However, housing design has generally been based on universal models where inhabitants have adapted themselves to conditions regulated by the dwelling itself (Hankonen 1994, Saarikangas 1993). To put it crudely, housing production steeped in efficiency thinking has even been interpreted as locating people. It was particularly in the industrial system building era that the uniform housing solutions became "packed utility" (Bosma et al. 2000 : 43). One meaningful objective of this research is to look at the produced space from the point of view of people's proactive behaviour. The question then arises: how can the produced space increase wellbeing? Can it also feed people's creativity and activity, something that has a great impact on social as well as economic sustainability? The idea I seek to convey in the subtitle of

33 This thought is also reflected in self-determination theory (SDT) which has been evolving since the 1970s. Ryan & Deci (2017) developed it into a theory of motivation. According to the theory, people are motivated from within by interests, curiosity, care or abiding values, and less by external causes. Conditions supporting the individual's experience of *autonomy*, *competence* and *relatedness* are crucial for motivation in people. SDT proposes that the degree to which any of these three psychological needs is unsupported or thwarted within a social context will have a robust detrimental impact on wellness in that setting (Selfdeterminationtheory.org 2017).

Fig. 2. Emerging urban culture. *Restaurant day* in Helsinki.



the research is that the objective of producing high quality and resilient space could also create new social meanings and practices and thus create new wellbeing. This could even locate emerging and unpredictable social and economic contexts, through the intrinsic adaptive and flexible capability of buildings and space.

People are more and more interested in influencing their environment and taking care of it. In certain circumstances they have been able to create a new kind of urban culture and communality in a bottom-up manner, as for example in spontaneous urban gardening initiatives, local street celebrations and even taking into use buildings under demolition threat for temporary uses that have after the “takeover” become permanent.³⁴ See Fig. 2. and 3.

The internet and social media have certainly had a great impact on releasing and enabling new kinds of initiatives by people, but the social media has not created it out of nothing. This new social interaction capability has appeared as a tool to satisfy a basic human condition and has created a new kind of culture. It is largely a question of self-organizing action by people who have been able to generate something new, which town planners and architects as well as other actors involved in the production of space could not have predicted beforehand.

In the past decade, both in Finland and internationally, interest in developing space from more personal as well as communal starting points has grown significantly. It has partly sprung out of frustration and as a reaction against uniform housing production that leaves people no choices (Krokfors 2012). According to researchers, we have entered a new phase in industrial production, which manifests itself in so-called prosumerism (Victor & Boynton 1998). According to Victor and Boynton, we are moving from industrial mass production and mass customization towards the co-configuration of production, in which people become partners in production and can have influence on how products evolve. The idea can be applied to housing production as well (Mäntysalo & Puustinen 2008). But also in the co-configuration the demands that resilient housing production imposes, future generations need to be taken into consideration as well. This all refers to adaptive buildings that can be locations for satisfying spontaneous and emerging needs in a self-organizing manner.

In the past the possibility of self-organization has been in spatial contexts connected with city planning (Portugali 2000). Within the context of urban design and planning, self-organization is already starting to be understood as a force of its own, but this research takes self-organization further as a meaningful spatial parameter of design of buildings as well. Self-organization has also been seen as a driving force and a way to tackle resource intensive city planning in a situation where public resources

34 This has happened in Helsinki in the Cable Factory and Suvilahti old factory development areas, both of which have become important cultural hubs in the city.

Fig. 3. Urban gardening in Berlin

are diminishing. It has also been seen as partly replacing the welfare state.³⁵ From my Nordic European perspective, where the idea of the welfare state is still strong, I do not want to attach strong political connotations to the self-organization of space. Rather, I see it as another way of being able to create new social contexts, a way that can create new kinds of social activity. As Jackson's research shows, public resources are a prerequisite for creating social capital, not optional to it. For Jackson, the question is how the public resources are utilized. Partly the issue is about how wellbeing is understood. Jackson argues that wellbeing has recently started to be defined through money, and the concept of economic wellbeing and the growth of welfare have both been linked to economic growth (Jackson 2009 : 27). To change this social logic Jackson thinks it is important to promote equality and to reinforce everybody's social capital in a multitude of ways. He proposes that we should protect common public spaces, encourage initiatives promoting the sustainability of one's own environment and give local communities a say in city planning and urban design, as well as protect public services that promote local initiatives (Jackson 2009 : 209). Self-organizing space can further reinforce the social capital of local communities, give rise to new small scale business and services, and help third sector initiatives and other spontaneous activity on local level.

This research aims to advance understanding of how design and spatial tools could help people utilize their own potential in producing self-organizing space. Through self-organizing of space, it can also be made possible for people to create other kinds of proactive wellbeing, creating new mental, social and even economic capital with it as well as gaining economic benefits and balance their investment in space. For example, being able to rent or sell parts of their dwelling without needing to sell the whole property at once, gives them flexibility in life situations. People could use space in a more instrumental way as a source of income, offering different kind of services, or even use parts of it as small-scale production space for more spontaneous, temporary and evolving ventures. This kind of bottom-up based initiative by individuals needs space that does not demand big investments and does not usually base its market logic on substantial profit margins to cover the investment and create capital. This is why such space should be found within existing building stock, and why its efficient use on the city level should be made easy, to save resources, both natural and economic, and create new resources by producing self-organizing space.

In creating spatial self-organizing solutions, it is also very important to develop innovative tenure types. These should be ones that make use of self-organizing space possible and easy to adapt both within rental and owner-occupied housing and in their potential adaptations. Adaptability should then become characteristic of all

35 Thomas Sieverts in the EUROSPAN Intersessions Forum in Paris November 2014. The theme of EUROSPAN 12 and 13 has been the adaptable city, which also dwells on self-organization as a character of cities.

tenure types. This is also important not only because it helps ensure the equality of people but also because we cannot know what kind of tenure might be required in buildings, say, in 100 years. The self-organizing character of new building will also need a critical mass to have societal effects.

Another agenda and reason for creating self-organizing space can be perceived at a much larger scale; the long-term point of view of national wealth. In Finland, as much as 60% of wealth is tied to real estate property (Rakli.fi 2013). And the whole built environment covers 74 % of national wealth (Kirafoorumi.fi 2017). If the built environment is not able to adjust to change and development, the value of this national property could diminish (Kirafoorumi.fi 2014).

0.4

THE DESIGN CHALLENGE OF RESILIENT SPACE

WHAT ARE THE QUALITIES OF RESILIENT SPACE?

How might we define and design resilient space? If we take as a starting point the long-term focus of building stock that is achieved through the adaptable character of the buildings, the next question is how this adaptable character is understood, defined and enhanced. Flexibility as a concept has been used in architectural discourse regularly, particularly by practicing architects. Approaches to flexible design have varied, but in most cases the guiding principle has been how it promotes people's self-conditional living in one form or another.

THE CONCEPTS OF FLEXIBILITY AND ADAPTABILITY IN ARCHITECTURE

The use of the concept of flexibility is very mixed in architectural discourse and in the way it is reflected in architectural practice. To avoid misunderstanding I have wanted to give a general definition to flexibility, which I will use throughout the research. The concept is loaded with different kinds of interpretations. The same term, flexibility, is used in very different contexts to express very different kinds of aspirations. Mostly, flexibility is a general term that covers almost all kinds of flexibility from construction to use. In the context of use it can embody the possibility for inhabitants to modify their own space (Priemus 1993) or it can refer to the actual performance of the modification (Groák 1992 : 15). Also, both concepts; adaptability and flexibility, have a somewhat different tone depending on which angle they are approached from.

Steven Groák (1992) distinguishes the concepts of adaptability and flexibility from each other. According to Groák, adaptability can be considered social in its character.

For him adaptability enables different social uses whereas flexibility is a question of physical arrangements. (Groák 1992 : 15). Groák considers that adaptability is accomplished by designing spaces in such a manner that they can be used in different ways. This is achieved mainly by organizing circulation and giving certain definitions to spaces. His understanding of adaptability is thus very close to the concept of multi-usability. For Groák, the idea of flexibility is about the changing of the physical fabric or structure of the building. (cit. Schneider & Till 2007 : 5).

Even though Groák's division of the concept is insightful and clear and to some extent also very essential for this research, I have used the concepts of adaptability and flexibility as general umbrella terms for a variety of interpretations. Despite the mixed use of these terms, in the everyday language they have started to become general terms with different interpretations. However, like Groák, I distinguish adaptability and flexibility from each other. I define the term adaptability as the ability encompassed in the building or space that can cope with the flux of changes happening in society. Adaptability does not yet refer to its physical imperatives whatever they are. I use the term flexibility as a general term that comprises the different dynamics that a space encompasses and that can fulfil the adaptable character of the building.³⁶ Adaptability is then the generalized resilient character of the building, whereas flexibility is already a much more concrete way of defining the implementation of change. If the objective of adaptability is to cope with external changes, as in its definition in the context of resilient adaptable systems, so flexibility is about how changes can be made to happen. Adaptability compared to flexibility is, in my interpretation, a somewhat more reactive term than flexibility, which is seen as more dynamic and active in character. Flexibility can have different attributes and characteristics which can be produced by modifying the physical realms of space. Or, it can be understood as the multi-usable character of space. In multi-usability, space does not necessarily need modification but can nonetheless be flexible. However, multi-usability is then also linked to the physical character of the building that makes it multi-usable. Transformability is often used as a synonym for flexibility, even though as a concept it more or less spells out how the multi-usability of space can be accomplished. Multi-usability is here linked to the objectives of the social use of space, which in turn is the paramount aspiration of adaptability – the potential of space – whereas transformability is a characteristic of space, one that helps these aspirations to come to be realized.

³⁶ As I use flexibility as an umbrella term, it comprises both the flexibility of the construction phase and the flexibility of use, even though in the context of typological flexibility I use it mostly in the context of use. I have chosen this wide angle because both construction and use usually have to do with the physical aspects of the building.

THEORETICAL APPROACHES TO FLEXIBILITY

Even though the context for flexible design has, for understandable reasons, been practice related, there are some theoretical approaches for studying adaptability and flexibility of space more consistently. Among the most prominent ones is the *open building* approach put forward by N.J Habraken (1961).³⁷ It identifies flexibility mostly at the dwelling level, where the inhabitant has been able to adjust the context of their own apartment. There are, however, also more recent in-depth studies of flexibility at the building level, as in Leupen's book *Frame as a generic space* (2006a). In this case, rather than considering it a full-fledged design theory, it can be called a significant and profound research exercise into the flexibility of buildings. The different theoretical approaches, also other than those mentioned here, will be studied more thoroughly in chapter III. Depending on their background assumptions, they tend to address very different aspects of the flexibility agenda. Chapter III sheds light on these aspirations and how they contribute to the flexibility agenda as it relates to the idea of resilient building developed in this research.

In most of these theoretical approaches, attempts to go beyond individual solutions to a more comprehensive understanding of flexibility are apparent. Some are more straightforward, asking more simple questions, and some are more multi-dimensional, taking into consideration several features of space and building objectives that will affect flexibility at different scales and time frames. One very specific difference between them is how they understand time. A long-term view can be considered the most significant feature in their approach to flexibility and adaptability, even though they usually also support short-term aspirations as well. Even open building, which usually mainly concentrates on the flexibility of the dwelling level, considers the temporal perspective in some form, with the flexibility often benefitting the future inhabitants as well. In Leupen's (2006a) approach, in which the whole building and its flexibility are under scrutiny, the focus is even more attached to temporal aspirations for spatial change. Leupen (2006a) is in search of generic aspects of flexibility in the frame of the building, which also emphasizes other aspects such as the spatial configuration of the building, closely connected to the *typology* and *type*³⁸ of the building. The generic flexible structural quality of a building will not promote resilient and flexible features if the organizational as well as architectural

37 It defines the hierarchical levels of influence of space and applies it in everyday industrial housing production. In the theory of open building the main hierarchical levels are *supports and infill*, which are clearly distinguished from each other. The load bearing structure, *supports*, is something permanent and the *infill* is flexible so it could be changed according to different needs of the inhabitant. There are also two other structures, namely city and urban tissue.

38 Type as an architectural concept is a much wider concept than just building type, which is more commonly used in architectural discourse. Type is the architectural and configurational design principle of the whole building, also conveying the meanings it can create in people. Typology is the study of types but in architectural design it usually refers to a certain spatial configuration coming from a certain type.

aspects and qualities are not recognized at the same time (Krokfors 2006a).³⁹ These features will be discussed more thoroughly in chapter III and IV.

Most of the research on the flexibility of buildings focuses particularly on housing or office building design, and usually the perspective is either-or. However, a focus of mixing different uses at the building level can be seen, mostly in the discourse on hybrid building.⁴⁰ The understanding of hybrid buildings does not necessarily promote self-organizational qualities of space. Generally, hybrid building is understood as comprising housing as well as other functions, but self-organizing that would allow building spaces to adjust to different unpredictable uses without defining particular uses to particular spaces has not been studied comprehensively. With the self-organizing quality of space also comes the possibility of emergence – the potential for something totally new to appear – as a consequence of the flexible typological quality of the building (Krokfors 2010). One important hypothesis of this research is that space should not be so clearly defined for housing or other use in order to be resilient from a long-term perspective. Accordingly, the term housing production is used sparingly here, because it always refers to a more constrained understanding of the use of a building. This approach, however, changes the understanding of building design. If we are not making purpose built buildings for certain functions the architectural approach to building design will most likely change as well.

Contextual change in time can be observed in many old buildings, for instance, in old townhouses that, during their existence, have seen many different kinds of uses. Or, vice versa, it can be perceived in old industrial buildings that have been developed for housing use once the need for industrial use has gone. Town houses or old industrial buildings have comprised certain characteristics that have made them persist in time. These characteristics have usually been linked to structure and the spatial configuration and passage within the building connected to multi-usability, or to some kind of surplus capacity, such as, the size of the space or high ceiling height.

Promoting the self-organizational qualities of space, however, requires novel understandings of spatial efficiency in the context of the whole building and how it is configured. The potential for choice in using a building for different kinds of socio-spatial contexts is what makes it resilient. This kind of understanding of resilient, self-organizing flexibility, which can encompass different kinds of typologies and situations, and which does not focus on certain kinds of structural solutions only, is epitomized in the concept of typological flexibility. The most important impetus for typological flexibility and the core of the theoretical context it offers springs from the potential for resilient evolution of the buildings and its self-conditional use.

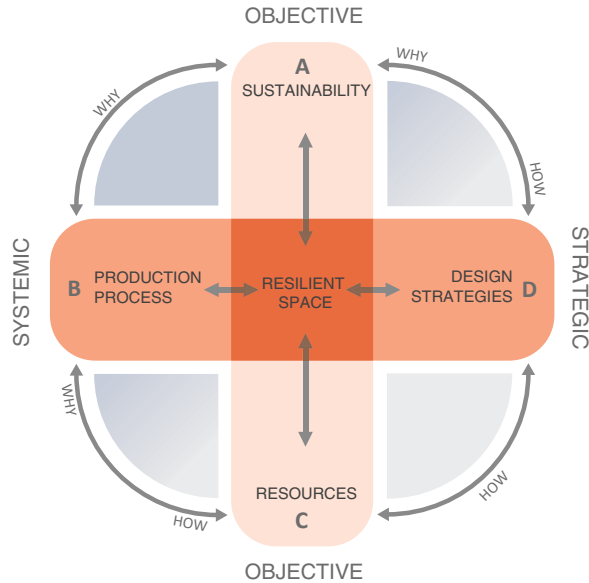
39 For example, large open spaces like loft spaces do not necessarily promote multi-usability unless the passage to different part of the space, when the space is divided into rooms, is regarded in the design in advance.

40 The hybrid building discourse is discussed amongst others in two publications, concentrating on different approaches to modern hybrid buildings: *HYBRIDS I. High-Rise Mixed-Use Buildings*. a + t 31, 2008. a + t publishers. *HYBRIDS II. Low-Rise Mixed-Use Buildings*. a + t 32, 2008. a + t publishers.

RESEARCH QUESTIONS

The overarching research question is how the spatial criteria for resilient space could be perceived and developed so that the design could seize it and create new strategic and tactical approaches to spatial production that guidance and control could also support and promote. It is not a question of developing a method for design, but rather elaborating on the strategic dimension of design that could create the kinds of resilient spatial conditions that in turn could promote diversity and proactive contexts in the built environment. The focus is first and foremost on design and its potential to promote the self-conditionality of space and the endurance of the building stock. The strategic quality of space springs from a flexible typology of building that can be applied in different ways. Its objective is not to limit or guide the architectural character of the building. The architectural character is linked to architectural quality, which is seen as an asset for creating meaningful built environments that people want to preserve and cherish. The concept of type in design context is also very important for the thesis because it comprises a holistic understanding of buildings that is linked to both architectural quality and to their structural as well as spatial configurations. The theoretical approach developed for understanding and promoting the strategic dimension of buildings, studied more closely in chapters III and IV, is just one dimension of design that should be taken into consideration, but not the only one. Nevertheless, not all building stock can endure, however good its architectural qualities, unless it has qualities that serve people's changing needs and aspirations. There are not the resources to just preserve building stock, so what is preserved must have the potential to respond to changing circumstances.

The rather ambitious main research question – how to create resilient space – is further divided into several questions aiming to shed light on this all-encompassing and challenging research question. These are epitomized as viewpoints that run throughout the thesis that considers both the context of design as well the context within which the design operates. All these viewpoints deal with the understanding of resilient space gone through so far in the thesis. The argumentation and hypotheses already introduced as the context of resilient space in the thesis brings up four viewpoints that deal either with the objectives that should be imposed on design, or the systemic and strategic understanding of the built environment and buildings. The objectives are the expansion of the definition of sustainability and how we understand resources in the context of the built environment and buildings. For the development of design, from the point of view of resilient space, the systemic and strategic dimension is relevant concerning the production processes and buildings.



The four viewpoints are:

- | | |
|--------------------------------|---|
| A (Objective) | The definition of sustainability in the context of spatial production |
| B (Systemic condition) | The systemic contexts of the production processes |
| C (Objective) | Understanding of resources in the built environment |
| D (Strategic condition) | The contexts of the strategic design dimension |

These four viewpoints run through the whole thesis as a framework that defines the context for the research. They are crystallized as four topics that have an interlinked relationship to each other. The objectives are A sustainability and C resources. Both the systemic and strategic understanding of B production processes and D design are affected by and affect these objectives. The relationships of these viewpoints – as topics – are presented in Figure 4. Taking a more in-depth look at the definitions of A sustainability and B production processes will define WHY the state of art in the production of the built environment is what it is currently, but redefining the understandings of C resources and D design will help to reconcile HOW the resilient space could be obtained.

Fig. 4. Connections and relations between the four viewpoints of the thesis.

A THE DEFINITION OF SUSTAINABILITY IN THE CONTEXT OF SPATIAL PRODUCTION

This viewpoint studies the context of sustainability and how it can be promoted through design. It sheds light on the question of why spatial viewpoints offer important criteria for advancing the resilient development of building, as well as how spatial conditions promote balanced social development.

B THE SYSTEMIC CONTEXTS OF THE PRODUCTION PROCESSES

The second viewpoint approaches the systemic context of the overall building culture and asks what kind of effects it has on design. It also surveys those issues in the building culture and processes that work against a sustainable and resilient development of the built environment. It sheds light on the systemic connection between the parts of the overall building culture. It also deals with the understanding of what are considered as innovations and how this understanding affects their emergence. There are tendencies apparent in building culture and processes that make the development of all kinds of innovations very difficult, particularly in housing design. This viewpoint also focuses on how those tendencies limit the potential for innovation.

C UNDERSTANDING OF RESOURCES IN THE BUILT ENVIRONMENT

The third viewpoint looks at how resources are understood in the context of spatial production, and how this understanding could be developed. It is based on the acknowledged fact that natural resources are at risk globally. It also tackles the problem of economic resources being reinvested over and over again in the same structure in a wasteful manner. Resolving this would free resources for other social investments. Even though the array of resources in the built environment is very wide, the ones tackled here are emphasized because of their effect on resilient design and construction. I call these resources material and immaterial resources. Material resources are epitomized by quantifiable resources, like natural and economic resources, that are a precondition for all building. The thesis, however, also emphasizes immaterial resources, qualitative resources interpreted as an intellectual framework for design and innovations that would promote wellbeing and further people's productive activity if it were also perceived as a resource. That is, it refers to the emergence that happens as a result of strategic design, which, at its best enables people's proactivity in societal contexts as well. Through spatial production both material and immaterial resources can emerge. Material resources can also be interpreted as the physical structure of the building connected to its temporal dimensions. Immaterial resources are the potential that the material resources give rise to in the form of new kinds of social activity.

D THE CONTEXTS OF THE STRATEGIC DESIGN DIMENSION

This question helps define more closely what the strategic dimension of design serves, and what it could entail. It is a dimension of design that can have an effect at all scales, from urban area to dwelling units. It springs from the typological flexibility of buildings. The viewpoint approaches the issue of what it is in the essence of design that enables choices and different scenarios for buildings. It understands building not only as a product but also as an ongoing process. This viewpoint acts like an autopsy of the typologically flexible building. Instead of trying to know merely what has gone wrong, it tries to understand how the production of the built environment could operate in the best possible way to achieve a longer and healthier life. It is the way the temporally more appropriate and self-conditional aspects of space can be accomplished. This autopsy will be conducted in chapter IV. The final chapter will also consider how different applications of typological flexibility and their strategic and tactical characteristics can be verified and valued.

0.6 THE INTELLECTUAL FRAMEWORK OF THE RESEARCH

The intellectual framework for and the objectives of this research draw on the concepts of systems thinking, resilience, resilience thinking, self-organization and emergence. All these concepts are “borrowed” from other disciplines, and are applied here to design and design thinking, and are understood specifically as strategic and seeking for resiliency in spatial production. These concepts and the modes of thinking associated with them constitute a point of departure for approaching the objectives of adaptability and flexibility, interpreted in the concept of typological flexibility. The key concepts are portrayed here as they are generally understood, and applied to the understanding of the built environment and its formation.

SYSTEMS THINKING

Systems thinking is a holistic approach at understanding systemic behaviour. Systems thinking studies the way things influence each other within a whole.

A system is a set of interconnected parts, but each part may be seen as a system itself and the whole system may be regarded as but one part of a larger system. (McLoughlin 1969 : 76)

Originally understood as an analysis of systems and how they operate, systems thinking has been developed as a tool for addressing how many environmental, political, social and economic problems operate across different fields.⁴¹ As an analytical tool it does not try to break the system down to its constituted parts as in classical analysis, but instead tries to see the parts more comprehensively in relation to each other (Meadows 2008).

A system consists of three kinds of things: elements, interconnections and function or purpose. A system is not just a collection of things; instead its fundamental feature is the interconnected set of elements that is coherently organized in such a way that it achieves something. It is more than the sum of its parts. Using Meadows' example, sand is not a system but a mere collection of things, whereas a football team with purpose and interconnections and rules of the game can be understood as a system. (Meadows 2008 : 11–12).

Many of the interconnections in systems operate through the flow of information. Information holds systems together and plays a great role in determining how they operate[...]. (Meadows 2008 : 14)

The most important properties of complex systems are their ability to correct themselves as their intrinsic character.

A diverse system with multiple pathways and redundancies is more stable and less vulnerable to external shocks than a uniform system with little diversity. (Meadows 2008 : 3–4).

Systems can change, adapt, respond to events, seek goals, mend injuries and attend to their own survival in lifelike ways, although they may contain or consist of non-living things. Systems can be self-organizing, and often are self-repairing over at least some range of disruptions. They are resilient, and many of them are evolutionary. Out of one system other completely new, never-before imagined systems can arise. (Meadows 2008 : 12).

⁴¹ General systems theory was originally developed by Karl Ludwig von Bertalanffy in the 1930s, and this formed the basis for contemporary systems thinking. Bertalanffy's idea first emerged in studying open systems in thermodynamics that did not follow the classical laws of closed systems. However, he recognized that systems thinking can also be applied to social sciences and other open systems containing living and non-living things. (Weckowicz 2000). Systems thinking started in 1956 when MIT professor Jay Forrester recognized the need to improve the testing of novel ideas about social systems, similar to the manner of testing the ideas in engineering (Aronson 1996).

INTRODUCTION

It is this self-organizing capacity that gives a system its potential to create diversity. Self-organizing systems are unpredictable and we cannot control them, but as Meadows reminds us, we can “dance” with them. We cannot make them to do what we want but we can, to some extent, design them and so envision the future (Meadows 2008 : 170). An important feature of systems is feedback and feedback loops.⁴² Feedback is the stabilizing effect of self-organization.

Balancing feedback loops are equilibrating or goal-seeking structures in systems and are both sources of stability and source of resistance to change. (Meadows 2008 : 30).

A concept that originates in systems thinking and is crucial also for resilience thinking is *threshold*.

THRESHOLD

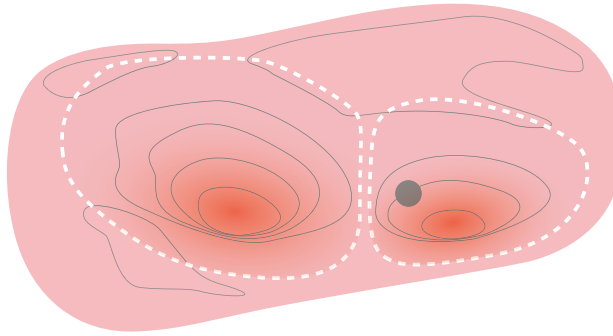
Threshold⁴³ is the state at which the system changes into a new regime. Regime is understood as the current function and character of the system that it possesses. In regime change, the system loses its current state of resilience and becomes something else or collapses. Thresholds are usually portrayed by the images of basin and ball. See Fig. 5. Ecological sustainability is epitomized by how much disturbance and change a system can take before it loses its ability to stay in the same basin (Holling 1973).

The capacity of the actors in the system to manage resilience is described as adaptability. This might happen by moving thresholds, moving the current state of the system away from the threshold or making a threshold more difficult to reach. When a system is stuck in an undesirable basin, it might be that it is impossible or too expensive to manage the threshold or the system's trajectory. Transformability is the capacity to create a fundamentally new system when ecological, social, economic, and political condition make the existing system untenable. (Walker & Salt 2006 : 59–62)

Many of the other essential features of systems thinking will be dealt with within my discussion of the concept of resilience thinking.

⁴² Feedback can be positive or negative. Feedback is said to be positive if a recurrent influence reinforces the initial change. Feedback is negative if the reaction is opposite to the initial action, so the change is opposed or counteracted. A good example of negative feedback is turning the thermostat of the radiator down when it gets too hot.

⁴³ Threshold can also be called an attractor.



RESILIENCE THINKING

Resilience as a term was first introduced by Holling (1973). The concept of resilience thinking has been profoundly studied as means of analysis by Walker and Salt in their book *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*.⁴⁴

Resilience thinking provides a framework for viewing a social-ecological system as one system operating over many linked scales of time and space. Its focus is on how the system changes and copes with disturbance. Resilience, a system's capacity to absorb disturbances without a regime shift, is the key to sustainability. (Walker & Salt 2006 : 38)

Ecological systems and social systems are amazingly dynamic in character. They are constantly in flux and confronted with surprises and unpredictable behaviours. A resilient system can undergo changes and still retain essentially the same functions, structure and feedbacks – its identity. (Walker & Salt 2006 : 32) They can also be transformed, which refers to “transformability [...] [as] the capacity to cross thresholds into new development trajectories” (Folke et al. 2010 : 1).

Complex systems have emergent behaviours. This emergent behaviour cannot be predicted by understanding the individual mechanics of its component parts or any pair of interactions (Levin 1998).⁴⁵ There is now a result state of existence because the

⁴⁴ Resilience thinking is based on systems thinking and has its roots in Holling's writings from the 1970s. Resilience thinking has emerged from a network of people exploring the dynamics of social-ecological systems, who have tried out this new way of looking at reality for understanding why so much extant resource management has so tragically failed. A first big Resilience Conference was held in Stockholm in 2008: *Resilience, Adaptation and Transformation in Turbulent Times – Preparing for Change in Social-ecological Systems* (Resilience2008.org).

⁴⁵ The components of systems are both independent and interacting. There is some selection process at work on those components, with variation as well as novelty constantly being added to the system. We are all part of the social-ecological system and systems cannot be ever really viewed outside of its context.

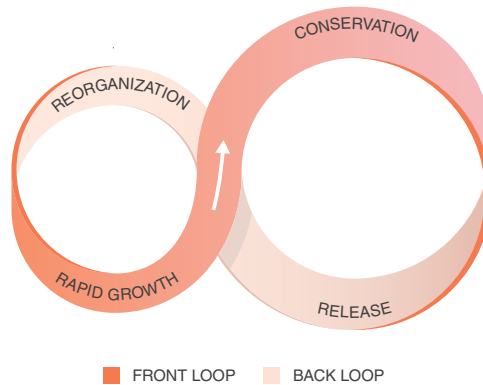
Fig.5. Basin and ball model epitomizing threshold.

living world is in a constant state of flux. The optimal state for any system is always temporary because its different parts are in constant interaction with each other. According to Walker and Salt, the key to sustainability lies in the resilience of the whole system, not in the optimizing of isolated components of it (Walker & Salt 2006).

In resilience thinking it is a question of perceiving how the world actually works. According to Walker and Salt (2006), many of the misfortunes of the built environment are caused by applying inappropriate models that misunderstand how the world works. People are very prone to choose to degrade natural resources because they think that the advancement of technology will sort out the problems in the course of time. Linear and optimized command-and-control approaches for managing systems, however, fail to acknowledge the limits and the unpredictability inherent in complex adaptive systems. (Walker & Salt 2006 : 11)

And yet, efficiency and optimization are still the corner stones of many areas of policy. An optimized system adapts around changes but frequently loses resiliency in the process. Even though we can hold parts of the system in our control, the border system is beyond command and control (Walker & Salt 2006). If an optimized system is likely to narrow down possible paths of development, resilience thinking opens up options. Resilient systems are more open to multiple uses while being more forgiving of management risks (Walker & Salt 2006 : 12).

Current best practices are, however, based on a philosophy of optimization in the delivery of particular products and they seek generally to maximize the production of specific components or outcomes in the system by controlling the others. It seeks to find an optimal state for the system and hold it there. It is based on the assumption that changes will be incremental and linear. These models fail to integrate knowledge of what is happening at a higher scale with changes at a lower scale. (Walker & Salt 2006 : 6). Walker and Salt argue that even though optimization and efficiency are considered laudable goals in business, they cause major inefficiencies for how we generate value and drastic losses in resilience, because they only attend to those things that are directly and immediately beneficial (Walker & Salt 2006 : 7). Housing production is good example of this. Optimization also does not match the way societies value things. According to Walker and Salt, it promotes a “simplification of values to a few quantifiable and marketable ones” (Walker & Salt 2006 : 7). Optimization reduces time horizons to a couple of decades, which is the limit of the time for most commercial investments and so promotes short-term thinking. However, societies depend on their existence on ecosystem services that exists from generation to generation. The results of such overly simple assumptions about the systems around us are unwanted outcomes. In reality all regions and businesses are interlinked systems of people and nature, driven and dominated by the manner in which they respond and interact with each other and adapt to change. (Walker & Salt 2006 : 7–8).



The real essence of a resilient system, according to Walker and Salt, is its capability to recover (Walker & Salt 2006 : 37). Resilience is not good or bad per se⁴⁶, the significant thing is that a resilient system can recover and not collapse or use up resources in a manner that will ultimately lead to collapse.

Very important concepts within resilience thinking that are needed to understand it fully and originate from systems thinking are *adaptive cycles* and *panarchy*.

ADAPTIVE CYCLE

The cycles occurring in ecosystems can be called adaptive cycles. The adaptive cycle as a technical ecological term was introduced by Holling (1973). The term has been expanded to socio-ecological (e.g.; Gunderson 2000; Walker, et al. 2002; Folke et al. 2010; Wilson Pearson, Kashima, Lusher & Pearson 2013), and then to social systems (e.g., Radywyl and Biggs 2013, Ratter 2013, Amundsen 2012).⁴⁷ Adaptive cycles are also features of such things as communities, businesses and nations (Walker & Salt 2006 : 80). At different times and phases of these cycles a system behaves differently. Sometimes the changes occur rapidly, sometimes slowly. By studying ecosystems, Gunderson and Holling (2002) have detected 4 phases of a lifecycle, which they use on a metaphoric level. The phases are: 1 *rapid growth*, 2 *conservation*, 3 *release* and 4 *reorganization*. In every phase the system's strength is changed in its internal connections, its flexibility and its resilience. Even though this image portrays an ecological system it has relevance also in social and socio-ecological systems as they change

⁴⁶ Walker and Salt make comparison to the Franco regime that was very resilient, but not necessarily a good thing for the society (Walker & Salt 2006 : 37)

⁴⁷ Based on the article *Navigating the adaptive cycle: an approach to managing the resilience of social system*. (Fath, Carly, Dean & Katzmaier 2015).

Fig. 6. Adaptive cycle.

through time (Gunderson and Holling 2002). Creative destruction is used to describe the disturbances that periodically punctuate the adaptive cycle. It breaks down stability and predictability but releases resources for innovation and reorganization. This is important to understand from the point of view of policy and managerial issues because it suggests that there are times when there is greater leverage to change things. At other times, effecting change might be more difficult (Walker et al. 2006 : 75–76).

The adaptive cycle can be divided into *back loop* and *front loop*. See Fig. 6. The back loop has the most potential for initiating destructive and innovative change in the system (reorganization and release phases). In comparison to front loop the back loop is often very short. The front loop is crucial for capital accumulation of all kinds (exploitation and conservation phases). In the late conservation phase (K-phase), the system begins to be locked up. This can be characterized by increase of efficiency; subsidies are usually introduced to discourage people from changing (Walker & Salt 2006 : 75–85). Walker and Salt argue that we put more effort into continuing with existing investments than exploring new ways. The increased command and control of the process, with more and more rules, means novelty is suppressed and transaction costs rise in order to get things done (Walker & Salt 2006 : 85–87). Any release phase is costly and unpleasant and involves loss of capital (social, economic and natural). The cost of staying in the late conservation phase increases over time, and when the cost exceeds the benefits, a society can even collapse (Tainter 1988). The back loop can also be a window of opportunity for new beginnings. As you move out of the back loop the opportunities for innovation and novelty shrink. (Walker & Salt 2006 : 88).

PANARCHY

All systems are composed of a hierarchy of linked adaptive cycles operating at different scales and times. These linked sets of hierarchies are called panarchy (Gunderson and Holling 2002). This can be also interpreted as an interlinked system of people and nature. Linkages over scales are the key aspect of multi-scaled adaptive cycles that constitute panarchy. What happens at one scale can affect what happens at other scales. The recovery pattern of communities of people depends on the memory of how to respond, which is embedded at the higher scale of the society in which the community exists. However, bottom-up linkages can be equally important. (Walker & Salt 2006 : 88–91).

SELF-ORGANIZATION

At the core of the concept of the resilience lies the concept of self-organization, already considered in this thesis, which is a characteristic of all organisms and complex systems.⁴⁸ Self-organization is a new scientific worldview challenging Newtonian and reductionist world views and it sees the universe as in an irreversible state of 'becoming' endlessly creating novelty (Heylinghen 1999 : 3).

An important notion in self-organizing systems is that it is a spontaneous process and its outcomes cannot be predicted. Even a very small cause can start a process, which can have outcomes that could not have been foreseen by the parameters that caused the change. A higher-level order can be created from local interactions of the components. All the different components of the system affect each other simultaneously and without any authoritative leadership and systematic structure causing the system to organize. What all self-organizing systems have in common is the appearance of structure without an external agent imposing it or centralized control (Heylinghen 1999 : 2).⁴⁹

It is this intrinsic variability and diversity that makes self-organization possible. [...] a certain amount of random permutations will facilitate rather than hinder self-organization. (Heylinghen 1999 : 9)

So any self-organizing complex system is continually adapting to a changing environment. This means that they are relatively insensitive to perturbations or errors and have a strong capacity to restore themselves, unlike most humanly designed systems.

One reason for this fault-tolerance is the redundant, distributed organization: the non-damaged regions can usually make up for the damaged ones. (Heylinghen 1999 : 9) It is systems' intrinsic variability and diversity that makes self-organization possible. A certain amount of random permutations will facilitate rather than hinder self-organization. (Heylinghen 1999 : 9)

Whereas self-organization allows a system to develop spontaneously, natural selection is responsible for its adaptation to a variable environment. (Heylinghen 1999 : 4)

According to classical mechanics, the evolution of a system is deterministic and re-

⁴⁸ Self-organizing systems were first studied in the 1950s and 1960s in thermodynamics and cybernetics, but the idea has been applied to many fields since then, including social systems such as cities (Heylinghen 1999 : 3).

⁴⁹ Linear systems normally have a single solution whereas non-linear systems typically have several solutions and there is no a priori way to decide which solution is the "right" one. There are many stable configurations the system may settle at (Heylinghen 1999 : 12). A configuration of a system can be described as "fit" if it is able to maintain itself or change within the specific configuration of its environment. An unfit configuration is one that will spontaneously disintegrate under the conditions imposed by the environment, based on their degree of fitness, or likeliness to survive. (Heylinghen 1999 : 15-16).

versible. The evolution of complex systems is usually irreversible. The future is fundamentally different, and it is impossible to reconstruct the past from the present. Even though self-organizing systems can intrinsically resist external changes, it is difficult to make them do what you want (Heylinghen 1999 : 21–23). The question concerning a system-like built environment is not how to predict things better but how to create systems and solutions that, through adaptation and ability to transform, we can, as Meadows (2008) describes it, “dance” with the system.

BOXES WITH-IN BOXES STRUCTURE

Order in self-organizing systems does not necessarily mean organization. Organization can be characterized as being ordered or structured to fulfil a particular function. In self-organizing systems this means that the function can maintain a particular configuration in spite of disturbances. Only those orders will result that can maintain themselves. The self-organizing system is self-sufficient and closely identified with the concept of closure; the system is open, but organizationally closed. Systems tend to have this “boxes within boxes” configuration where at each level you can see a number of quite autonomous and closed organizations (Heylingen 1999 : 11). Heylinghen gives an example of a cell that is part of bigger multicellular organism interacting through cell membrane protecting the cell from external disturbances.

The organism is then again part of a bigger ecosystem and so forth. “The organizational closure turns a collection of interacting elements into an individual, coherent whole. This whole has properties that arise out of its organization, and that cannot be reduced to the properties of its elements. Such properties are called emergent. (Heylinghen 1999 : 11).

EMERGENCE

Emergence is created when local interactions in complex system result in discernible macro behaviour, which is well-suited to its environment. So, from bottom-up forces can be created higher-level order. The emergent behaviour has a distinctive quality of growing smarter over time, and responding to the specific and changing needs of the environment (Johnson 2002 : 19–20). Adaptability is its essential quality and basis. The system needs connections and it is the interconnectedness as well as the reinforcement of random connections that make the system evolve into a more intelligent system. Emergent systems are great innovators, because they are more adaptable to sudden change than pure hierarchical systems (Johnson 2002 : 223). This is the reason why big cities with a lot of continuous activities or ‘buzz’ are usually more prone to create more innovations. Hierarchical systems on the contrary are, by their character, one-way and linear and do not encourage random interaction and so foster innova-

tion. However, building centralized models is very deep rooted in people. When we see patterns emerge we usually look for their creator. (Johnson 2002).

Like the concepts of resilience and self-organization, emergence is not necessarily a good or bad thing in itself. Johnson gives an example of ghettos that can be considered a bad example of emergence (Johnson 2002). This raises the question of how we can affect self-organization and emergence in such a manner that it will not create clearly unwanted outcomes. In the beginning of the research on self-organization, the aim was more or less to understand it, whereas now the focus is slowly changing towards how to create certain kinds of self-organization and emergence. (Johnson 2002 : 21). This is called artificial emergence and it is already being done in some software development. To make an adaptive system even more adaptive entails tinkering with different kind of feedback, positive or negative (Johnson 2002 : 137). This is a way of pushing, indirectly, a fluid and changeable system towards a goal. In other words, it means transforming a complex system into an *adaptive system*.⁵⁰

Encountering diversity does nothing for a global system like the city unless that encounter has a chance of altering behaviour. There has to be feedback between the agents, like cells changing in response to changes in other cells. (Johnson 2002 : 96).

Evolution usually requires several generations, but emergent system can be speeded up because adaptive systems are great learners. This is portrayed by Johnson when he compares a computer that just passively receives information to a computer that learns (Johnson 2002 : 53). This is a leap from interpreting the world to affecting it.

RESILIENCE, SELF-ORGANIZATION AND EMERGENCE IN THE CONTEXT OF THE BUILT ENVIRONMENT

The emergence that is relevant to the built environment is its ability to respond to its environment in a self-organizing manner and to grow smarter over time. The objective is then to look for and create dynamic self-organizing adaptive systems that are created with a conscious understanding of what emergence is. They can exploit certain laws or rules (Johnson 2002 : 19–21).⁵¹ This means working towards more evolutionary

⁵⁰ A complex system is a system in which components can interact with each other. An adaptive system is a set of interacting or interdependent entities forming an integrated whole that together are able to respond to environmental changes or changes in the interacting parts. An adaptive system is also a “learning” system.

⁵¹ “Information handling always needs some kind of structure (web) to get hold of the right information. Intelligent systems demand structure and organization as much as they need pure connectedness. Emergent systems are rule-governed systems. Without rules there would not be any global intelligence, just anarchy of isolated agents. Emergent behaviour, like games, is all about living within defined rules, but also using that space to create something greater than the sum of its parts” (Johnson 2002 : 19–21).

techniques to force the system towards more specific goals. This has in some form been applied to city planning through strategic and rule-based planning that does not try to define the manifestations so precisely but works instead through principles that create flexibility for the execution and development of an area.

At their best, feedback loops like guidance and public sector control of initiatives make systems balanced. A lack of any control or feedback system will have chaotic consequences, and according to resilience thinking, this can also generate regime changes that bring the system to a threshold where change can lead to collapse. According to Walker and Salt (2006), it is, however, important to define what kind of resilience we are talking about. They argue that in the planning context, when planners talk about resilience it is often unclear what they mean. Planners often talk about engineering resilience where the aim is that the system bounces back quickly to business as usual following a small disturbance. There is a difference, however, according to Walker and Salt, between “bounce back” and “retaining the ability to bounce back”. Resilience is more the system’s ability to recover at all (Walker & Salt 2006 : 63).

Self-organization and emergence are more like natural laws, which could be used in the context of cities as well as buildings. The way they can genuinely contribute to the emergence of resilient cities and new social contexts means that there is a need to go beyond the scale of the street life into the scale of buildings. In the context of public space, such as the street, the building is the interface, but if the building itself cannot produce diversity and adapt to unpredicted needs the street cannot be self-organizing either. For building design this usually means spatial configurations that enable several configurations of use, so that a diversity of different developmental paths and situations becomes possible in the use of the building. In this research the focus is on the levels of action, phenomena and the social contexts that the spatial qualities of a building can promote as a result of typological flexibility.

DESIGN THINKING

This thesis can be considered to be both theoretical as well as design research with its focus on what I have termed the developing tendency of design, which requires changes to the prevailing design and production paradigms. All the research questions spring from the design contexts and from the actual design process.

Design is used in the thesis rather like a strategic tool for problem solving in the production of new knowledge. The designs portrayed in this research – conceptual and concrete, made by my own architectural practice or other practices – are there to epitomize typological flexibility.⁵² They are singular manifestations and examples of

⁵² The designs are not the objective or the actual content of the thesis. Instead they are used as examples of strategic design that portray different aspects of typological flexibility or other features of adaptability and flexibility.

how adaptive and flexible housing structure could be made possible. Other architectural practices would most likely define and represent the design problem at issue in a different manner, also perhaps asking different questions. The diversity of approaches, which can be even seen as an “ecosystem” of different approaches, is vital for a resilient future because it allows different pathways to be explored.

THE UNDERSTANDING OF TACIT KNOWLEDGE IN THE RESEARCH

A very important concept for all design research is Michael Polanyi's (1966) concept of tacit knowledge, which he developed in discussing scientific knowledge. Tacit knowledge is considered the opposite of explicit knowledge, which is formal, systematic and well-defined (Polanyi 1966). According to Polanyi, we know more than we can verbalize. His realization was to understand the meaning of tacit knowledge in all scientific practice. Polanyi saw that tacit knowledge is an essential part of knowledge in general and that ignoring it is destructive. He tried to open up the concept with a very simple example of tacit knowledge, which is the human capacity to recognize one and other by their face, even if we do not know how we do it. We observe the whole and not the details separately (Polanyi 1966 : 4).

According to Polanyi (1966), in the pattern of identification it is a question of active shaping that takes place in all knowledge acquisition. Our bodily processes are part of the observation. We observe everything as whole, but it is not so much a question of observation but of experience. It is by doing that we first understand the components' role and relation to each other. The objective of modern science is to establish separate objective knowledge in a reductionist manner. Aspects that do not fit this ideal are considered temporary imperfectness that should be eliminated (Polanyi 1966 : 20). According to Polanyi, tacit knowledge is an irreplaceable part of knowledge. Eliminating all personal and experiential elements from scientific knowledge is doomed to fail, in his view.

Research work can be successful if the research question is good. Polanyi, however, asks how we find the research problem – good or bad. To be able to find the research problem we have to see something which is still hidden. It is just a hunch about the coherence of parts which are still incomprehensible. The research problem is good if the hunch is right. To be able to see the problem that leads to great scientific discovery you have to see something that the others do not see yet. Polanyi thought that we consider this self-evident, but Plato had showed how contradictory this assumption is. Polanyi paid attention to tacit knowledge based on Meno's paradox, as Plato laid it out. Plato reasons how absurd it is overall to try to find a solution to a problem; either you know what you are looking for and there is no problem, or you do not know what you are looking for and you cannot expect to find anything. Meno shows that if knowledge is very precise, and can be displayed accurately, then we cannot know the

problem or find a solution to it. According to Polanyi, this shows that if the problem still exists and discoveries can be made by solving the problem, then we can know important things that we cannot express yet. That kind of tacit knowledge, which solves the paradox, consists of a hunch of something still hidden that has not been found yet (Polanyi 1966 : 22). This line of thought comes very close to descriptions of the nature of artistic work and developmental design. According to Polanyi (1966 : 23), we can have pre-information of tacit knowledge of things that are not known. He considers the positivist understanding of knowledge an illusion, but admits that it is very difficult to find stable alternative to the ideal of objectivity.

SCHÖN'S CONCEPT OF REFLECTION-IN-ACTION

In work that creates something new, like in architectural design, the hunches that Polanyi describes, the tacit knowledge, is very much present and part of the process. Schön (2009) however, points to a problem that Polanyi himself also perceived, namely how difficult it is to get conscious tools and professional development and self-reflection out of tacit knowledge. In his book *The Reflective Practitioner* (2009), Schön continues with the thought that people know more than they can express. Schön examines the thought through professional practice and creative work, like architectural education.⁵³ Professionals use tacit knowledge to practice their profession. They use it to be able to cope in unique and uncertain as well as contradictory situations (Schön 2009). Schön analyzes how professionals' *reflection-in-action* builds up. According to him, professions have for a long time suffered from a credibility gap. Through technological advancement and industrialization those professionals, like engineers and doctors, that relied on technology, gained much respect and belief in their superiority through invoking the scientific basis of their professions. They used specific knowledge in all manners belonging to the human realms and thereby gained a dominating role in relation to the rest of society (Schön 2009 : 14–15). Defenders of human rights and the representatives of minorities started, however, to question the experts that they saw as mediating the problems of the existing system. Environmental destruction, the exploitation of consumers and continuous social injustice made the formerly valued scientists and scientifically educated professionals look questionable (Schön 2009 : 10).

Nowadays, many professions recognize the mismatch between professional knowledge and the situation of constant change that practice holds. Complexity,

53 There has been criticism towards Schön concept of *reflection-in-action* as well as other concepts he puts forth (among others Newman 1999, Neumann 2000). In the criticism, the key objective has been whether the concept can be applied to different disciplines (that are usually not design disciplines) and that its context is very ambiguous. Because I use it in the context of the design discipline and in the contexts of design as artistic process, which can never really form a solid empirical platform for research, my own approach to the concept is very much in line with the way Schön sees the concept. Schön also uses examples from design and design teaching situations, which are the essence of this research as well.

uncertainty, instability, uniqueness and conflicts of value are increasingly at the core of professional practice. Education is not sufficient to control these sides of the professions. There is a conflict between knowledge and the expectations that society imposes. Schön sees that when the tasks change, the demand for usable knowledge grows. Then the character of the tasks and knowledge becomes unstable. In practice, problems consist of situations that comprise the dynamic character of systems and changing circumstances. It is more a question of managing problems than of solving them. This uncertainty and complexity has led, according to Schön, to professional pluralism. This can be seen in conflicting views and roles, because the core of the praxis is as much to define the problem as to solve it. Schön points out, however, that within professional knowledge there is no room for setting the problem. The choice between the prevailing paradigms is not generally considered as desirable. (Schön 2009 : 16–17).

According to Schön, professional knowledge that is based on scientific knowledge and that operates on the basis of a technical rationality has formed the way we think about professions and the institutional relationships between research, education and practice. Problem solving has become the strict application of knowledge and technology, and the professions have become very specialized (Schön 2009). Schön divides the professions, following the terms that Nathan Glazer (1974) launched, into *major* and *minor* professions. The major professions or those close to them are, for example, medicine, law and the engineering sciences, as well as economics. The minor professions are, for example, social work, librarianship, education and planning. The major professions are disciplined, and have very clear outcomes, such as health, winning a law case or financial profit. They operate in stable institutional contexts and their education is based on systematic and technological scientific knowledge. The outcomes of minor professions are more vague, changing and very difficult to measure, and that is the reason why they cannot form a systematic scientific basis. Systematic knowledge can be seen to be formed out of specialized and strictly connected scientific knowledge whose character, according to Schön, is standardized (Schön 2009 : 31–33).⁵⁴

In the world, problems do not appear in pure form but rather have to be defined. The practitioner has to try to understand the situation, which can be very difficult to

54 Professionals apply general principles and standardized knowledge to concrete problems. The basis for technical rationality, which has been transmitted to professional action, like Polanyi also points out, can be considered the positivist heritage. Western thinking since the Enlightenment has been shaped by the development of science and technology, while the industrial era affected the creation of a very strong scientific world view. Human progress has been seen to be accomplished by harnessing science to create technology to meet objectives (Schön 2009 : 31). Only observations based on empirical knowledge are considered meaningful, and all contradictions are presumed to be solvable only by reference to observable facts. Knowledge that has not been analytically or empirically verified has had no meaning. Practical knowledge exists, but it does not fit easily into positivist categories. (Schön 2009 : 33).

decipher. Even though problem setting is a normal condition for a technical solution, it is not, according to Schön, a technical problem itself. Problem setting is a process, in which we interactively name the issues we deal with and construct the context for our processing. Even though the problem is constructed, it can escape the constructions of the applied sciences, because each problem is unique and unstable. Uncertainty, value choices and the uniqueness of situations are usually part of complex problems, which cannot be solved by relying on theories, but which, in the context of society as a whole, are usually the most meaningful. For positivist thinking this kind of creative coping with problems is not valid. Professionals who choose the creative way to cope with complex problems speak about experience, trial and error as well as intuition. (Schön 2009 : 42–43).

Several writers that Schön refers to, like Edgar Schein (1973), Nathan Glazer (1974) and Herbert Simon (1969), have recognized the gap between professional knowledge and the demands that the real world imposes. According to Schein this gap is caused by the fact that the applied sciences are by their nature *convergent* whereas practice is *divergent* (Schein 1973 : 4). Schein believes that the problem of practicing a profession is continually unique and works in unpredictable circumstances. Each profession marks the fact that it should possess the ability to form convergent knowledge based on practice and the unique demands of customers, which involve divergent models of thinking (Schön 2009 : 45–46). Schön refers to Simon (1969), who sees that the professions deal with design, which he understands as shaping existing situations towards desired ones.⁵⁵

According to Schön (2009), normal professional practice needs *tacit-knowing-in-action*. Following the ideas of Polanyi, we know more than we can express. Normal work demands qualitative evaluations for which we cannot easily define appropriate criteria, and it demands skills to which we cannot apply regulations and procedures. Even when we work towards research outcomes, we are still dependent on tacit understanding, consideration and skill. Schön sees that these cases are instances of reflection-in-action and knowing-in-action. If technical rationality sees intellectual action as the application of knowledge to instrumental decisions, so knowing-in-action is inherent in all intellectual action. Even though we think, to a large extent, before we act, in skill-requiring action we use knowledge that is not born of some immediately preceding intellectual action (Schön 2009 : 50–51).

The concept of reflection-in-action also includes the idea that a practitioner, based on professional experience, analyses the situation and studies the causes and the consequences of that action (Schön 2009 : 50–51). In reflection-in-action the person becomes a researcher within a certain context. The practitioner is not dependent on established theories and techniques or categories, but creates new theory out of indi-

55 Simon is talking about other than design professions.

vidual situations. For the professional, means and objectives are not separate and they do not separate action and thought (Schön 2009 : 68–69).⁵⁶

Schön takes an example of this kind of transmission of nonverbal knowledge from architecture education, drawing on the relationship between teacher and student in a teaching situation. This is a familiar teaching situation for architects, one where teacher and student look through how a unique design task that the student presents could be further developed. The language the teacher uses is connected to the lines on the paper, and the instruction works together with the lines on the paper. The instruction cannot be only comprehended by following the teacher's speech. The verbal part is clearly connected to information that is transmitted interactively and in interpretation of the student work. The teacher has no experience of this particular design work and is reacting to the special features of the scheme, not trying to apply a standard solution to the task the student is struggling with. They both try to achieve the best possible solution and intervention – the architectural design. When the student is baffled by the assignment, the teacher has to help her/him to define the problem again. The solution is a creative approach through which they solve complex problems that are caused by many simultaneous facts at different scales. (Schön 2009 : 130–131).

The teacher's task is to redefine the problem from a different perspective, so that the student understands what kind of problems the new problem definition introduces and can try to apply a solution to the new problem setting. The teacher might want to continue the scheme with changes, which again creates new meanings in the situation. The teacher and student are then making new inventions, which demand new definitions of the situation. Uniqueness and uncertainty is understood to function through the design change, which has happened in the process of trying to understand. (Schön 2009 : 131–132). Neither of them knows in advance whether the new change will work but the teacher's guidance is based on a hunch as to how the new solution might work. At the same time, the teacher is trying to understand the problem and change the situation in order to solve it. The intent to change and the change happen at the same time. Through the action, the situation, according to Schön, "speaks" back, and the teacher finds new meanings in it, which led the teacher to reshape the problem anew (Schön 2009 : 135).

Like the teacher, the professional (which the teacher also represents) has built a repertoire of different situations, examples, images and understanding shaped by personal experience. When the professional faces a problem they see in it something similar to what is in the present problem, even though they cannot analyse the essence of the similarity or articulate it very precisely (Schön 2009 : 137–140). This can

⁵⁶ This understanding of Schön's is also valid for this design research approach. The experience and skill acquired in professional creative practice is very much what defines the problem for the design task, and does so as part of the design action itself. Means and objectives are very entangled in each other, which is also reflected in the structure and framework of the research.

be conscious comparison to tacit knowledge. I see that Schön's understanding of design and its transmission is very close to the understanding of the concept of type as architectural creative potential, a changing framework that tackles all aspects of architectural design. Our capability to see unknown situations as familiar helps us to bring knowledge from past situations to solve unique problems. In everyday practice we cannot usually carry out experimental research within the boundaries of the profession, or only in a limited measure. In practice, we try to see where our action leads. This resembles the child's way to study the surrounding world. Schön calls this *exploratory experiment* (Schön 2009 :145).

Schön, however, sees that intuition and creativity are often mystified. Instead, he speaks of the *seeing-as* event, perceived in the creative metaphor and he calls it a *generative metaphor*. The seeing-as concept is important in invention and design, in that with the help of metaphor people are able to see an innovative solution to a problem, which could not have been found just by bringing together parameters connected to the problem in a "click together" manner. A creative metaphor cannot be created by bringing together features and shaping the metaphor afterwards, rather it requires developing a process in which the metaphor first helps to find the solution. Schön calls this a *reflective discussion with the situation*.⁵⁷ Each field shapes its own problem setting and the framework for it through expertise, interests and ideology in which all situations are different. (Schön 2009 : 193).⁵⁸

THE CONCEPT OF TYPOLOGICAL FLEXIBILITY

The concept of typological flexibility, which is a key concept for this whole thesis, is deeply related to the understanding of self-organization and emergence and particularly important for the understanding of design thinking in the thesis. The concept of typological flexibility refers to the idea of building and its spatial configuration, which

⁵⁷ Schön gives an example of a creative metaphor. A research team's task was to improve the performance of a paintbrush that was made of synthetic hair whose capacities were not yet comparable to those of brushes made of natural components. Synthetic hair made the paint lumpy. Different experiments to treat the ends of the synthetic hair failed until one of the researchers noticed that a brush works like a pump. They started to experiment by thinking of a brush as a pump. Then they noticed that the natural hair formed a gradual curve whereas the synthetic hairs formed an angle. They concluded that this feature was what made the synthetic brush form lumps. They applied this idea in practice and developed a new kind of synthetic brush, which did not make the paint lumpy. With this example, Schön draws attention to the way the process was born through metaphor. (Schön 2009 :183-187).

⁵⁸ According to Schön, to make professional knowledge understandable can mean two things. Either it can be treated like the emperor's new clothes or as way of establishing that the profession knows something really worth knowing, something that in some form will be understandable by others. He says that making professional practice understandable is not pretentiousness, rather it opens up the profession to questioning and research. But, according to Schön, radical critique cannot replace the self-reflection of qualified professionals. He also sees that non-reflective professionals are equally limited or even destructive for the professions. (Schön 2009 : 289-290).

is epitomized as the design feature of building that enables unpredictable use of the building and space. It is based on an understanding of type related to architectural design that also understands the continual renewal as part of the concept (Moneo 1978 : 10). Typological flexibility is first and foremost related to design process that all architects conduct from their own typological starting points and generally in a slightly different manner. This links it to the tacit understanding of knowledge in the context of design and also to the reflection in action in design, which are both integral parts of the design event.

Most of this this research is connected to defining the concept, both in abstract as well as concrete terms. Even though typological flexibility is closely related to self-organization it is not entirely consistent with that concept. Whereas self-organization refers to the possibility of people to reorganize space from more self-conditional starting points, typological flexibility already deals with the characteristics of the dynamics of space that allow self-organization. Typological flexibility defines how self-organization is made possible for space. To understand the concept of typological flexibility better, it is, however, relevant to define more thoroughly how the concept of flexibility is understood as part of this concept. The key terms in this thesis for understanding flexibility are transformability and multi-usability mentioned earlier.

TRANSFORMABILITY AND MULTI-USABILITY

To be able to modify the physical parameters of buildings is one way of approaching flexibility, which has been named in different ways by different authors. Groák uses the term transformability to portray the possibility to change temporary structures. Leupen and many others use the word *changeability*. I consider that the concept of transformability is better for this research because it relates well to the division of flexibility of use into modifying and multi-use, and is also used in the context of resilience as well. To transform refers to construction, which can be modified and worked, whereas the word change is again a much wider term. Transforming refers to something existing being transformed into something else, and in this respect fits my division of multi-usability and transformability better. The concept of multi-usability, which is also very strong in the context of self-organization of space, springs from the idea that space can be flexible even if it is not modified in any way. This idea is key essence in the Herman Hertzberger's concept of *polyvalence*, which is also linked to multi-usability. Polyvalence as a concept generally refers to multi-purpose rooms

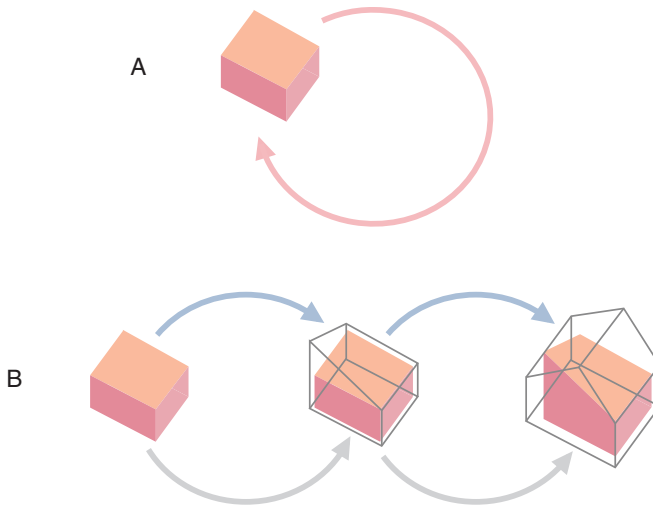
where the function is not defined.⁵⁹ Polyvalence, as well as transformability, will be studied more thoroughly in chapter III.

THE PROACTIVE CONDITION – CONCEPTS OF TYPE VERSUS MODEL

Because typological flexibility refers to the configurational condition of buildings – the typology – and their strategic attributes, it is useful to understand the difference between the concepts of type and model in architectural design. They are different interpretations of the context of building. The concepts of type and model are easily confused with each other, but model is actually contradictory to type or can be seen as a very narrow interpretation of it. A model is concrete and can be copied as such. A good example of a model mode of understanding of space is industrial mass production, which is based on copying and repetition. Type, on the other hand, can be interpreted as the architectural idea – thought – of how a building is spatially configured and how it can be applied to its site and place. Type can, however, have very different manifestations of the same idea. Whereas a model copies itself forever and refers to itself, type is a more abstract idea that can be applied in various ways, and it also holds the potential for development within it. The concept of type is like an abstract frame within which change can take place. Even though, in the study of typology, type is about copying in some form, in architecture it can never truly depart from the idea of uniqueness (Moneo 1978). As type, the manifestation of a building is unique and always connected to the place and situation where it exists. The current approach to spatial production comes contextually very close to this repetitious understanding of model. The hypothesis of this research is that to be able to develop resilient solutions in the built environment, the emphasis on the concept of type, linked to a more interpretative and strategic understanding of the built environment, is more relevant.

The character of the prevailing system of production processes viewed through the concepts of model and type are portrayed by two diagrams in Fig. 7. Diagram A portrays the system using the model mode. Innovation is scarce. The character of the process is such that it always returns to the initial state in one form or another. Development is marginal and systemic learning is low. The system is not able to correct itself because of its locked-in character in production processes and in the general building culture. Repetition is its core essence. Diagram B portrays the type mode as a developing and evolving system. The system is capable of correcting itself to meet emerging needs through innovation. Type is understood as an alterable spatial context, in which change is possible and in which systemic learning takes place.

59 The concept was introduced in architecture by Hertzberger, and he borrowed it from the word *polyvalent*, which refers to a multi-purpose hall or *salle polyvalente*. These are spaces that exist in French villages or small towns that can be used for weddings and parties and other events like musical or theatrical performances. The idea behind polyvalence is that space does not necessarily demand any changes to be flexible, but as such is multi-usable. (Leupen 2006b : 24).



UNDERSTANDING STRATEGIC AND TACTICAL CONDITIONS IN DESIGN

Strategy and tactics are common military terms that were first developed by Carl von Clausewitz (1780–1831) (Clausewitz.com 2017) and today are widely applied to all realms of life, for example, management and game theory. Strategy is usually understood as a form of planning in the face of uncertainty.⁶⁰ McKeown (2012) sees that strategy is about shaping the future. The result of action is not known, but it can be guided by some form of preplanning and it also takes into consideration the means and resources available (McKeown 2012).

All these features can also be detected at the core of typological flexibility. The flexible character of the concept of type gives potential for many manifestations to emerge, so in that respect typological flexibility can be considered as promoting a strategic agenda. Compared to tactics, strategy is usually considered something more profound and wider in its scope, as in how to win a war. Tactics concentrates more on singular events and units within the wider realms of strategic objectives. A tactic is usually used to advance towards a specific target, which has already been set.

In his book *The Practice of Everyday Life* (1984), Michel de Certeau develops the division between strategic and tactical in a manner that considers strategy as the actions of institutions and structures of power, and tactic as the actions of individuals as consumers unable to exert effects at the level of strategies (de Certeau 1984 : xvii–xix). The interpretation used in this research follows de Certeau’s division to some extent.

⁶⁰ Strategy for the military arts, according to Clausewitz, deals with the unknown and embraces it as a source of their art (Von Ghyczy et al. & Bassford 2001).

Fig. 7. *The prevailing model mode system A and the developing type mode system B*

However, I do not separate strategy and tactics in a strict hierarchical manner based on who has power over space at any particular level.⁶¹ The overall objective of typological flexibility is that it recognizes the spatial power of people on all levels, also on the societal level, through their use of space. In typological flexibility, strategy is understood in the context of the whole building, in the way the architect has designed the strategic qualities of the typological flexibility. Tactics are usually conducted by the inhabitants or the owners of a whole building. They can affect the spatial context through the more immediate qualities of self-conditional aspirations that the building gives rise to, which can, however, also have an effect on a societal level.

0.7

METHOD

The chosen method for this research deviates to some extent from traditional research methods. This is because the focus is on developing novel approaches in design for evolutionary contexts that recognize the fact that the past behaviour is not a reliable predictor of future behaviour. More traditional methods focus on what exists and draw conclusions from it. In some form, this research is related to traditional research but also to research-by-design-thinking, which means acquiring knowledge through design as a form of knowledge that is difficult to perceive only through text. Research by design is very much a question of a new understanding of knowledge. To some extent it replaces the traditional understanding of knowledge, or it is produced alongside more traditional forms of knowledge acquisition. However, what has been characteristic of all design research is its variation in form.⁶²

61 For de Certeau (1984), strategy is location-driven whereas tactics deal with impulses. People take advantage of impulses but at the same time they are dependent on them. De Certeau sees tactics as something more reactive. To some extent typological flexibility incorporates a reactive tendency, allowing only what is incorporated in the strategy of typological flexibility. But the objective of typological flexibility is to widen the scope in a manner that also supports people's proactivity in their dealings with space that can have effects on other levels as well. By strategic aspect I understand the wider view of type that can promote the multi-usability of space at all levels from dwellings to buildings. The strategy itself is incorporated into the tactical manoeuvres that it allows.

62 The PhD by design forms one kind of approach in research by design. Its starting points are in new forms of artistic research work. The research is often based on personal art work, which is linked to the wider theoretical context reflecting how the personal work relates to existing discourses on the topic. The approach is discursive and idiosyncratic at the same time. Professor Jonathan Hill of the Bartlett School of Architecture also draws attention to the research community. Architecture schools that exist inside technical universities have different approaches to the PhD by design from multidisciplinary universities (Jonathan Hill: presentation at PhD by Design seminar at Westminster University, May 21th 2008).

DEVELOPING A DESIGN RESEARCH METHOD

The method I have applied for this research touches on Polanyi's and Schön's thinking and combines traditional research with different emerging design research methods. Because this research deals with design it has been a natural choice and to some extent the only possible choice to tackle some issues in design form because design comprises knowledge that cannot be explained by verbalizing. In all forms of art, the essential knowledge is almost impossible to measure or describe in an exact manner, and to disassemble it in order to understand it would mean that something essential is lost. Design is not just logical and systematic action; rather it produces a frame and a "world" in which everything affects everything at the same time. In that way it resembles systems thinking in general, because that too has a similar holistic tendency.

The designing architect perceives the whole in the creative work, which, through certain architectural ideas, is connected to several different scales and situations at the same time. For example, a city's structural idea and the form of the buildings are in an integral relation to each other – part of the same design concept and architecture. The relationship to site and the city structure are shaped simultaneously within the design of the building and its spatial configuration. The architect is, at the same time, resolving the inner context of the architectural idea as well as relating the future design intervention to its existing condition and surroundings. An architect does these things from the point of view of architectural, structural, functional, ecological, social and economic perspectives. The viewpoints of the design solution are almost endless and a full and conscious understanding of the designs made usually only follows afterwards.

Design is based to a great extent on experience and skill as well as on the inner vision accomplished in practice. The character of the creative work is not clearly hierarchical either. The architect has to work on many levels at the same time. The designer does not precisely know where the design will lead, but s/he has to reflect on accurate design solutions from various viewpoints in an open way during the design process. However, the end of the process will be a tangible concrete building. To quote Schön, even though the architect uses technology, design work is not a technical problem. Only a small part of the design is related to technical problems and these are usually subordinate to the spatial and functional solutions as part of the whole. In architecture, the question is always much more than just solving a problem. A design is almost always, in one way or another, unique, a consequence of the designer's insight and vision as applied to architecture, offering more than just the solution to the problem. And depending on the designer, there are endless possible solutions available for each unique situation. In that way design can be, and often has been considered mystical, its essence very difficult to grasp, not least because it is very difficult for the designer to consciously understand all those processes that connect the mind and hand.

Through some kind of reflection, the designer can however perceive the success of the design. An ambitious designer usually "holds a conversation" continuously with

the design, something Schön also refers to in arguing that the design “speaks” to the designer. It is, however, very important to open up these elements of the “mystique” of design to other realms than just the profession itself, so that the different processes and contexts could be taken into consideration, and also appreciate the added value they can create. Currently the processes, which are very linear and hierarchical in character, cannot recognize this feature. This also affects the creation of innovations at all levels of processes.

THE RELATIONSHIP TO OTHER RESEARCH METHODS

Because I am researching something that does not yet exist, something that is more of a potential – the hunch that might work – the empirical and reductionist way of research is inadequate as a research method. Even research based solely on case studies would not satisfactorily answer my research questions, because the focus in cases is on existing examples generally portraying current paradigms.

Even though this research focuses on social aspects, it also differs from social science research, which is geared towards explaining and understanding different phenomena. Developing architecture is to aspire for change. Van Aken (2004) talks about the design sciences as having the character of a scientific field that pursues change (Van Aken 2004; Simon 1969). Straatemeier, Bertolini and Brömmelstroet (2010) claim that to great extent academic research does not recognize the field’s [planning] aspirations for change, and that research does not use methods by which change could be promoted (Straatemeier et al. 2010 : 578).⁶³ According to Straatemeier et al. (2010) what is common across the design sciences is the fact that their understanding of the problem only comes in halfway towards the solution (Straatemeier et al. 2010 : 578). They are seeking, however, some kind of generalizability within *design science* research. It is good to notice that what they are after is different from what is usually considered to be the contexts of design research. On the other hand, research by design does not actually try to find generalizability, as it is usually idiosyncratic in character. Straatemeier et al. (2010), however, locate themselves within or near the *social sciences* but look for new interpretations within the discipline that considers the issue of what could be, and not what exists.

From the point of view of the key essence of this research, I have joined these emerging ways of conducting research, which are both familiar to the design sciences, as Straatemeier et al. (2010) see them, as well as research by design in which knowledge is also understood as situational. My research incorporates new kinds of knowledge in the form of design, which cannot easily be verbalized, and which is

⁶³ Straatemeier et al. describe planning as a change-aspiring professional field, with which I have equated with architecture.

very near the research by design. However, my objective is to produce some kind of generalized knowledge that could be used as part of the design sciences, which, by definition, aspire for change. My approach is to produce new knowledge that could also be utilized by others.

According to Straatemeir et al. (2010), it is, however, difficult to make generalizations in the design sciences. They see, nevertheless, that there is a potential to transmit processes and method through some kind of know-how from one examined case to another, as is the case in *action research* approach. Nonaka and Takeuchi (1995) have tried to solve the problem of tacit knowledge and its connection to explicit knowledge. They have researched the Japanese car industry and observed that within that context it was possible to transform tacit knowledge into systematic explicit knowledge in a four-stage process.⁶⁴ In both of these approaches, however, I see quite a narrow interpretation of creative work and creative research. The creative work of tacit knowledge is not only a question of a process that can be repeated – like a model – as in Nonaka’s and Takeuchi’s understanding. The process itself should be seen as creative as well, and as something that can also create novelty and make new things emerge. It is more like a systemic loop that has a tendency to develop or move into another mode or loop. Nonaka and Takeuchi has been also criticized for their simplistic epistemological definition of knowledge and particularly the restricted understanding of tacit knowledge (among others Gourlay 2006 : 21).

In this research, I have found it important not to offer an action or operation model or models, but have instead created a framework of thought that combines the different viewpoints and parts of the system that affect each other as a whole, and thus help others to create new creative solutions and new approaches for reaching the same resilience objectives of creating an ecosystem that can breed new design paradigms and methods. My goal is, however, as in the in design sciences, to accomplish a paradigm shift, and my research is about creating a mental framework that will help perceive the research question in the complex and almost immeasurable context. The conclusions drawn through the framework can be considered to some extent fuzzy, the reasoning approximate rather than exact, but still usable.

⁶⁴ Nonaka and Takeuchi (1995) have developed a four-stage SECI model for knowledge acquisition in organizations, in which they consider tacit knowledge as the first stage of sourcing information. Their four stages are *socialization, externalization, combination, internalization*. Tacit knowledge for them is hidden mental knowledge that is combined with know-how. With the four-stage process, tacit knowledge transforms itself into explicit knowledge (Nonaka & Takeuchi 1995 : 62–67,69,71).

THE FRAMEWORK STRUCTURE OF THE THESIS

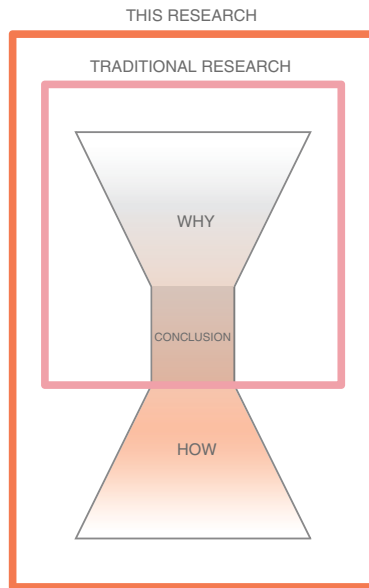
I think that the built environment, which touches so many parties, fields and scientific fields, would benefit from an approach which has a connection to the processes in the context of design. In my view, the fields that study the built environment would benefit from a research approach with a clearer understanding of the context and process of design. The processes are observed from points of view that are important for the development of design and they recognize the role the processes play in design and the systemic context that there exists.

The structure of the framework I have created also replaces strict rational logic and linear thinking. The arguments do not just follow a linear logic according to which A causes B, but rather they also take into consideration the whole space and the viewpoints that concern the relationships between A and B in the way that tacit knowledge and reflection in action do. I do not see the research as a polar and linear path from research question to conclusions, rather I want to understand the whole framework that the research defines but which is also open to new interpretations. In this respect I find the thinking of Henri Lefebvre very inspiring.

*Reflexive thought and hence philosophy has for a long time accentuated dyads. Those of the dry and the humid, the large and the small, the finite and the infinite, as in Greek antiquity. Then those that constituted the Western philosophical paradigm: subject-object, continuity-discontinuity, open-closed, etc. Finally, in the modern era there are the binary oppositions between signifier and signified, knowledge and non-knowledge, centre and periphery... [But] is there ever a relation only between two terms...? One always has Three. There is always the Other. (In *La présence et l'absence*, (Lefebvre 1980 : 225, 143, translation in Soja 1996 : 53)*

Lefebvre sees the binary approach in research as limited, although he does not deny its significance. The choices between two opposites are not either-or, but based on them it is possible to create new categories and open choices. This is similar to the understanding of viewpoints that can be redefined and reorganized in relation to each other; new connections can be made, and connections can even be given up if they do not work anymore. I can best describe my research method with the help of diagrams. The first diagram, Fig. 8, is my interpretation of traditional research, which is also included in this research.

In traditional research, information and knowledge are reduced by cropping from a large palette of existing knowledge down to the object of research. The research produces new knowledge, which, after the approval of the research community, starts its path into the existing world and its practices. In the best case, the research produces new knowledge and thinking by which a paradigm shift can be accomplished either in the scientific realm or in practice.



To understand the production processes that would make these new approaches and innovation emerge in the real world, more traditional research approaches can also be found in this thesis. Studying the processes and their developmental capabilities, as well the existing ways of approaching flexibility and adaptability, helps to understand how these innovative paths could emerge in existing housing production and not merely remain as one-off experiments or even paper tigers.

If the point of traditional research is to try to understand “what exists”, in developmental design research the focus is on also on “what could be”. Based on my research question I have developed a *research framework* with which I try to create a perceivable context for developing novel strategic design approaches. In this framework I take into consideration the complexity of the world in which design operates and in which causes and effects are difficult to perceive when studied as isolated incidences. Rather, as systems thinking highlights, everything affects everything in manmade or organic systems simultaneously, rather than in a linear fashion. The overall objective of the research – paradigm change in design – cannot be perceived in isolation nor by narrowing the aspects of study. This would distort the knowledge and thus its applicability. Conversely, research can be so one-sided that whatever is located outside the core viewpoints and structure is difficult to apply in practice.

My objective is not to relate the research results to certain ways of design or design methods, but to create an understandable research framework for developing

Fig. 8 The relationship between this research and traditional research, epitomized in the metaphor of an hourglass.

new strategic and/or tactical tools that enable strategic adaptability and flexibility of space to emerge. Each designer, design researcher or other practitioner can use it as supportive tool to understand the design context and reflect on whether the strategic content of adaptability and flexibility used is producing the desired results in a timely perspective that promote resilient space. The utilization of knowledge of this kind that architectural design could possess is a point developed further in chapter IV. It contains my design-theoretical study, which is based on the preceding theoretical study in chapters I-III. The chapter portrays the new design paradigm – typological flexibility – that promotes long term resilient development of cities and societies. The knowledge created through the research framework, in four chapters, is a combination of theoretical, practical and tacit knowledge. In chapter IV I define the general attributes housing design should take into consideration. The objective of the chapter is also to define tools to evaluate whether the created space or building is typologically flexible.

The framework has also normative tendencies. Erich Jantsch (1967) divides the exploratory and normative approach in his theory of *technological forecasting* as polar points between action and reaction. For Jantsch, the forecasting is connected to the normative approach in which the goal is usually known and the transfer is done by finding the right routes to the goal (Jantsch 1967 : 30–31). See Fig. 9.

In the context of the built environment and planning this kind of divide is still valid (Joutsiniemi 2010).

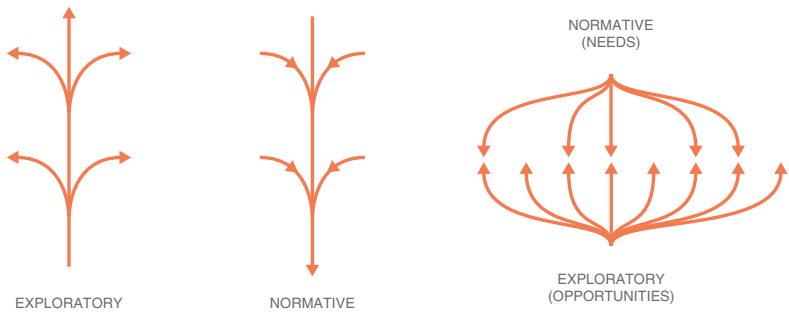
In the case of planning, an important distinction is usually made between these positivist and normative approaches. The aim of positivist theory is to provide explanations for urban regularities, while normative theory is to identify efficient patterns and means for achieving them. (Joutsiniemi 2010 : 90–91)

A similar line of thought to Jantsch's forecasting is apparent in the newer concept of *backcasting*, which refers to a strategic approach in planning and is aiming at sustainable development and innovation.

A successful outcome is imagined in the future, then the question is asked: what do we need to do today to reach that vision of success? (Thenaturalstep.org 2017)

The idea is to move back from the vision to the present and to create scenarios as steps towards the imagined future vision.

According to Joutsiniemi (2010 : 91), since planning concerns future opportunities and because the future is to some extent dependent on plans to anticipate it, then both approaches, the exploratory and the normative, need each other and need to merge



together, which, however, is very challenging and requires new forms of advanced combinations of these polar points.

Similar to Jantsch’s understanding of forecasting, backcasting is also seen in this research, where it is portrayed as an hourglass, where the upper part reflects the research question and tries to answer the question WHY things are as they are. The conclusion and research results settle in the middle of the hourglass also as the goal of typological flexibility. When the research results spread into scientific realms or into the practical world, the knowledge again expands and creates new ideas and practices. This can be considered the HOW question about the way results start to live in the world. Traditional research does not usually tackle the actual practice of how change is accomplished unless this is the conscious object of the research.

Here the research is based on the same hourglass image, but with the hourglass turned sideways. I continue the research all the way to the bottom of the hourglass, in which case the HOW question forms a large part of the research: HOW to get to the new design paradigm, see Fig. 8. The normative tendencies in this method work more as an evaluative principle. An example of this is the starting point that a certain mode of action is better than another – the paradigm shift – for example, from the point of view of resilient development.

The research forms a three-dimensional framework or corridor, where the issues affecting the research questions and results – the research viewpoints – constitute its edges. The framework, observed two-dimensionally, helps us to see the systemic connections between different issues, but it works even better if it is observed three-dimensionally. See Fig. 10.

Transparent levels are created through which you can observe the second level, and so on. Each level forms a review point, which is, in a way, a prerequisite for moving to the next level. See Fig. 11.

Fig. 9. Diagrams by Erich Jantsch (1967) portraying exploratory and normative research in his theory of technological forecasting.

INTRODUCTION

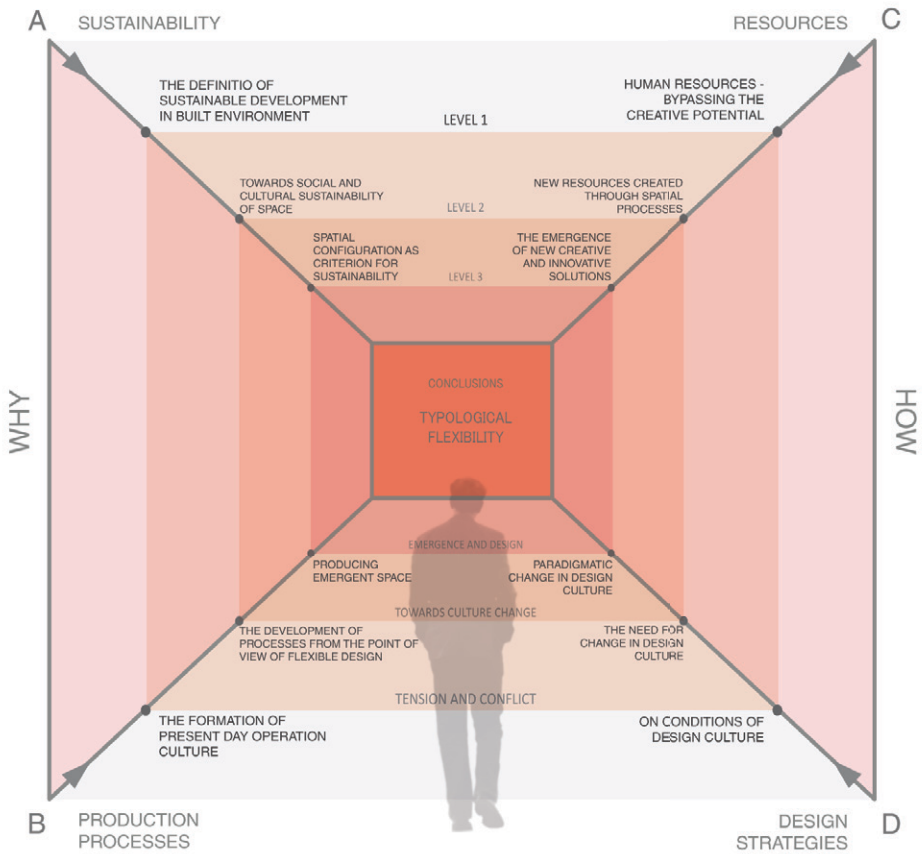
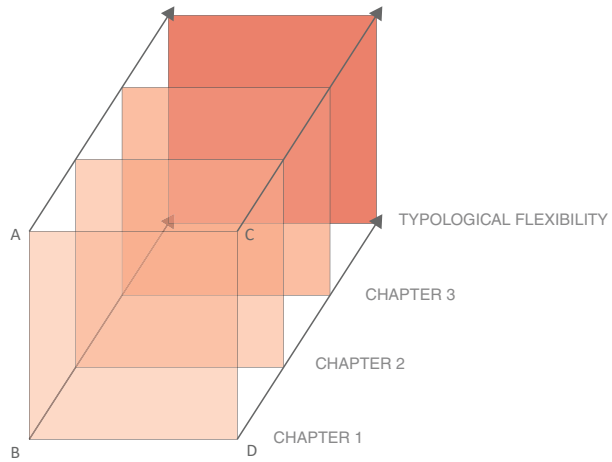


Fig. 10. The levels defined by the viewpoints of A, B, C and D epitomize a review point of each chapter.

Fig. 11. The research framework.

The edges lead the argument towards the conclusions that are situated in the middle of the framework. The last level is based on the theoretical thinking of the design. It is also a door to the next space, opening up to new interpretations going into the world. The hourglass, where the knowledge is draining down, has then been changed from a two-dimensional viewpoint to a three-dimensional corridor where the edges reflect the WHY and HOW questions that are studied simultaneously as part of each other, and move towards the conclusions.

RESEARCH VIEWPOINTS IN THE FRAMEWORK

The edges leading towards the conclusions all represent one particular research viewpoint and the questions that are essential for developing housing design and production that have been presented earlier.

The A and B edges generally answer the question of WHY housing production is as it is in Finland and WHY it is crucial to develop it. The C and D edges, on the other hand, answer the questions of HOW design and production could be developed, and increase the understanding of HOW resources could be widened. These viewpoints portray what is considered vital to the development of housing design and production, and they are based on research that I have been involved in during the course of this thesis work, as well as on the personal practice I have led for the past 25 years. Those four viewpoints are usually crucial and always present in housing design and production. They are also closely tied to each other when the potential development of housing is reviewed.

A SUSTAINABILITY	The definition of sustainability in the context of spatial production
B PRODUCTION PROCESS	The systemic contexts of the production processes
C RESOURCES	Understanding of resources in the built environment
D DESIGN	The contexts of strategic design dimension

RESEARCH STRUCTURE

The structure and method of the research is reflected in the chapter division and as the levels in research frame work. The research is divided into four chapters. The three first chapters contain the thinking and reflections on the existing condition from which the new approach for housing design – based on the conclusions of chapters I-III – is developed in chapter IV.

All the viewpoints A, B, C and D run through chapters I-III and deepen the question on its way to the conclusions. The framework also helps concentration on a certain topic at a time, and allows, even within the linear structure, the viewpoints to be read viewpoint by viewpoint in a non-linear manner following the letters A, B, C and D.

Chapter I

conveys the analysis of the situation by portraying the contradiction between the production of the built environment and the creation of a resilient built environment. The most important existing concepts referred to in chapter I are: Sari Puustinen's *sieve of norms*; Matthew Carmona's *sustainable design*; Victor and Boyton's *co-configuration* and *path dependency*.

Chapter II

examines and evaluates how culture change in design processes could contribute to the formation of sustainable and living built environments. The most important concepts referred to in chapter II are: Henri Lefebvre's *perceived space*, *conceived space* and *lived space*; Thomas Sievert's *Zwischenstadt* and *specific resilience*, *general resilience*, related to resilience thinking; Fridjof Capra's views on the understanding of complex systems. Capra has studied the application of ecological systems to social systems.

Chapter III

introduces the synthesis by examining how this culture change could create new societal activity, by helping to access the creative potential of people through socio-spatial innovations. Chapter III is the broadest of the chapters because it contains the discourse and theoretical basis for the concepts of flexibility and adaptability as well as multi-usability and transformability. This discourse is based on the ideas and theories of architects and others who have contributed to these concepts from the point of view of design, a constant focal point in architecture since modernism. The perspective of the theoretical survey has been to go more in depth into the concepts and particularly into the background assumptions that shape key understandings of time-based spatial flexibility. There is a wide range of work done by architects inter-linking the theory and practice of adaptability and flexibility, which also shows how important and relevant a part design research and its modifications have played in the

profession even before the actual concept had surfaced.⁶⁵ The key concepts considered in this chapter are Habraken's *open building* and Hertzberger's *polyvalence* as well as the Leupen's *frame as generic space* that tries to cover both concepts of open building and polyvalence as part of his theoretical study. It also tackles more in depth the concept of *creative dweller* influenced and inspired by Jonathan Hill's concept of *creative user*.

Chapter iv

The overall conclusions part and the study of the contexts of typological flexibility and the ideas presented earlier that has been made visible in chapter III. My hope is that that the element of design research and the framework that I have created here could bridge the gap between design work and its intellectual property. I hope that this research will help increase the understanding of design as a strategic tool that could establish connections to society and people's experience of the world, which have always been important dimensions of architecture.

0.8

RESEARCH MATERIAL

The research material is multifarious, partly because of the way it combines theory and design. The theoretical research material is based on literature, and on semi structured interviews with different actors and stakeholders linked to the housing production sector. The interviews were mostly conducted as individual interviews. There were some interviews with two people from the same organization (SAFA, Design of London and two architectural practises that were interviewed in Interview 4). Besides interviewing people from CABE, I had personal discussion with Richard Simmons, Kirsten Mackay and Diane Haig that increased my general understanding of CABE. The interviews were generally conducted in the organizations the interviewees presented (except three interviews in Finland). I made notes and recorded the interviews.

The interviews have generally not been particularly made for this research except for some parts of Interview 4. Nevertheless, all interviews have had an organic connection to the thesis. Due to my PhD topic I have been invited to take part in research projects that have contributed significantly to this research. There were altogether four different interview periods during the research projects that will be clarified underneath. The analyses of the interviews have already been published as articles or books. In this way the interviews are mainly used as literature references, but if the content is directly connected to the interviews I have stated to which interview

⁶⁵ Design research has not just emerged in recent years, rather it has been part of architectural thinking and is actually a built-in feature of architectural practice itself.

they refer. The various interviews are numbered and the interviewees of each interview period are listed. Because the interviews were originally done anonymously, I have not always stated the background institution of the interviewees in the text unless they have specifically given permission for that.

LITERATURE

The main literature used in this thesis generally concerns either the key concepts and their interpretations, or the research on the different aspects of production processes, systems thinking, resilience thinking and design thinking. The division of flexibility into the key concepts of multi-usability and transformability is already present in my licentiate thesis in 2006, and I have discussed it already in my published articles.

The concept of resilient development is based on Brian Walker and David Salt's understanding of resilience thinking (2006) and Matthew Carmona's (2009) understanding of spatial sustainability, which is in fact a summary of extensive research material. The understanding of the social agenda and its meaning in city development as well as in economics owe very much to the works of Tim Jackson (2009) and Thomas Sieverts (2003).

The concept of lived space introduced by Henri Lefebvre (1991) forms the basis for the understanding of the creative dweller, a concept put forward in this thesis as the means and ends of the resilient development from the self-conditional condition of space. The concept springs from Martin Heidegger's⁶⁶ understanding of the *dweller* and Jonathan Hill's concept of the *creative user* (2003).

The research on innovation in the housing production sector, a topic very modestly studied so far, very much relies on the writings of Michael Ball (1999) and James Barlow (1999). For studying and understanding the context of Finnish housing production processes by Johanna Hankonen (1994), Sari Puustinen (2010, 2012) and Erja Väyrynen (2010) have been the most influential.

The main concepts multi-usability and transformability, on which this thesis bases the self-organizing condition of adaptability and flexibility, to a great extent draw on the ideas introduced by N.J. Habraken (1961, 1972) and Herman Hertzberger (1962, 1963, 1991). In addition, the in-depth research studies of Bosma, Van Hoogstraten, and Vos (2000) and Leupen (2006a) have been very helpful in the understanding of the theoretical standing and influence that Habraken and Hertzberger have held since the 1960s.

The work of Stewart Brand (1994) and Leupen (2006a) that study the temporal conditions of building construction also have been helpful for developing the concept

66 Martin Heidegger first presented the idea on August 5th 1951, in a lecture *Bauen Wohnen und Denken* (Building Dwelling Thinking) at the Darmstadt Symposium on *Man and Space* (Martin Heidegger, *Basic Writings* ed. Krell 2000).

of typological flexibility. The work of Schneider and Till (2007), that gives a general overview of flexibility, has widened the understanding of the dynamics of flexibility. For the definition of the concept of type as a basis for typological flexibility the most influential writings have been those of Rafael Moneo (1978), Karen Frank and Linda Schneekloth (1994) and Adrian Forty (2000). The understanding of design thinking and the creative condition within the concept of type is also reflected in the writings of Michael Polanyi (1966) and Edgar Schön (2009) that emphasize tacit knowledge and the interactive condition of the design process – reflection in action – which are linked to the continual renewal of the concept of type as well as the method of the thesis.

RESEARCH PROJECTS

As a researcher, during the course of my PhD studies I took part in the URBA research project at YTK (Centre for Urban and Regional Studies⁶⁷), at the Technical University of Helsinki (today part of Aalto University) throughout the whole period of the project between 2007–2010. The URBA project⁶⁸ studied the housing design processes and the potential of people to affect their own housing condition. The URBA project introduced several housing concepts that were geared towards this kind of thinking. Within the URBA project it was widely recognized that path dependencies and systemic “locks” have caused problems in Finland. The achievement of the URBA project could be seen in the ways it brought the different stakeholders together to discuss and think about how to proceed beyond the customary boundaries and interfaces that usually limit the development processes. It also mapped possible ways to achieve this as well as potential avenues for going forward with the developments. The URBA project recognized several problems in a rather broad manner and opened up new research viewpoints. During the URBA project I also interviewed several actors in England, took part in working seminars, and, with the architect Henna Helander, co-led the working group that studied flexibility and its problems in Finland. It is referred to as the URBA flexibility working group in the text. The URBA working groups served as a platform for more in-depth discussion of the potentials and limitations of the housing concepts introduced as part of the overall URBA project. The URBA flexibility working group invited stakeholders from professional practice, cities (from the Helsinki Metropolitan area) and the Finnish Ministry of the Environment to present their views and discuss the potential for promoting flexibility in housing production. Short memos were made of these meetings.

Other research projects I took part in that also touch on the topic of this research,

67 This is the former English name for YTK when it was part of Helsinki University of Technology before it all became part of Aalto University.

68 The brief of the URBA project is published in English in *Urban Design and Planning*, Volume 164, Issue DPI March 2011 p. 15–18, under the title *Briefing: Initial findings from the Urba Project* (Krokfors 2011a).

were the ELOISA, MOVE and PEKA⁶⁹ projects at Aalto University's YTK (currently called Land Use Planning and Urban Studies Group in Aalto University). During that time, between 2010–2015, I also carried out interviews. In 2010–2011 I conducted, in my own practice, some research on the English organization CABE, an assignment given to me by ARMI Ry with the support of the Ministry of Environment of Finland and the Arts Council of Finland.⁷⁰ For the *CABE selvitys*⁷¹, I interviewed people working for CABE in England. I also interviewed several key actors in Finland for the CABE report, asking them how they saw the current situation in Finland and whether they thought similar work that CABE did could and should be applied to the Finnish context. In the PEKA project, that examined the possibilities of flexible and rule-based (or principle-based – direct translation) planning in Finland between 2013–2015, I interviewed several key actors in the Helsinki metropolitan area (in Helsinki and Vantaa) concerning the guidance and control of planning and building design. In 2013–2016 I also conducted research for the City of Helsinki, which was initiated by the building control of Helsinki (Helsingin rakennusvalvontavirasto) and supported by the Finnish Ministry of the Environment, the Asuntomessusäätiö (Finnish Housing Fair Foundation) and published by Aalto University (2016) as *Kerrostaloasumisen tilaratkaisujen kehitys Helsingissä vuosina 1997–2012 (Development of spatial solutions in apartment buildings in Helsinki 1997–2012)*. It involved mapping everyday housing design solutions in Helsinki and how they have evolved. This, as well as the interview material from the URBA, PEKA projects as well as the CABE report, formed an important basis for the part of this research that deals with Finnish processes.

The text included here, concerning the concept of type, was partly published already in my licentiate thesis of 2006. The part that deals with method and design thinking has also been partly published as part of a research publication of 2011, Architectural Research Seminars (Arkkitehtuurin tutkimuksen päivät 2011) in Oulu.

I have also studied the phenomenon of co-housing as a guest editor of the Journal of Built Environment (Editorial, Journal of Built Environment, volume 38, 3/2012, UK, *Co-Housing in the Making*, which solely concentrated on co-housing. In this work I was able to explore vast material relating to international co-housing experiments and examples with different social and communal starting points. This illuminated the needs and aspirations of people to diversify housing production and problematized the concept of housing in general. As a contributor to a publication for Ashgate (2016),

69 PEKA is an abbreviation of the Finnish for 'rule-based planning' (*periaatekaavoitus*). It was a research project that studied the potentiality of rule-based planning and its possible application in the Finnish planning context.

70 I became familiar with CABE during my research period in London. Representatives of CABE visited Finland as part of the URBA research project in 2009 and as guest of ARMI Ry in 2010 giving altogether three public lectures. CABE's way of operating generated wide interest in Finland among built environment professionals, particularly planners and designers.

71 The Finnish name of the research project, meaning approximately 'report'.

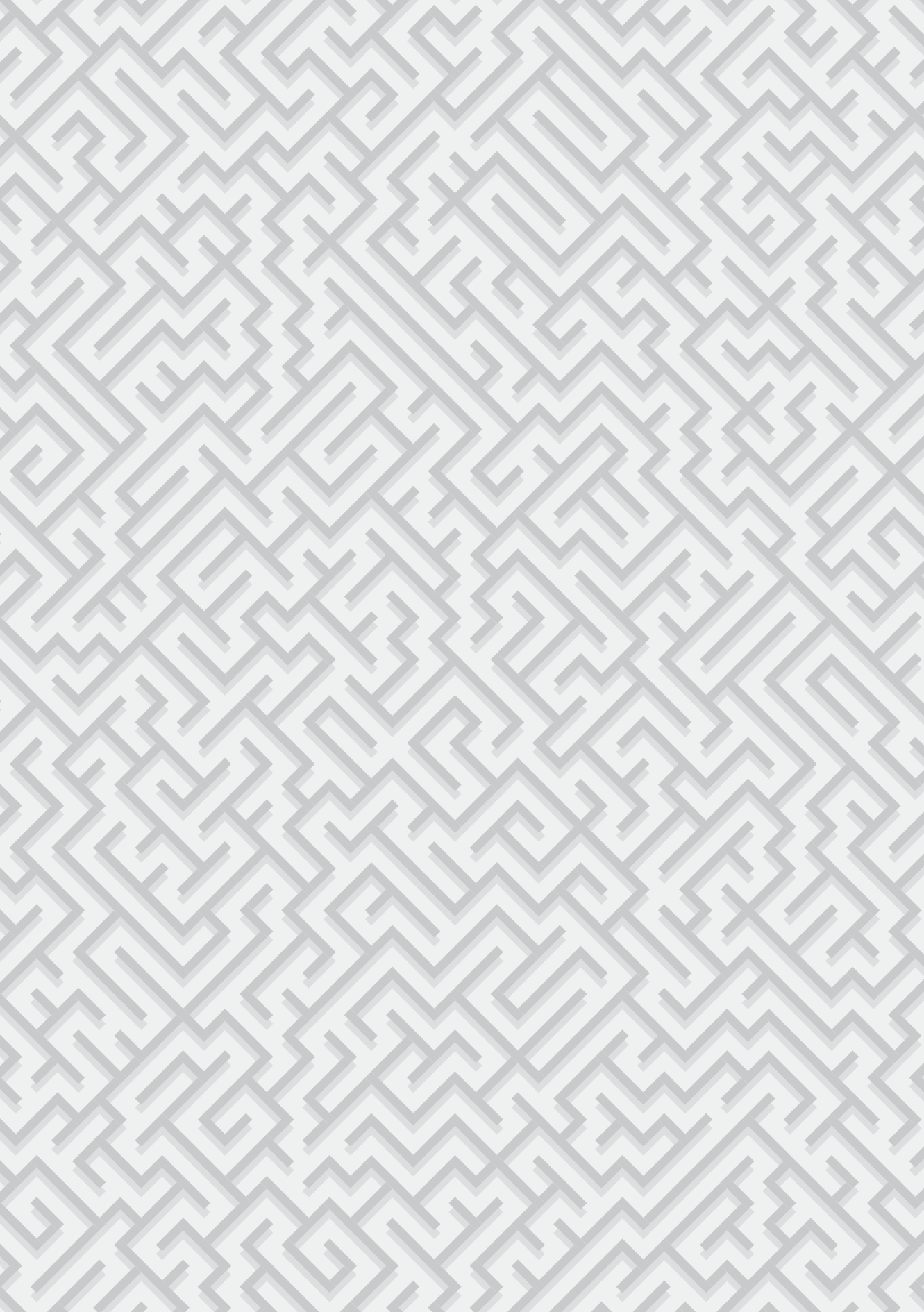
Ways of Residing in Transformation, Interdisciplinary Perspectives, I studied innovation in housing design and in the production sector in Finland and England. Part of this research has also been published in that article.

WORK IN PRACTICE

Crucially my research is based on my long experience as a practicing architect. As a designer as well as part of a group involved with the co-housing development Kellokas, I have gained experience of co-housing development, which has enhanced my understanding of processes as well. This kind of personal experience, simultaneously as a designer and a developer, has expanded my understanding even more clearly of the interlocked relationships within processes. The Kellokas housing project had many objectives relating to sustainability (ecological, social and economic), which were much more ambitious than in everyday Finnish housing production. This gave me clear insight into the key sore points for the emergence of innovations in Finnish processes and the overall building culture. Even though Kellokas is rather small in scale, as housing it reflects similar tendencies to those that surfaced in the interview material and to what I have experienced in other projects as principal architect. Certain features of flexibility in Kellokas are also focussed on in this research, since for their part they help to open up the concept of typological flexibility. The Living House project⁷² that we have been developing in my architectural practice is a more advanced experiment, which is here also used as example of typological flexibility in chapter IV.

⁷² *Elävä talo* in Finnish.

CHAPTER I



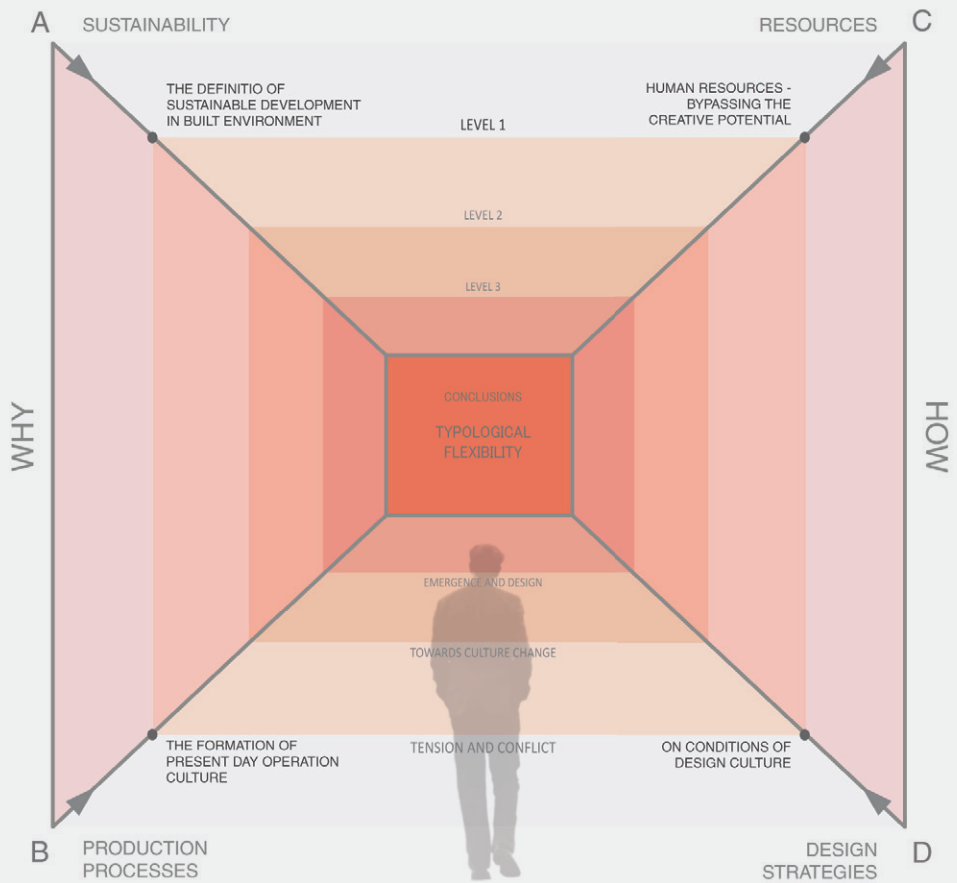


Fig. 12.

I TENSION AND CONFLICT

1.0

PERCEIVING THE CONFLICT BETWEEN PRODUCTION AND RESILIENT SPACE

The objective of the first chapter, and the first level as defined in the research framework, is to make perceptible the tensions and conflicts that exist between everyday housing production and the needs and aspirations apparent in society. The chapter establishes the way housing production works as a system through the four viewpoints by understanding the contexts of sustainability (1A), the overall production processes (1B), and the resources (1C) connected to design strategies (1D). See Fig. 12.

The demands imposed on housing and on the formation of cities are greater than ever before because of the challenges we are facing today through interlinked climate and culture change taking place simultaneously. Even though the processes examined in this research are very much linked to the Finnish context, similar tendencies exist in many industrial societies as well as in newly industrializing societies that rely on approaches and understandings of housing familiar from industrial economies after the Second World War. This is one of the reasons why the chapter stretches the examination of the development of housing design and production all the way back to the birth of modern housing and the industrial execution methods developed then and which, in some forms, still prevail. Many of the background assumptions of those times are still guiding housing design and production. The main reason why I have studied the processes over such a long time span has been to establish the lines of thought and path dependencies that remain embedded in industrial housing production today. Some new lines of development are occurring all the time in everyday housing production, but they seem to be largely built on earlier assumptions, and hide the drivers that seem to dominate housing production in general. What new development there is can almost be considered to be the icing on the cake of underlying tendencies that have not changed very much. The research hypothesis is that as long as these lines of thought remain buried within the processes, they cannot sustain a balanced and resilient path towards social advancement and wellbeing. Many issues in housing production are taken as given because it is difficult to change them or even imagine what could be changed, given different circumstances. It is thus very challenging to establish a new line of action if the development is based on same background assumptions that have created the problems in the first place.

CULTURE CHANGE

We are in the middle of major cultural transition, which is projected in many ways in different societies. In industrial societies people's aspirations are differentiated and diversifying. Households and working conditions are going through radical changes (Sieverts 2003; Mitchell 1996). Working from home is increasing and working careers vary from steady jobs to unemployment, to short term jobs or small scale business ventures and self-employment. So, people also spend more time at home. At least in some fields of work people are freer in relation to time and space and can thus develop complex lifestyles that allow them to be spatially and temporally relaxed (Sieverts 2003 : 49). The differentiation of needs into a more individual direction, the spectrum of family structures, multiculturalism, demographic changes as well as growing migration towards cities all set enormous challenges for the development of cities and the production of space. In many cultures the old community structures including extended families, which once provided protection and support, have become part of the past (Sieverts 2003 : 58).

Demographic changes, particularly in more developed countries, are a real challenge to societies because public resources are diminishing and the ratio between the number of wage earners and people dependent of them is getting wider. Finland is one of the societies that are facing the challenge of an ageing society. The proportion of pensioners as compared to other populations is considerable, which also puts growing demands on resources and is bound to create changes in the physical built environment. There is, among other things, a growing need for services in the vicinity of the home as well as inside the home. The goal of the ageing industrial societies has been to enable the elderly to live at home as long as possible. The social context of families and the concept of the family are also changing. There is a growing number of reconstituted families whose spatial needs diverge considerably from the needs of "nuclear" families, of which the percentage of all households is rapidly decreasing.⁷³ The needs for intimacy and social interactions can manifest in diverse ways, particularly in situations where new family members are getting to know each other and adapting to emerging family situations. The size of a family can also vary from week to week. Furthermore, immigrants of varied backgrounds expand the cultural spectrum of housing and its physical realms. Family sizes and way of organizing living can differ notably from the original population (Dhalmann 2013). Sieverts (2003) sees that an awareness of these changes can already be perceived in people's lifestyles and that city districts should be developed in a manner that takes this into the consideration, facilitating the development of local social and cultural bonds. According to Sieverts,

73 The percentage of people living alone out of all households was 42 % in 2014 in Finland. The percentage of households comprising 3 or more people was 25 % of all households in that year (Tilastokeskus.fi 2014a). The number of reconstituted families that show in the statistics was 9.1 % in 2014 in Finland (Tilastokeskus.fi 2014b).

all this means that we need new kinds of homes that cater for people forced to live in constantly changing and uncertain circumstances (Sieverts 2003 : 58–59).

This manifold knitting of a complexity of needs and aspirations means there is a growing necessity to profoundly rethink how we want to develop the cities and provide living solutions. The pressures for diverse housing and new housing solutions that serve people better are notable, but in the house building sector this change is not visible and the tension between real needs and available solutions is growing (Gimble & Tyvima 2014 : 351). At the same time as new needs emerge, the move towards centres of growth is putting pressure on housing and leading to efforts to create more at an accelerating pace. This challenges the processes as well as the housing markets. It also puts to the test people's patience when developing new approaches in the housing sector. The homogeneous housing on offer keeps on appearing for various reasons, but the problem is much more extensive than what immediately meets the eye: the short term objectives of house building, based on quantitative approaches, are having a damaging effect on sustainability. In this existing conflict between production and needs, the question is not only how we can simply fulfil the aspirations of individual people, or even meet production expectations, but rather, what the effects are on the built environment. These two viewpoints, namely the contextual aspects of housing development and the issue of achieving quantitative expectations of housing, are usually approached as separate questions that do not easily intersect, and can even be seen as opposing each other. Simply satisfying quantitative criteria is a more reactive response, whereas the other, approaching housing as a question of long-term sustainability, requires visionary thinking and innovation of a more proactive nature than has been seen in housing production up to now.

THE DEMANDS OF SUSTAINABLE DEVELOPMENT

The agenda of city planning and building has changed with the demands imposed on the built environment by sustainable development. Sustainable development has provided a new kind of legitimacy, which it had already partly lost as a reaction to industrial and anti-urban design and building in the latter half of the 20th century (Carmona 2009 : 49). This change in legitimacy, however, cannot be observed as an increase in the diversity of housing solutions. Trends in regional construction and more suburban types of building, in which housing and services do not mix properly, are still part of the everyday built environment in Finland, likewise in many other countries. This is partly the result of a transition in retail systems, particularly apparent in countries, such as Finland, where corporate processes have given business a strong position in defining the locations for retail trading (Mäntysalo, Joutsiniemi, Nenonen & Syrman 2012). Other services have also developed as more centralized models, which has also had an effect on city structure. For several reasons it has become more

and more difficult to create a mixed living urban fabric, even though as an objective it usually guides planning initiatives. Copenhagen demonstrates a good example of the measures that cities have to take to create vibrant and mixed city structures. In the development of the Nordhavnen area of Copenhagen there is commitment to long-term public-private development that creates a mixed city fabric and the will on the city's part to fulfil these objectives. The actions taken have been ambitious and resource intensive (Simmons & Krokfors 2015 : 313–314).⁷⁴

Even though the identification of existing needs has not yet led to tangible change in housing production, global threats will most likely be the catalyst that directs societies, before long, to ponder more profoundly the way we build, and to rethink and assess whether our building sector has a remotely resilient basis. In the name of ecological sustainability, energy and particularly energy efficiency have been increasingly in the focus. Beside energy consumption, other aspects of sustainability, such as social sustainability, have also slowly been rising into the public consciousness. From the beginning of 2012, social sustainability has also been incorporated into assessments of building performance in EU standards (Sfs.fi 2017).⁷⁵

How we build today has far-reaching effects from the standpoint of social sustainability. Congruent building today can endanger resilient development, from many viewpoints, and for decades to come. If we cannot respond to the constantly changing needs in living, we also jeopardize balanced city development. Without a diverse as well as an adaptive building stock, building will most likely increase cumulatively, because there will be a constant demand to rebuild housing districts based on emerging new needs. This has already happened in many countries as part of solving the problems of 1960–70s suburbs, which were – surprisingly – only built for an average expected 30-year life span (Hankonen 1994). Suburbs have shaped the development of cities in a consequential manner, and because of the absence of alternative ways of building, the effects and mistakes have been vast, both in terms of housing production and city development. In a world of diminishing resources, the impacts of one-sided solutions have created a great hindrance to the well-balanced development of communities and ecosystems.

74 So far the filling of commercial spaces and retail spaces in Nordhavn has been quite challenging, partly because the area is still unfinished and will be built for decades to come. The city has been able to deal with this kind of long term focus through the creation of CPH City and Port Development (CPH) (By & Havn) that is owned by the city (95%) and by the government (5%). The budgeting is detached from the city's annual budgeting making its operations more flexible and long term in focus. The CPH has bought all the ground floor commercial and retail spaces and can thus guide the emergence of services in the area. CPH starts by renting these premises with lower rental expectation, for example to artists and other groups that are more prone to come to unfinished areas in search of lower rents. Later on, as the area becomes more finished, the rental of ground floor spaces can better follow market conditions and the CPH can get back its investments. As a "public" stakeholder it can more easily execute the long-term focus in investments and at the same time ensure the mixed urban character of the area. (Presentation by CPH representative at the Nordhavnen information centre on March 4th of 2015).

75 SFS_EN 15643-3 Suomen standardoimisliitto.

As Säynäjoki et al. (2012) have shown, the peak of energy consumption in the building construction phase is emphasized because the energy efficiency of buildings is increasing. The carbon spike in the construction phase can put into question a building's entire energy efficiency because the payback time due to the energy use during the construction period can be several decades (Säynäjoki et al. 2012 : 6–7). Säynäjoki's (2014) solution has been to take into use as much as possible buildings that are currently unused, but the principle can also be applied to new building. Alongside a low-energy construction process, the energy efficiency of a building depends on the life span of the building stock. The life span itself becomes a significant aspect from the point of view of the production of greenhouse gases. Even the most energy efficient building, if it cannot serve the inhabitants in the future, may be gone in few decades. Because of the difficulty of predicting future needs, even a diverse building stock does not necessarily guarantee the persistence of the built environment in the long run, as it may not be adaptable to changing needs. Social and ecological sustainability are thus very closely interrelated and are very difficult to clearly distinguish from each other.

The current manner of seeing housing as a replaceable consumer product, and the constant rebuilding, are real threats to sustainability, from an ecological point of view and on a global scale. The built environment should actually withstand time over several generations, closer to hundreds of years than one hundred years, to be even closely ecologically sustainable.

A PRODUCTION SYSTEM CREATED FOR A DIFFERENT WORLD

Current housing production is largely influenced by the movement of modernism and, in Finland, especially by the functionalist period of modernism. The mechanistic world view is still strong and in some way forms the underlying basis for the development of housing production. Even though production culture in the early years of modernism had very social objectives, production was interpreted and developed in the end from the business objectives of element construction, which resulted in very homogeneous housing (Hankonen 1994).

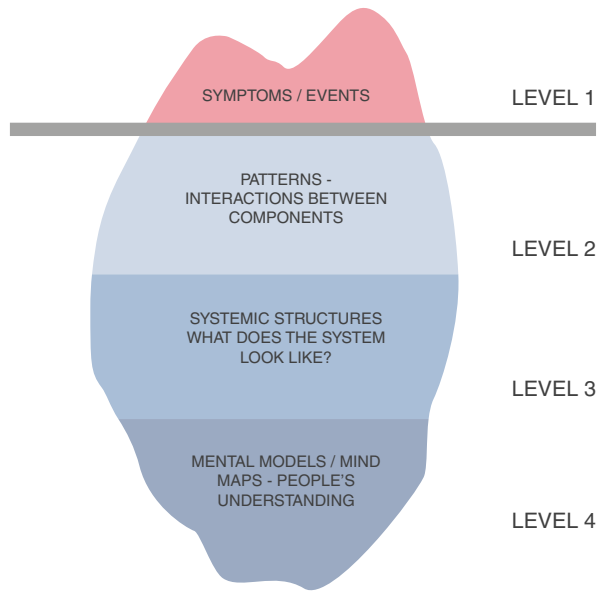
The lack of diversity on offer within the housing market is particularly notable in housing production systems that are based on industrialization and strong standardization. Finland's housing production sector has been amongst the most industrialized in Europe since the 1960s, and it has carried with it a very strong tendency towards standardization and regulation (Hankonen 1994). This problem is not, however, restricted solely to countries relying on industrial housing production and strong regulation. Countries like Britain, without strong regulation, in which strong market forces operate, and the variation in the kinds of housing on offer is developer-led, appear to be struggling with similar tendencies but for different reasons. The designs of dwellings rely strongly on developers' design guidance (Interview 1). Because the construction

companies are operating in a fairly closed market situation, market logic does not apply to them in the same way as it would in other industrial sectors. Construction companies can even regulate the market by controlling the initiation of the number of projects started (Interview 1 and 2). Innovation is rare among house building companies because they are more concerned with profit margins and the rise in input costs. It is beneficial for them to proceed as before (Ball 1999 : 10). Changing the manner of production would mean extra investments and risks in a field that operates on a very short perspective (Barlow 1998 : 38).

Housing production is also affected by mental models of what housing should comprise. The housing production system practised today in Finland was originally created for a very different world, based on the ideology of the reconstruction period after the war and the regional construction model created in the 1960s. In general the sizes of singular constructions have become smaller in the past decades. However, to a great extent, the system is based on a faith in predictability within the boundaries of the housing production system presently executed in Finland. The world around has changed but the system has not yet been able live up to the challenge of contextual change.

THE PROBLEM OF PREDICTABILITY

Finnish housing production, from planning to execution, is based on an assumption of predictability. The local plan is based on an assumption about the family profiles of the future inhabitants of the region. This untested assumption is further reinforced by the building typology introduced in local detail plans. Also, production is based on the predictability of the housing markets, so that the developers are able to handle the risks and profits in the developments. This faith in predictability has also led to a stiffening of the housing production because, for developers, the engineered predictability in a rather closed market situation has so far been beneficial. As a result of this, people have been forced to buy what is available on the market and have also been wary of the resale value in such uniform housing markets (Gimble & Tyvimaa 2014 : 354). The realities of housing production have been taken for granted, which has in part strengthened the idea of predictability and the homogeneity of the housing stock. However, many predictions about the development of areas have gone wrong, particularly regarding the planning objectives, such as the number of schools and kindergartens needed, and dealing with this may have required changes in planning and implementation as well as further resourcing. This general approach at the root of the processes ignores the reality that the future is very difficult to predict, even though it had been possible earlier, at least for short term spans, in the safe embrace of the uniform culture of the past. Planning and housing production should therefore adopt new approaches in which the difficulty of predicting could be taken into consideration.



This is particularly the case with the transition away from short-term aspirations to long-term views in the resilient development of processes.

The tendencies enshrined in standards, regulation and guidance are considered to be responsible for developing housing production, and this has carried housing as a whole in a very generic direction. One basis of this regulation is the general understanding of what is good housing. The production and content of housing in Finland are based on the views and values of the stakeholders responsible for production and regulation. “Hidden” values and ideals are still taken for granted, including some that are very old, and they still guide the housing regulation (Puustinen 2010). Puustinen has divided these values into four different value families that guide housing production. One of these is the faith in standards and the law, a faith which is very strong among Finns (Puustinen 2010 : 324).⁷⁶ Puustinen has also examined the lack of alternatives in housing in Finland through the concept of *the sieve of norms*. By that she means aspects of land use, housing construction, tax and financial regulatory laws, regulations and standards, as well as standard practice and their interactions and interdependencies within the system. According to Puustinen, only those developments

⁷⁶ According to Puustinen there is a hidden family of values guiding housing regulation: 1 the value of self-help and coping alone, 2 the value of confidence in legislation and norms, 3 the value of equality and 4 the value of proximity of nature.

Fig. 13. Iceberg model.

that meet all the requirements of the multi-layered sieve penetrate through the system (Puustinen 2010 : 328). She sees that the systemic and fixed context is so strong that any development in housing is difficult to execute in the current state of housing production in Finland. This means there needs to be a rethinking of the system as a whole and development in understanding the driving forces behind it in order to gain an overall developmental tendency in the system.

This is very well epitomized in the iceberg model often used in connection with systems thinking: the tip of the iceberg is just the clearly visible part of a far larger set of events and processes. Decisions and interventions take place at this top level. They are the symptoms of the systems and are usually the issues people try to affect (Maani & Cavana 2007). However, working at this level does not provide lasting solutions, only “quick fixes” that try to cure the symptoms. The real causes lie beneath the surface. The iceberg model and systems approach can be understood in a framework of four levels of thinking. The first level, above the water, consists of the events that we usually react to. The other more hidden levels under the water are: level two, which refers to the patterns of interaction between the components; the third level, which represents the systemic structures and how they look; and the fourth level, which comprises the mental models that guide the systems (See Fig. 13). Mental models are linked to how people perceive and understand things and are also epitomized in Puustinen’s research on the Finnish processes that direct the production of the built environment.

[...]mental models of individuals and organizations[...]influence why things work the way they do. Mental models reflect the beliefs, values and assumptions that we personally hold, and they underline our reasons for doing things the way we do. (Maani & Cavana 2007 : 15)

According to the iceberg model theory, stakeholders should move from the events level to deeper levels of thinking (Maani & Cavana 2007). Moving through the levels of the iceberg model means taking steps towards the mental models in level four, to see how they can be integrated in a system structure and how the different components are interconnected and affect one another. To be able to affect and change things, it is necessary to study the levels beneath the symptoms level.

1.1

THE DEFINITION OF SUSTAINABLE DEVELOPMENT IN BUILT ENVIRONMENT

A

By the beginning of the 1960s, the idea of limitless growth had emerged. It was understood that a mass consumption society could become reality. However, in the 1960s and 1970s concern was also raised about the balance between ecological and economic forces, as well as about the impacts of the economic growth and development in industrial societies. Many pressure groups such as Greenpeace and Friends of the Earth were created then. In 1972, the report *The Limits to Growth* was published, commissioned by the global think tank, the Club of Rome. This was the first serious attempt to start a discussion about global environmental issues. The report was a warning about the consequences of the prevailing trends in industrial societies, but also an optimistic review of human resources and our possibility to affect and innovate to solve future problems (Meadows et. al 1972). It concentrated on the issues of industrialization, expanding undernourishment, the exhaustion of natural resources and where the destruction of the environment could lead. The writers posed the question: how would we like our world to be? Limiting growth would mean major efforts and new ways of doing things (Blewitt 2008 : 15).

Over forty years later we are still struggling with the same questions and facing the threats presented in the report, which have now started to manifest in people's lives and in the environment. Biodiversity is also diminishing at an accelerated rate. The IPCC (Intergovernmental Panel on Climate Change) report of 2014 (Books.google.fi 2014) and later reports makes gloomy reading about the progress of climate change even though the writers concentrate on ways to mitigate it. Economic growth based on constantly producing more products is still the basis of all our actions. The question of how we could produce less in order to meet the limits of the planet's natural resources has, in the past few years, been gaining wider space in public discourse. A good example of this is the de-growth movement, which is based on the claim that we cannot sustain growing consumption. The idea behind the thinking is that continued economic growth based on material goods is impossible. According to de-growth thinking, eco efficiency is not enough because the growth of consumption eats away the gained benefit, a thought which also resonates in Jackson's (2009) research. If levels of consumption also spread from developed to developing countries with high populations, we will need several planets to sustain it.

As an alternative to growth, many scientist and professionals propose new kinds of habits in consumption and new criteria to be imposed on consumer production as well as on how we behave. The recycling of goods, however, is not enough if products are overproduced in comparison with resources. McDonough and Braungart (2002) have

argued that the way recycling is conducted today, it would be more appropriate to call it downscaling than recycling, because the recycling itself does not remove the problem but can actually prolong unwanted development in the environment (McDonough & Braungart 2002 : 56–59). According to them, recycling is often regarded as a good reason to proceed as before. Recycling also demands a lot of energy for reworking the old products, so the criteria for sustainability are not necessarily always fulfilled (McDonough & Braungart 2002). McDonough and Braungart have also argued that many recycled products are actually poisonous and even dangerous if they are recycled into other uses than what they were originally meant for (McDonough & Braungart 2002 : 57–58). The recycling business in developing countries can be also very polluting and is often conducted in inhumane conditions (Baichwall 2006). With recycling the product can have at least a partly new life, but there is a cost in energy, including for transport. All this means that to fulfil ecological criteria consumer products need to last longer. This will mean that the relationship to consuming will also change. According to Princen (2005), in order for societies to become more ecologically sustainable the emphasis should be on production rather than on consumption.

McDonough and Braungart (2002) see that if we want to direct recycling onto a more sustainable and healthy path, we should understand the design of products in a new way. According to them, from the beginning, products should be designed with future recycling already in mind, and they should be made of healthy materials. They see that the lifespan of products should be seen in their whole organic context in which the life span of the product is understood as part of natural processes. This kind of thinking has not been the focus of industrial production, because its objectives are not based in natural processes and cycles, but in linear production, as cheaply and fast as possible, ignoring everything else. They see that our way of producing consumer products contradicts nature as well as cultural diversity. Industrial production closes the options while nature is constantly creating diversity. McDonough and Braungart see this as a *cradle-to-grave* model, and note that we should aim at a *cradle-to-cradle* way of production like natural organisms, in which no waste is created and all the material can be reused endlessly (McDonough & Braungart 2002 : 26). Their message is above all one of anticipatory design, but in a manner that does not close off diverse uses of a product during its lifespan and after. This line of thought can be applied also for promoting the longevity of buildings from the viewpoint of resilient development. The more variety of options space offers for use, the more resilient the building becomes.

A similar line of thought is anticipated by Jackson (2009), in his discussion of how we could enable economic growth without destroying the planet's natural resources. He has been studying how to ensure wellbeing without growth in consumer production. He sees that economic growth should be detached from the consumption of natural resources. In that way Jackson calls into question the idea of limitless

growth by production. He sees that we should pay attention to three major challenges. First, we have to define the ecological limits of human action, and second, we must repair the erroneous economics based on limitless growth, and third, we must change the harmful social logic of the consumer society (Jackson 2009 : 231).

When we recognize the limits of growth in natural resources, the question arises as to how we can produce better, more durable products that are based on cradle-to-cradle thinking. However, not all products involved in building can necessarily be recycled according to the cradle-to-cradle model. Buildings are also complex entities of which the parts are usually replaced at a different pace. The replacement of buildings always also needs a lot of energy compared to the energy used for long-lasting buildings. Jackson thus sees that the industry should pay far more attention to durability and sustainability as well as to reparability. According to him, both in the context of existing buildings, and in new construction, the priority should be on being easily repairable (Jackson 2009 : 224). This reparability concerning buildings could be partly interpreted as easy changeability in the spatial contexts of the buildings.

According to Chapman (2005), the problem also lies in the design itself. Consumers do not react emotionally and sustainably to products. People do not commit and create relationships with products: products are not cared about and are easily thrown away (Chapman 2005). This logic can be applied to the built environment as well. Without an emotional bond and meanings attached to it, we easily experience the built environment as replaceable. From this point of view, meaning creation is a very important feature of a durable environment.

There is endless rhetoric over sustainability, and its forms of application are being developed constantly, with recycling as a good example. In spoken language the concept “greenwash” is familiar to many. It refers to the marketing and branding of products as ecological that in reality do not possess sustainable qualities, or if they do, the understanding of sustainability is very limited. The Norwegian philosopher, Arne Ness, talks about *deep* and *shallow ecology* (Naess 1973, 1995), where shallow ecology is about using natural resources better. In deep ecology the focus is on natural resources, territories and habitats. No object of nature is only understood as resource to be exploited. The worldview of deep ecology is holistic and sees everything in interaction with everything else. Naess also talks about cultural diversity as analogical to biodiversity. According to him, industrialization and modern technology should not be allowed to destroy the cultural identities, diversity and values of non-industrialized countries. He sees that the model of industrialization of western countries for developing countries is an example of *shallow ecology* (Naess 1995 : 68–74). Like Jackson (2009) he also makes a distinction between a high standard of living in economic terms and the quality of life.

The power of corporations has also been widely criticized from the point of view of sustainability. According to Korten (1995, 2000), corporations can, under the protec-

tion of legislation, benefit from immense economic concentration and yet bear very low social responsibilities and duties towards the natural environment.⁷⁷ There has been growing discussion on how the social responsibility of corporations could be increased, so the locals and local environment could also benefit, and not just the companies.

The eco-anarchist writer Murray Bookchin (1993) brings the concept of *social ecology* into the discourse. His point is that unless we realize the root causes, such as trade for profit, industrial expansion and the identification of 'progress' with corporate self-interest, we will falsely tend to blame technology as such or population growth for environmental problems. He says that we tend to focus on the symptoms of a grim social pathology rather than the pathology itself. Our efforts are then directed towards limited goals and the results are more cosmetic than likely to cure the problem. Bookchin's approach is very much in line with Naess's perspective on sustainability. They both believe that we should concentrate on living with nature in the manner of natural processes instead of dominating and just exploiting them. Ecological harmony is, according to Bookchin, a defender of social harmony. It is rather interesting to compare Bookchin's ideas with those in the building sector. In housing production too, the aim of most actors, particularly those who only construct to sell, is to grow the business and create dividends for shareholders. The more that is built the better the building corporations and building industry will flourish. They do not necessarily benefit from timeless, durable and less resource-intensive building unless the business logic is rethought considerably and more demands are imposed on them to take into consideration the long-term quality and development of the built environment.

However, the continuously evolving housing production could keep the industry busy and on a developmental path by creating premeditated services for easy adaptation and maintenance of the building stock. These could be based on the more sustainable solutions that Jackson (2009) also calls for. For those developers that manage the building stock after its execution, the interest in more timeless and sustainable solutions would be far greater and could actually be beneficial for them in the long run if the long term view would also be applied to the ways of estimating the costs that guide the construction initiatives.

All building eats up resources, so building construction can never truly be totally resource saving. In other words, everything cannot yet be built of totally renewable and non-polluting materials. But consideration of how we build and what objectives we impose on the built environment could help in the use of the limited global natural resources. Economic activity is often considered to be one of the main motivations of the building sector, so it is not so keenly bridled by the society at large. This brings us to the two-fold attitude towards the built environment from the point of view of

77 Particularly in developing countries corporations are even locally supported and sustained through exploiting an underpaid workforce.

business and built environment. If the viewpoint is short they tend to be also contradictory to each other. In the long term view the reference point changes radically. How people want to live in the future becomes one of the main questions that also need to be tackled from the point of view business logic. If we take as a starting point that the built environment should withstand time, over several generations if not centuries, in order to be really less resource-intensive people's behaviour in general comes into focus. This means considering social sustainability from its spatial starting points as a meaningful criterion for creating built environments and emphasizing its role particularly in creating adaptive and flexible buildings.

TOWARDS THE SOCIAL SUSTAINABILITY OF SPACE

The most commonly used interpretation of sustainable development is the definition given by the Brundtland Commission in 1987:

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (Un-documents.net 1987 : 43)

The definition is usefully unambiguous and it also adopts the perspective of an undefined time span and sustainable development as a continuous process. The report has been a good general ethical precept, and it very well crystallizes the objectives of sustainable development so that we do not, with our own behaviour, hinder the balanced development potential of future generations. Each generation has to take responsibility for its own actions. The viewpoints of the Commission have also been criticized because they refer to the necessities of economic growth, markets and industrial modernization (Blewitt 2008 : 15). The report, however, also emphasizes the ecological and economic aspects of sustainable development. Sociocultural sustainability is not yet fully recognized as being equal to them, but there are references in the report to the social and cultural contexts, which are seen as important factors in defining the context of sustainable development in different cultures and societies (Un-documents.net 1987 : 44).

Today the focus has moved towards social and economic sustainability as themes in their own right (Turkington & Sangster 2006). Social sustainability is also recognized as an important criterion for sustainability. The sociocultural sustainability of societies is, as a concept, more difficult and ambiguous to define than ecological sustainability, which means ensuring the natural diversity of ecosystems. Even though the sociocultural aspect is connected to objectives of diversity, its interpretations vary quite a lot (Burton & Mitchell 2006). Hence, social sustainability can be considered as a dynamic concept changing over time and open to different interpretations (Demsey, Bramley, Power & Brown 2009). In this research social sustainability is seen from the viewpoint

of community structure and the quality of the built environment, highlighting its spatial terms, or how the physical environment affects the wellbeing of people, for example, how the possibility for interaction between people and their life situations are affected by space. This thinking is based on the fundamental assumption that these features are greatly influenced by the physical environment.

THE VIEW OF SUSTAINABLE DEVELOPMENT IN URBAN AND HOUSING DESIGN

At present the sustainable development of the built environment is usually defined from the viewpoint of energy consumption, which of course is an extremely valid perspective that has to be addressed in the near future. Housing design is guided by regulations and standards, which give very precise guidelines for building design in Finland. Building regulations concerning sustainability currently consider the ecological footprint of building materials, the energy consumption of the building or the eco-efficiency of the area. The compactness of the city or region is also considered a significant criterion for assessing sustainability, mainly based on efficiency in energy consumption, infrastructure and transport, although this aspect is also under scrutiny from social and cultural perspectives (Mäenpää 2008, Hall 2005). Focusing on the measurable properties of energy consumption is, however, a very one-sided and technocratic approach, which easily excludes other essential socio-spatial factors affecting the sustainability of the built environment that also indirectly have an effect on energy consumption and ecological aspects. The housing regulations and guidance in Finland do not recognize sociocultural aspects even though legislation does. The objectives of building guidance should promote building that is based on solutions that are, in their life cycle properties, sustainable, economic, socially and ecologically functional and that also create as well as maintain cultural values.⁷⁸

The characteristics of the sustainability of the built environment are taken as given in present day housing production, and have not so far been challenged in planning practices and regulations either. The sociologist Blake Ratner (2004) sees the definition of sustainable development as a dialogue of values. He recognizes three fundamental tendencies in the practice of sustainable development: *technological*, *ethical* and *dialogic*. Only through discussion, debate, critical reflection, learning and dialogue can action towards sustainable development be established (Ratner 2004). A value-based discussion on housing production, which could widen the perspective, has been very sparse in Finland thus far. In present day processes, at least in Finland, the system view and understanding of it is not holistic. At all levels of production the actors involved in the

⁷⁸ In *MRL 12§ Rakentamisen ohjauksen tavoitteet*: The objectives of the guidance of building in the Finnish Land Use and Building Act 12§. Translation by Karin Krokfors.

process concentrate on their own objectives and are preoccupied with the parts that they can affect, and therefore the system view is very segmented, not least in bigger cities with more hierarchical organizational structures. The definition of sustainability basically follows the phases of the process, and the built environment is not perceived comprehensively by all the actors involved. Guidance and control happens mainly through optimizing the parts rather than seeking a comprehensive view of the whole (Staffans, Kytä & Merikoski, 2008). This can for example be seen in the planning of infrastructure, which is undertaken well ahead of the planning procedure when the built environment has not yet taken shape in the plan. The infrastructure has an effect on potential solutions in the future. Any changes to the infrastructure are usually very expensive and less willingly implemented (Interview 2).

Because future needs and lifestyles cannot be predicted and because they are diversifying, we need better definitions of sustainability that also take into consideration the changing needs and aspirations of human activity. New approaches are needed that involve socio-spatial characteristics, although these cannot be measured easily. Fulfilling the needs of sustainability holistically would not be so difficult if the processes comprised a tendency towards development, and diverse housing solutions would emerge from the adaptability of the building stock itself. Sustainable solutions in general are formed by experimentation and evaluating different emerging solutions. This is also due to the fact that the character of the solutions, particularly ecological, is usually very local and situation-bound, and one that works in one place may not necessarily suit other circumstances (Carmona 2009; Dunster, Simmons & Gilbert 2007). Social criteria are also culturally bound, and so defining social sustainability as habits and values varies considerably, even locally. Discourse based on the experiences of different solutions as joint ventures is also needed to guide the processes towards more balanced objectives. Currently, the rigid process of producing built environment actually reflects an insoluble image of the state of the world, one in which new ideas and approaches do not easily emerge. Given this state of affairs, we cannot respond to the demands of the resilient development of buildings holistically. Additionally, the objectives we are aiming at should also be put under scrutiny: are we asking the right questions and are we tackling the issues necessary for creating sustainable solutions in the built environment? Lang (2005) argues that we should ask what the human interest is in the long term. He questions whether we are asking overly simplistic questions about human behaviour and processes when tackling the creation of built environment. For Lang, city planning should avoid forms in city structure that may lead to the degrading of the quality of life and to the decay of the physical environment. He asserts that, because needs are no longer predictable, (if they ever were), the most reasonable way to approach city planning is environmentally gentle, and not assume that people will always find technological solutions to problems (Lang 1994 : 348). Spatial problems cannot be solved by technology (Lang 2005).

DEFINING SUSTAINABLE DESIGN

All building has a greater impact than its immediate context, and sustainable design has to take into consideration all spatial scales, from a single building to larger settlements (Rowley 1994 : 186; Rees and Wackernagle 1994). Urban design operates across building, block/street, neighborhood, town/village, city and regional scales (Roger Evans Associates 2007 : 6). The sustainable design of buildings is interlinked with the objectives set for urban design. When considering sustainable design principles in guidance, particularly at building level, the focus is usually on materials, energy efficiency and the use of energy during the life span of the building. At the urban design level, the scope is already much wider and includes the quality of the built environment and its social context, which is in turn, however, closely linked to building design. The objectives set at building level often contradict the objectives set at the urban level, when in fact they should coincide at all levels. Carmona (2009 : 56–57) has defined 10 reference points as sustainable urban design principles, building on similar ones defined by others.⁷⁹ For Carmona, principles operate at different levels, namely: building, spaces, quarters, and settlements (Carmona 2009 : 59–67). This approach recognizes the building level as being encompassed by the urban level, not as a separate issue with some connection to city. The list below represents Carmona's different principles on building levels that should guide sustainable design:⁸⁰

1 Stewardship

Carmona means here the stewardship of the built environment, as practised by public and private stakeholders. The important objective is the long-term view and an understanding what makes towns and cities sustainable. On the building level it means responding to and enhancing the design context for easy maintenance during its life span (Carmona 2009 : 59).

2 Resource efficiency

Resource efficiency means taking into consideration all notions of environmental sustainability, implying care in the use of energy and in the use of non-renewable or environmentally destructive materials. On the building level, it means using renewable energy, design for energy retention, reduced embodied energy, use of recycled and renewable material as well as designing for natural light and ventilation (Carmona 2009 : 62).

79 Hough 1984; Bentley 1990; Breheny 1992; Blowers 1993; Haughton & Hunter 1994; Lang 1994; Barton 1996; URBED 1997; Rogers 1997; Frey 1999; Edwards 2000; Clarke 2003; European Union Working Group on Urban design for sustainability 2004 (Kau.edu.sa 2004); Jabareen 2006.

80 The list is part of much wider table comprising different spatial scales, from buildings to settlements.

3 Diversity and choice

Environmental diversity is a key tenet for sustainable development. In the natural context it implies biodiversity and in the context of building it refers to diversity and choice. On the building level it means providing opportunities for mixed uses within buildings and mixed building types for different age and tenure groups, as well as building accessible, lifetime homes and buildings (Carmona 2009 : 62).

4 Human needs

Environmental needs cannot be met if human needs are ignored, including taking into consideration social and economic sustainability. This includes equity, quality of life and participation. On the building level this means supporting innovation and artistic expression in design and designing for human scale and creating visually interesting buildings (Carmona 2009 : 63).

5 Resilience

Resilience is linked to resource efficiency – once constructed, built form represents considerable investments in energy and resources. Considering resilience encourages building for the long term, which reduces the use of resources, reduces waste and energy requirements, and encourages more adaptable buildings, spaces and urban forms as well as infrastructure (Moughtin and Shirley 2005 : 36–39. Cit. Carmona 2009 : 64). On the building level it means building extensible as well as adaptable buildings, which are built to last. This also involves using resilient materials (Carmona 2009 : 64).

6 Pollution reduction

Pollution reduction has an important role in improving the quality of life. On the building level it means, for example, reusing and recycling waste water as well as on-site foul water treatment or insulating for reduced noise transmission (Carmona 2009 : 64).

7 Concentration

This is the most controversial of the design principles and incites the most disagreement. Even if living at higher densities is technically sustainable, individually it might be considered unacceptable and even socially unsustainable in the long run. On the building level it means designing compact building forms to reduce heat loss, e.g. terraces. It also means bringing derelict buildings back into use and considering high building where appropriate (Carmona 2009 : 65).

8 Distinctiveness

This is the objective of supporting local distinctiveness. It is also about achieving other sustainable objectives, such as careful stewardship and conservation of the built fabric through good maintenance and management, and answering to human needs. Distinctiveness is

linked to resilience in that it is about valuing the built and natural assets over the long term and considering the surrounding architectural character when designing, enhancing locally distinctive building settings and retaining important buildings and heritage (Carmona 2009 : 66).

9 Biotic support

Biotic support is needed in all design scales, maintaining environmental diversity. On the building level it means providing opportunities for greening buildings and considering buildings as habitats (Carmona 2009 : 66).

10 Self-sufficiency

Self-sufficiency is connected to human needs, but it also encompasses issues of resource management. Design has a potentially important role to play in providing people with the possibility for more self-sufficient lifestyles. This will require stakeholders and local people to have more active roles in developing vision for their locality and its ongoing management (Stewart 2000. Cit. Carmona 2009 : 67). On the building level it means demonstrating a sense of public sector civic responsibility and encouraging private sector civic responsibility (Carmona 2009 : 67).

These ten principles clearly demonstrate the complexity of sustainable design.⁸¹ It includes attention to ecological tendencies, strong place making and strategic goals. The culture of production and the practices currently applied do not necessarily affirm this complexity and the long-term view. Instead, they try to guide it directly from the point of view energy consumption and the time frame and scope of execution. According to Carmona and Magalheas (2007), besides building construction, all actions relating to the management of urban space, the organization of traffic, the renewal and conservation as well as the personalizing of people's own property, are crucial for resilient building. In this respect, all scales and continuous management and adaptation processes can be channeled in a positive manner, thereby enabling a better quality of the built environment. This means taking a long-term view in all investments made, and understanding that they together make cities durable and sustainable (Urban Design Group 1998 : 33).

⁸¹ Writing about urban contexts, Oswald and Bacchini (2002) have presented a similar interpretation with their criteria for urban quality: *identification, diversity, flexibility, degree of self-sufficiency and resource efficiency*. They define flexibility in urban quality as a "system's ability to handle internal and external change in two ways: the system does not change (homeostasis, buffer capacity) [and] the system is renewed or improved (evolution, potential of innovation)" (Oswald and Bacchini 2002 : 50–53).

1.2

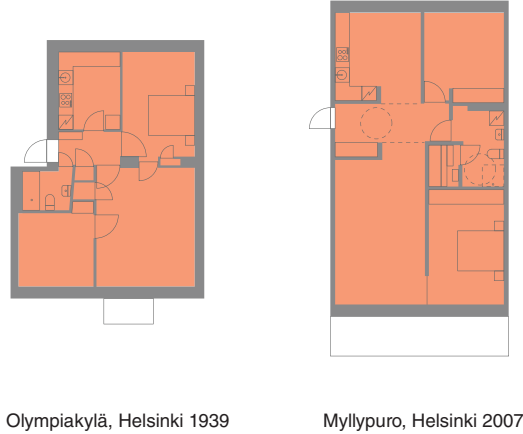
THE FORMATION OF PRESENT DAY CULTURE OF OPERATION

B

THE HERITAGE OF MODERNISM IN HOUSING DESIGN

As mentioned earlier, the roots of housing production in Finland can be traced back to the emergence of modernism, and housing design and production today are largely shaped by the modernist world view. It is the tendencies of the early days of modernism that can still be found as underlying assumptions, reflected in several kinds of path dependencies as part of current housing production. Earlier trajectories and choices also guide today's housing production, particularly those that are anchored in the universal objectives of modernist thinking. I refer to the homogenous character and strong standardization related to the industrial production of housing and to the patronizing attitude in housing design. On the other hand, there are many more dynamic tendencies that operated with the earlier concept of modernism that have become less influential and significant.

Architecture historian Hilde Heynen (1999) sees that the concept of modern is very divided. According to her, modernity can be split into different concepts, the first linked to patronizing and non-patronizing elements, while the second is connected to its programmatic and transient, as well as instantaneous characteristics. Its programmatic features emphasize modernity as a project, one of development and emancipation, and it sees architecture as the rational organization of everyday life. Momentary content while focusing on cultural renewal believes in innovation and fights against attachment to tradition. The desire for innovation and opposition to the pressures of tradition are commonly accepted characteristics of modernity. (Heynen 1999 : 11–14). Some of the characteristics of modernity Heynen identifies still have a very important role in the Finnish housing building sector, while others have been carried to the margins over the decades as a result of general developments in the sector. These are particularly the questioning and renewing tendencies of housing production. Housing plans in general have changed remarkably little in their understanding of how people dwell during the past century. See Fig. 14.



Olympiakylä, Helsinki 1939

Myllypuro, Helsinki 2007

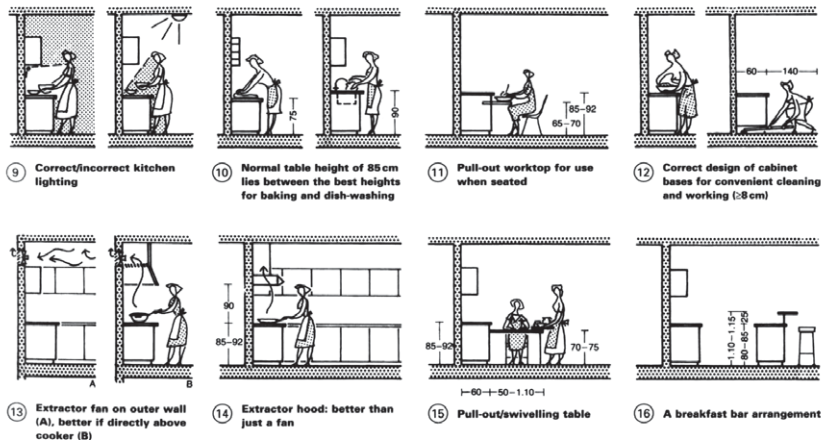
MODERN PROJECT

The birth of modernism by industrialism marked a great discontinuity and upheaval, in which housing design and housing production went through a major change. In different countries this happened to different degrees and at varying rates. Amidst enormous technical progress, and as society changed at a rapid rate in the early 1900s, architecture also looked to society and technological development as new points of reference. The rapid development of trains, cars and large ocean liners questioned the traditional way and style of building construction. The belief in rationality and its omnipotence to solve all the problems of human life increased to unprecedented levels. This belief in technology, typical of the era, is well illustrated by the story of Titanic's captain's indifference to the rescue operation after the ship had collided with an iceberg. The captain considered his ship unsinkable, and relied heavily on technical progress even bypassing the appropriate care of the passengers' lives after the collision. It does not need much imagination to draw parallels on a metaphorical level to the environmental and societal situation we live in today.

In the early 1900s, the strong development of engineering and science also had a great impact on architecture. Many of the leading architects of the era such as Le Corbusier promoted technical development as the source of a new kind of architecture. In his *Towards New Architecture – a new architectural manifesto*⁸² (Le Corbusier 1986), Le Corbusier called for bringing architecture into the industrial time, highlighting functionalism and free form, clean from style like an ocean liner. Along with the new architecture a new world would be build, in which all problems could be solved.

⁸² Original title *Vers une architecture*, first published 1923.

Fig. 14. The development of typical 3-room dwelling showing change merely by the addition of a sauna and extensive balcony.



A strong tendency in modernism was the contrast between tradition and faith on the one hand, and belief in a linear continuous development on the other. The Enlightenment had attached critical common sense to the idea of continuous development. In his book *Space, Time and Architecture: The Growth of a New Tradition*, Sigfried Giedion (1941) canonized the essence of modern architecture. After meeting with Le Corbusier, he championed modernism, speaking in favor of new ideas and settled against the eternal values. Giedion saw modernism as a result of a linear evolution, which culminated in the 1900s with modern architecture, and which he presented as a new tradition (Heynen 1999 : 29). According to Hilde Heynen (1999), for Giedion, modern architecture, however, marked the end of the searching and questioning. The new direction was already clearly mapped out. This thinking can still be spotted in housing design where it relies strongly on a functionalist agenda and standardized solution as the basis for housing design.

MODERNISM AND THE CULTURAL CHANGE IN HOUSING

Modern architecture was also seen, however, as a tool of freedom, emancipation and progress. At the background of its social reform was a fear that revolutionary developments would emerge if housing conditions were not improved. Like Giedion, the Neue Frankfurt School saw that architecture could play an important role in this social reform. Rationality and functionality were pursued as an objective of change away from the bourgeois social order. Existence minimum – the development of the minimum dwelling concept – was seen as a major project. It was better to make smaller homes

Fig.15. Kitchen area instructions according to Taylorism.

for more people than large homes just for a few. Existence minimum also played an important role in Giedion's rhetoric. The industrial rationality of Taylorism, in which for example every movement and function in the kitchen had been thought out in advance – and the entire kitchen designed on this basis – reflected rationality and efficiency as a basis of all design. (Heynen 1999). See Fig. 15.

The apartment was seen as a practical space enabling certain functions to be practised. With functionalism, the apartment as well as the urban structure became divided into different operational functional zones. All human activity was to have its own city district, space or room. The modernist building was freed from the traditional block structure and the buildings became autonomous. According to Heynen, the autonomy of architecture shrank into formal code (Heynen 1999).

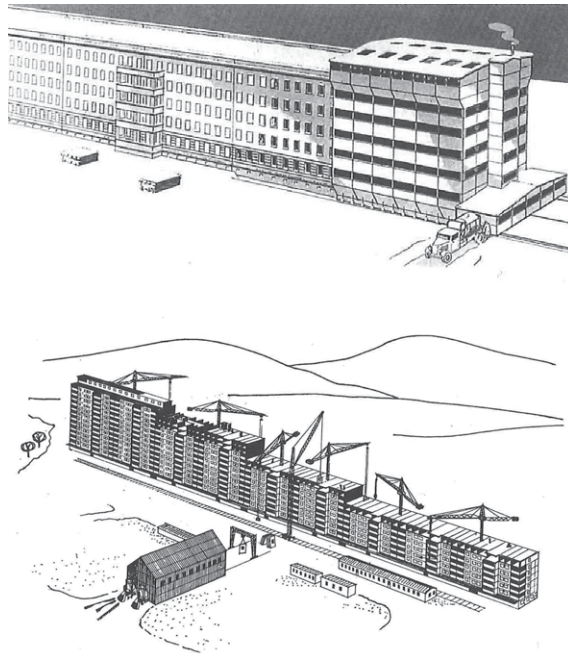
The Neue Frankfurt School saw that, in functionalism, society was rational and homogeneous, based on equal rights and, in general, on similarities in lifestyles. The aim in early modernism was, therefore, based on the agenda of the Neue Frankfurt School, a certain kind of generalizing tendency, and a universal model of housing and architecture (Heynen 1999 : 46). Within the universal model there was also a patronizing attitude towards housing. It defined the right way to live, based on ideas of practicality and rational action in all areas of living. The old bourgeois way of life was to be changed into a new lifestyle that emphasized simplicity. Modernism worked in a homogenizing and abstract manner with systemic rationality in a top-down manner. (Heynen 1999).

THE BIRTH OF A NEW HOUSING PRODUCTION PARADIGM

In Western countries, since the development of Modernism, the tendency was very much the same, although different countries saw slightly varying trajectories of development. For early modernists, prefabricated construction was at the centre of the housing reform. Prefabricated construction methods were designed to produce high-quality construction at an affordable price, for all social classes and conditions of wealth. In the 20th century, hardly any aspect of home life, recreation or cultural activity had escaped the unifying tendency (Bosma et al. 2000 : 16).

As a result of industrialization, people no longer self-produced or built their houses, but searched for homes from the housing market. After the war, housing needs grew quickly because the traditional ways of producing housing were no longer possible due to fact that wages were on the rise. Since then, economic life played an increasing role in the construction business alongside the fact that construction companies grew in size. As early as in the 1940s, architects in the Netherlands saw that there was a high risk that this kind of development would mean that construction would achieve a monopolistic position with all its side effects (Bosma et al. 2000 : 145).

Professional builders and developers largely took over housing production.



The context of housing gradually shifted to the hands of a professional housing production sector. The development of housing was also taken over by the professional construction industry. Thus the social status of housing also changed and the dwelling became largely a commodity. Industrial development led to the standardization of parts in construction and this in turn led to mass production, also thereby decreasing housing typology (Bosma et al. 2000). In most industrialized housing cultures the thinking inherited from Fordism and Taylorism had also shifted into housing production, so that housing construction became to a great extent an assembly line. Standardization, which was created mainly to enable industrial housing construction, also affected housing solutions, and housing solutions largely started to become subordinate to the technical solutions (Bosma et al. 2000, Hankonen 1994).

TOWARDS TOTAL STANDARDIZATION

In the early decades of the 1900s, the thinking was that the more standardized the housing, the larger the communal feeling among people, because all lived in the same way. Housing was then mainly seen as a technical problem, and architectural interventions as something that could change the culture of living in a positive manner. This, however, soon proved to be an illusion (Bosma et al. 2000 : 29). Robert Musil described the faceless people who perform functions: “It’s like a surreal panorama of

Fig 16. Above, Neufert’s housing construction machine and, below, a Swedish housing construction assembly line from the 1960s.

modern life and modern civilization” (Cit. Bosma et al 2000 : 31.) Neufert took the thinking even further into the surreal realms of understanding the production. In the 1940’s, Neufert’s *Baueinführungslehre* had become a best-selling book, in which all human life, from the cradle to the grave, was carefully measured and standardized. The home became merely a machine for living, and he took this thinking into the realms of production as well. Neufert developed housing construction machines reflecting Henry Ford’s automobile assembly lines, in which the material was fed in at one end, and out came the completed building at the other (Bosma et al. 2000 : 31–33). Based on these ideas, similar construction methods were developed and used in mass construction in Finland. The efficiency of building was a guiding force in housing production. See Fig. 16.

The strength of the rationalizing tendency of the era was epitomized in Neufert’s attempt to rationalize the entire production process by creating a new universal dimension, the Oktameter⁸³, which would replace the metric system and be based on the dimensions used by the construction industry (Bosma et al. 2000 : 31).

The Netherlands demonstrates a good example of how industrial construction was promoted immediately after the Second World War to solve the problems of housing shortage. The post-war reconstruction led to a centralized design body, which was created to produce even 500 000 housing units in 10 years (Bosma et al. 2000 : 37). It had to take into consideration professional shortages, construction materials and transportation. The system required radical standardization, in which dwelling typology was very limited, and where the building technology was a priority above the architectural qualities (Bosma et al. 2000 : 33–34). The core idea and target was the idea of a universal building system and its aim was to standardize the housing types (Bosma et al. 2000 : 149). To achieve its objectives the industry proposed that architects could take a more active role in creating universal standardization. Architects could make contracts regarding the dimensioning, which could be then used in design for mass production. Even contemporaries had trouble with these rationalizing tendencies. (Bosma et al. 2000).

As early as 1943, in the *Guidelines for Architecture* published by the Netherlands Kerngroep Woning Architectuur, attention was paid to the neutralizing effect of standardization by not taking into account the socio-cultural meanings of the city structure, and which saw the conservation of architectural diversity important. According to the guidelines, standardization of construction should not consider more than an area of the city and it should not be applied to larger entities such as regions or cities, otherwise “all subtlety would be lost” (Bosma et al. 2000 : 35). This had no impact on the architects’ housing programme in the Netherlands, which was inten-

⁸³ The Oktameter was supposed to be 1.25 m long, which should be a multiple of 12.5 parts (Bosma et al. 2000 : 31).

sively self-critical and omitted all the architectural movements before the war. The idea of architecture as a spatial concept was eliminated and the text concentrated on the particular details of minimum housing demands. The ideology of universalism was very much present. (Bosma et al. 2000 : 36).

In 1973, the problems caused by the homogeneity in housing in the Netherlands, where the problems had already surfaced, became strongly evident in the writings of architects. The wishes and needs of people were seen to be already differentiated, and this development showed a clear demand for diversifying the housing types (Bosma et al. 2000 : 39).

In Finland, in the same period, industrial construction methods were first tuned for mass production conditions and the mass production technology methods developed in Europe were imported. Industrialization became part of Finnish housing relatively late, in the 1960s, when the country was being consciously changed from an agrarian to an industrial society, and where the housing production sector had a strong role to play (Hankonen 1994 : 16). Tradition and traditional building methods had guided Finnish residential construction until the 1950s. Construction sites were isolated master-builder contracts. Contractor's firms appeared after the war in the 1940s and the size of the individual projects grew. In the 1950s, most of the housing was still built on site. The current housing construction model can be traced to the 1960s when industrial housing construction started on a vast scale (Hankonen 1994). Self-reliance and self-empowerment as a way of life changed into the consumption of finished goods and services as part of a monetary economy.

Self-building and co-operative building disappeared, and it was driven by political decisions consciously down to the construction of blocks of flats [...]. (Hankonen 1994 : 131)⁸⁴

Finland was changing from being an underdeveloped country to being a member of the competition for the countries with the highest standards of living. The housing construction sector played a crucial role in this change.

The substantial restructuring, which was even a key aspect of the national economy, was conducted through the modification of the physical environment into a functional environment of production and consumption [...]. (Hankonen 1994 : 16)⁸⁵

The efficiency thinking of Taylorism was also strongly rooted in housing design in Finland. Housing construction was inspired by Henry Ford's automobile assembly line and the construction of residential buildings became largely a housing industry.

⁸⁴ Translation from Finnish by Karin Krokfors.

⁸⁵ Translation from Finnish by Karin Krokfors.

Due to industrialization and urbanization, housing needs and households changed, and new guidance was needed in order to guarantee the minimum requirements for living conditions, which had worsened after people moved to the cities in large numbers (Hankonen 1994). As in the Netherlands, in order to improve the efficacy of production, standardization and regulation were imposed. Many prominent architects argued in favour of standardization and regulation. These matters were seen as the task of an architect ideologically and ethically, as a way towards better housing and well-being. The budding industrial housing was optimistically seen as an opportunity to produce cheap and better housing for more people. This, however, also soon proved to be an illusion in Finland. The residents did not benefit from the rationalizing of the construction. The benefits of industrial building did not reduce dwelling prices, and construction quality suffered (Hankonen 1994). During the stage of intense industrialization, skills in construction in Finland declined as builders became element aggregators. Standards were aligned to standardized production lines in the way Neufert had envisioned.

However, the nature of standardization was also under scrutiny among architects in Finland after the war. Among them, for example, was Alvar Aalto, who had been involved in the creation of the standardization institution of the Finnish Association of Architects. He, however, also warned of the dangers of standardization. Aalto thought that it was a mistake to compare a building to a car, which is a very one-sided type of product. The car industry's goal was to reduce the number of standard types of cars in the world. According to him, the opposite should be applied to architectural production. The human relationship with the car, he said, is temporary, whereas people have longer term and more fixed relationships with buildings. It was Aalto's view that standardization with a centralizing tendency, which suited the automotive industry, was alien to architecture. He stressed that architectural problems could not be solved with technique. He saw that standardization should not be used as inflexible finished buildings or complexes, but deeper in its internal limbs, structural elements and the elements of which can be formed flexibly into an unlimited number of different entities, like nature creates its types. He called this type of standardization architectural standardization. According to him, buildings had to be different, but they had to be so in an organic, non-arbitrary manner. In architecture, it should always be ensured that the organic connection between building and site and nature is resolved. (Schildt 1997 : 153–154). Industrial housing in Finland, however, increased along with a strong standardization objective. After the 1960s, industrial standardization began to guide the regulations (Hankonen 1994). Standardization also kept the housing sizes small as the minimum requirements became normal practice in the housing production conditions. The factors that could not be standardized slowly vanished. Housing design took place in the compression of standards and they became a new tradition of housing in Finland (Juntto 1990 : 297).

THE CRITIQUE OF MODERNISM AND INDUSTRIAL PRODUCTION

In the 1960s, a number of scientific studies appeared that criticized consumer society phenomena, scale, and in particular the alienation caused by the modern built environment. In the book *The Lonely Crowd* (1950), the sociologist David Riesman had in particular criticized the manipulation of the masses by doctrines learned from marketing and behavioural sciences (Bosma et al. 2000 : 68). Similarly, the Frankfurt School's Marxist perspectives were critical of modernism (Heynen 1999). Alongside the growing political consciousness, the criticism of post-war urban planning and industrial construction conventions increased, especially against the doctrines of CIAM (Congrès International d'Architecture Moderne).⁸⁶

The avant-garde Situationist movement, which operated mainly in the 1950s and 1960s, directed its severe criticism at the universal modernist tendencies and the power over individuals and their lack of influence. The Situationists particularly attacked Le Corbusier's visions of the city. For example, to the Situationists, the Habitation Marseilles seemed to be a mockery of a city that had lost the freedom of its people. The writing of one of the most prominent Situationists, Giles Ivans, in *Formulary for new urbanism* summed up the hope for human freedom and potential for creativity.

The architecture of tomorrow will thus be a means of modifying present conceptions of time and space. The architectural complex will be modifiable. Its aspects will change partially or totally in accordance with the will of its inhabitants. (Cit. McDonough 2009 : 36, published first in French in *Formulary for new urbanism*, 1958)

From today's perspective, Ivan's text could be considered visionary of a future epitomized in the present day. However, many architects, including Le Corbusier, had actually been working for objectives of architectural flexibility so that the flexibility of space could serve and benefit the design and building process but also the inhabitant's ability to affect the space of the dwelling.⁸⁷

What the Situationists seemed to shun, however, was the fetishistic attitude towards technology, advocated by architects, with Le Corbusier at their head (McDonough 2009). The ideas he presented in *plan libre*, in which the flexible frame gave freedom for designing plans that would guarantee great flexibility for spatial configurations, went largely unnoticed by the Situationists. This could be due to the fact that the *plan libre* concentrated on the design, and the architect was still seen as the determiner of the functions of the space, not as the promoter of freedom of living for the inhabitants. Alternatively, its potential for also benefitting inhabitants through flexibility was not totally comprehended.

⁸⁶ It operated between 1928–1959.

⁸⁷ Le Corbusier's domino house and Algiers project included these tendencies.

Le Corbusier's rather one-dimensional view of man and the universal needs of people, as well as his understanding of the dwelling as a machine for living in, understandably provoked angry reactions not only in the Situationists. The Structuralist Team X in the 1950s and 1960s, the avantgardist Yona Friedman among others (McDonough 2009 : 28), as well as the typomorphologists (Vernez Moudon 1989) were all critical of Corbusier's image of the human being in modern architecture and of the destruction of the humane meanings of architecture. A reaction against the domination of the car and over-sized projects, as well as calls for the returning of city life, mixed urban structure and human scale in street life, were promoted by Jane Jacobs in *The death and life of great American cities* published in 1961, by Kevin Lynch in *The image of the city* published in 1960 and Christopher Alexander in *A city is not a tree* published in 1965. They drew attention to people's mental understanding of the city and criticized the one-sided understanding of the city executed by urban planning at that time. Jane Jacobs was one of the most prominent antagonists of the one-sided city development, in which the functions were separated. Her point was that cities had lost their true character, which is based on the interaction of people and street life (Jacobs 1961). The architecture critic Manfredo Tafuri (1987) in turn saw that the city was rooted in hostility based on the invention of Siedlung model. According to him, architects were opting for a fragmented and static organization of the big city. On the other hand, modernity had freed people from the grip of tradition, family, and society and it had increased well-being (Heynen 1999). Yet at the same time man had lost the certainty and even the meaning of life. According to Tafuri (1987), this code in the spread of modernism became a code without meaning, even emotionally poor. According to him, [since the beginning of modernism] with the failure of social reform after an over-optimistic belief in industry, architects drew back into elitist positions.

THE ROLE OF THE ARCHITECT

Modernism and the housing production system that followed had also had an effect on the role of the architect. According to architecture critic Martin Pawley (1998), as a consequence the architect's role as a tool for a cultural mission has been played out. Earlier, attention was drawn to the architect, who bore a larger responsibility for design. Now, this responsibility is on the developers and the builders. Pawley sees this because the post-Cold War global economy went through a great change, with the building market becoming dominated by the large construction companies. According to him, it is difficult for the architect to maintain a role in this spider's web of stakeholders. Among the increasing number of experts, the architects are readily shifted to the margins. Their employers are the developers and construction companies and partly also engineering firms. The profession itself, of which the objectives are long-term sustainable architecture and which has generally been expected to take responsibil-

ity for visioning the future, has found itself operating largely in a hermetic context (Pawley 1998). Pawley sees that the design acrobatics of the facades in apartment design, the only design initiative left for architects, conceal standardization, regulations and quality standards, efficiency, cost claims of price/square metre apartment, and all of this has diminished the profession's role in design itself. The profession's position is very vulnerable and architects are only able to be active with a broader role in smaller projects (Pawley 1998, Bosma et al. 2000).

Even though Pawley draws quite a negative view of the diminishment of the architect's responsibility for design, it is true that architects as well as housing policy programmes have not had as important a role as the producers in defining the context of housing. Residents and architects have also been distanced from each other. Between them there is usually a client, such as developer, whose objectives do not necessarily fall in the contextual development of housing. When housing markets operate so that dwellings are sold without the need to develop, there is no real need for a developing tendency, unless it can be done to promote good business. This has put the architect in a difficult position: the design task is not always led by objectives pertaining to the housing itself, but rather by the secondary objectives of the contracting authority.

THE DEVELOPMENT OF REGULATION AND CONTROL IN THE FINNISH CONTEXT

Today, planning guides all building. The level of building control has also increased in recent decades in Finland (Interview 4). The nature of planning and building control in Finland has also had a notable impact on the emergence of new solutions – or rather – the lack of them. Urban planning has, throughout the post-war decades, been practised as physical planning and design. The local plan or zoning defines the objectives that are relevant to the area of implementation. In Finland, planning has three levels; regional plan, general/master plan and local detail plan.⁸⁸ The Finnish planning regulations define the physical architectural parameters in a rather fixed manner, and the role of the stakeholders and the relationship of planning and execution differ radically, for example, from the Anglo-Saxon models, even though the hierarchical levels in planning are similar. Although there is some development towards the Anglo-American differentiation in Finland, urban planning and urban design are almost synonymous because of Finnish planning, which is more detailed, far-reaching and visually regulating than its counterparts in the British context (Lehtovuori 2005 : 25). The local plan draws the essence of the building design already, even though the implementation might not happen until much later in the future. This tendency is largely due to the role of the planner and the quality problems created by the rational industrial construction

88 Translations of planning phases according to Viitanen and Huuhtanen (2007).

geared to extreme efficiency in the 1970s. The planners sought to compensate for the lack of quality with precise planning regulations including qualitative definition and codes for building. It is mainly for this reason that town planning, which in Finland is only undertaken by cities, also can guide building design rather strictly.

The town plans in Finland have been seen as a representation of the final product, which the developers and construction companies are seen as responsible for realizing. This is partly due to the fact that the planner has no official role in the actual execution phase in the Finnish process and the responsibility of the guidance is shifted at this stage to building control. The previous actor, such as a planner, whose role is minimal in execution, have sought to bind the next phase of implementation through meticulous regulations aiming to ensure quality. This has led to practices in which the planner also very often binds the implementation phase as well as the possibilities to implement new housing and building types or housing concepts at the implementation phase. The way regulations are derived by planners effects the building typology in the execution phase. This makes the planners largely responsible for the housing design solutions used, sometimes even to very detailed level (Krokfors 2010 : 227). The management of the complexity of housing design, however, is seldom part of the expertise of the planner. For a building designer in the execution phase it is therefore very difficult to create new house types and new approaches to housing design within the framework of a strict town plan. The developers or other clients rarely want to proceed by applying exemptions, unless the expected economic benefits are substantially greater than the cost of a prolonged project. The developer and construction company operate on the basis of their organizations' inner logic. For them it is far less risky and economically most profitable to proceed according to the customary practice in an effort to avoid high risks (Ball 1999; Clarke & Wall 1996).

As a result, a very hierarchical system has been created in Finland, where the different phases as well as actors are separated from each other. Instead of a holistic approach, the operations are segmented and scattered within the system (Väyrynen 2010). It is characteristic of Finnish processes that the different steps also represent a range of value and quality choices, and the various actors are not always in substantial dialogue with each other during the process (Interview 2, Väyrynen 2010).

In Finland the local detail plan includes the regulations and assisting guidelines for construction⁸⁹, which have been created to define the formal and material appearance of the local detail plan, and have been very precise in their character and do not usually include strategic tendencies. In her doctoral thesis, however, the architect Väyrynen (2010) has surveyed the Finnish planning system as a whole, and highlighted how on more general level in the hierarchical planning system, the ideas and information that the plan is based on are not always transmitted to another level, because the actors

89 *Rakennustapaohjeet* in Finnish.

and objectives change during the process. Because of this, the actors do not commit themselves to the objectives and decisions made in previous steps by different actors (Väyrynen 2010 : 92). According to Väyrynen, in land use planning there are clearly recognizable discontinuities, which prevent the formation of new innovations from town planning to emerge in the implementation phase. In particular, the vision created in the local detail plan is rarely transmitted to the implementation. The existence of assisting guidelines for the construction does not necessarily guarantee their use in implementation, because assisting guidelines for the construction do not have the same legal value as the town plan in Finland (Väyrynen 2010 : 92–93). Hence, even though the guidelines are drawn up in a meticulous manner they do not necessarily guarantee that the visions promoted in planning will materialize.

The problems of a sectorized and hierarchical system are reflected in the quality of the built environment. The process in its current form is also resource intensive. This was recognized by most of the interviewees as stakeholders dealing with the processes of the built environment in Finland (Interview 2). The interviewees pointed out the fragmented implementation process, in which quality control is also spread to several parties (Interview 2).⁹⁰ The built environment is reviewed in the process building by building. The whole does not gain the attention it deserves at any phase, except in the local detail plan, which, however, ties the solutions of the execution phase very early on in the process. Because of this, vision and commitment to the venture is lacking in the producers (Interview 2, 3 and 4).

The other problem in planning is the assumption that everything is based on the predictability of the production of the built environment, because the local plan is seen to set concrete objectives for the execution, and the plan does not genuinely consider what comes after the planning phase. The plan largely contains only one possible world, which is also assumed to remain the same. In Finland, because the local detail planning phase and the execution phase can also have an extensive period between them, the objectives and interpretations of the needs might have changed significantly, and the new actors and stakeholders developing the site might be totally different from those premeditated in planning. In that way planning becomes wishful thinking rather than preparation for change and development.

In Finland, it is considered that the main task of building control is to ensure that the town plan is realized according to the regulations as well as controlling the technical quality of the building. Building control is also expected to be the guardian of the architectural and aesthetic quality in the later phase of the process when the building permission documents are delivered to the building control office.

90 The interviewees saw in general that the actors are usually distanced from each other, acting at different times, and important dialogue about the objectives does not happen.

Although making exemptions to a town plan are laborious and resource-intensive in the implementation phase, minor deviations/exemptions are made very often. This is because the town plans are not able to anticipate potential needs for change (Staffans et al. 2015). For example, in Helsinki in 2008, about 90% of all building permits had some form of slight deviation (Interview 2).⁹¹ This does not just eat into resources for design control but also eats into the resources in design and can even prevent the best solutions being achieved because the developers are often reluctant to proceed with deviations because they are time consuming bureaucratic processes with uncertain outcomes, and time means money for builders that have investments tied to the projects (Interview 2 and 3). The resources, which are geared more to fulfilling the technicalities of the plan rather than the objective of best possible design, demand resources also from the architects, who are responsible for justifying the minor and major deviations and producing the material for it. Even if the developer, along with the architect, might see significant benefits in building and urban design in making radical changes in the master plan, the road of the bureaucratic and slow process is not easily taken (Interview 3).

In a way, it can be said that building design is done twice: first in the planning phase and then again in the implementation phase, which is resource intensive. This means that the accuracy of the building design in the planning phase is actually often wasted and can even delimit the best possible solutions to emerge. Due to resource constraints some cities in Finland, such as Tampere and Vantaa, have used new forms of planning processes similar to those in the Anglo-Saxon countries, such as partnership planning processes and project based planning which makes planning and execution even more intertwined with each other. Helsinki is also starting to apply partnership planning processes (Interview 3). The problem in these new processes may arise in the quality control of implementation, which is still based on a hierarchical process of planning and execution, unless all the stakeholders are actively involved with each other throughout the process (Interview 3).

Nevertheless, the application of partnership models does not self-evidently lead to more diverse solutions in housing production. In the Anglo-Saxon system of land use planning, because of the different nature of the relationship between the planning phase and the production phase, the planning and the implementation are not so separate from each other. The typology of the housing is defined largely in the implementation phase. However, in the UK the rather uniform housing stock is largely due to developers' and construction companies' design guidance, as well as to their own internal organizational risk management and short-term objectives (Ball 1999,

91 In Finnish planning and building control there are various exemptions to detail plans: major and minor. Building control can allocate minor deviations within the limits of the detail plan. Major ones demand a more extensive and bureaucratic procedure that involves changes in the detail plan and political decision-making in local councils.

Interview 1). Also, in the UK the educational background of the planners does not necessarily require an urban or building design education. Planners have thus been leaning on the building contractors and construction companies as regards project evaluation (Interview 1, Bramley, Bartlett & Lambert 1995). This planning system does not promote new design forms either (Bramley et al. 1995 : 38). The interesting fact is, however, that the subsidized social housing on the offer in the UK has a greater variety in housing typology than the standard free-market housing. Social housing production has been used in design experiments for many years (Ball 1999 : 13; Interview 1). This has, according to Ball, confirmed the more conservative design approach in the owner-occupied housing sector. Diverse housing development within the social housing sector has been possible due to public financial support. At the end of the 2000s, however, the form of social housing subsidizing has changed and risk management has also become the subject of support (Interview 1). In Finland, because of the strong regulation, social housing has also had the tendency to be as homogeneous as the market housing and actually has been lacking innovation similar manner as the market housing (Krokfors 2016b). This is largely indicative of the fact that the guidance and the production system, including both public and private sectors, also has a major role to play in the uniform housing production in Finland.

RESIDENTS' OPPORTUNITY TO INFLUENCE THEIR HOUSING

Residents' influence on the planning phase, which the Finnish Land Use and Building Act of 1999 strongly emphasized, became virtually a dead letter in land use planning (Väyrynen 2010). Väyrynen portrays aptly how the planning practice complies with the letter but not the spirit of the law (Väyrynen 2010). Residents are consulted over finished plans and have the possibility to a large extent to either agree or to make a complaint. This may delay the planning or implementation, but does not usually prevent it unless the planning tramples on someone's legal rights. It cannot be said, therefore, that the inhabitants can influence the built environment to any great extent. Another question to ask, then, is who the people are that can affect the planning of an area or region. Consultation with the people of the area within the planning procedure includes the people that are already living in the area or its vicinity. In the current system, the identities of future residents are rarely known before the planning takes place except in the case of condensing city areas, so there should also be a possibility to have influence after the area has already been built. Planning and design paradigms in their present form do not really consider the inhabitants influence over the area after construction, and there are no ways that the built environment and building stock could premeditate change. Planning, however, is rarely able to take into account and enable adaptive solutions which could contribute to the flexible change of use and as a consequence increase the livability of the city districts (URBA flexibility working group).

The problems in embryonic non-developing systems in planning, production and use can lead to a situation where it does not correspond to people's needs nor of the wider definitions of a good life, beyond the simple fulfilling of basic needs. Dissatisfaction with housing solutions can be already seen, for example, in the attention being paid to co-housing and co-housing development. Co-housing has started to arouse a new kind of public interest, recently interpreted in various forms and processes which even the modern middle class – with middle-class values – has begun to find attractive. Co-housing would seem to be very much in the making from a bottom-up basis, but it is in fact being increasingly helped along by the authorities in a top-down fashion, at least in the European context. Cities, in Germany and Scandinavia and elsewhere, are increasingly interested in co-housing developments, as it is considered to be a means to develop interesting and new housing solutions that can at the same time challenge the existing mode of housing production (Krokkfors 2012). For example, in Berlin this kind of development has already been manifested (Ring 2013).⁹²

In Finland, the City of Helsinki has also become weary of the stagnated housing situation that is jeopardizing a balanced urban development and has generously distributed plots for co-housing developments. Co-housing development was even promoted in the Finnish government platform of 2011. It remains to be seen whether co-housing can advance from the margins into something which could challenge the prevailing ways of distributing housing in Finland and create new social practices within cities in general. However, the rigid processes, legislation, financing and fixated practice culture in production in Finland has made it, difficult for co-housing to become more prevalent, partly because the system is largely based on the professional producer-oriented production process. But for co-housing to emerge from the margins into viable development and, at least in Finland, it will require updating of the processes as well as the legislation.⁹³

On the other hand, residents' needs are dynamic and time-bound, and do not always support sustainable solutions. Even though research has shown that sustainable solutions and lifestyles in co-housing developments play a bigger role than in developer-led projects (Marckmann, Gram-Hanssen & Haunstrup – Christensen 2012 : 414–416), if the next generation shy away from the housing solutions of the previous

92 The current system relies largely on professional players and their objectives. Co-housing developments, however, in some cases have been able to form a "bypass lane" that has challenged existing hierarchies of housing production in which a top-down definition of housing context has been the rule. This kind of new development has already surfaced in Berlin due to its extensive co-housing implementation (Ring 2013).

93 However, some deviations in the legislation were verified in 2015 and it will be seen how they direct the co-housing initiatives. The new legislation particularly concentrates on consumer protection issues linked to developments and their financing in which the developer and consumer roles mix. The inhabitant groups hope that the change in legislation will also open the finance markets to co-housing developments. So far, the inhabitant groups have been financing their co-housing developments on individual bases as individual loans.

generation, the building stock produced by the co-housing developments will not turn out in the end to be resilient and sustainable. The inhabitants' possibilities to influence and create their own contexts of living, however, should be created in such a way that it also serves future inhabitants, which can be attained with adaptable and flexible solutions. Such solutions should then be easy to apply and perceive and become an integral part of the spatial configuration premeditated in design. Major changes are always experienced as difficult and cost binding. The residents should be able to influence the space as well as to some extent the city functions that spring from their own actions after the construction, so the processes and the design paradigms should be able to give that possibility.

1.3 HUMAN RESOURCES – BYPASSING THE CREATIVE POTENTIAL C

THE INTERACTION BETWEEN MATERIAL AND IMMATERIAL INNOVATIONS

Both material and immaterial innovations are essential for the development of housing and building stock in general. If we interpret material innovations as those that concern the realms of producing physical space and immaterial innovations as those that either advance the production of space or benefit the self-conditional use of space, the innovations tend to present themselves in very different light than they do in everyday housing production. The immaterial resources can be interpreted as resources of design that help to accommodate social innovations or resources springing as ideas from people inhabiting the space. Through the use of space, people can then create new immaterial as well as material resources like new kinds of services or even business ventures. Because the understanding of innovation concerning the built environment is so production – and product – oriented it tends to rule out the latter understanding of immaterial resource creation, in spite of it being closely tied to the spatial realms of buildings. Material and immaterial innovation are extremely interwoven with each other. However, in existing housing production people are generally seen as objects of design instead of being seen as creative parties in their own context of housing and living.

Innovations concerning the built environment can be roughly divided into three main categories: technological, spatial and social, all of which are interlinked, particularly regarding the objectives of resilient space. Technological innovation has been much in focus so far in the product-oriented building culture. The understanding of housing inherent in the processes that guide the design in various forms in Finland is

contextually limited and production-oriented, as is the case in most countries learning to deal first with sustainable building. As Carmona (2009) points out, the demands on sustainable building are extremely complex and manifold in nature. The socially emphasized objectives for sustainability, which Carmona names as Diversity and Choice, Human needs, Resilience, Distinctiveness and Self-sufficiency, represent as much as half of the principles for sustainable design in his list, but as spatial innovations they do not yet stand out. The mechanistic and rational as well as mass production driven housing is still a significant form of control regarding the social context of settlement patterns in Finland, because the construction is structurally and technologically driven and concentrates largely on production and its context. The development projects led by professional developers are usually technology oriented, while the focus in more resident-led developments is usually social (Pirinen 2014). The technical solutions are developed, apart from the social and spatial contexts, in their own right.

The current housing production system is based on an understanding of innovation that is no longer fully relevant to this time. There is only a very narrow understanding of who it is that generates innovation, in which phase of the project it occurs, and most and all, what the innovation consists of. This limited view can also be harmful for the industry in the long run. A good example of this can be seen in another industrial sector, which is however a very competitive and wide market sector. The downfall of Nokia, the Finnish information technology giant, taught a lesson in how crucial a role social innovation plays in creating technological innovation (Heikkinen 2010). Nokia forgot to ask itself why they were doing what they were doing and what the mindset of the people was. To use systems thinking jargon, the organization was brought to a threshold at which the whole company structure needed to be changed. The ability of Nokia's competitor, Apple, to understand the social context of their products and to invest in user experience, ended up in them reinventing their products. The technology could be seen only serving the larger objectives and not being an end in itself. In a similar way, in order to promote resiliency, the development of housing could spring from social and spatial innovations, and the development of technology should be a subordinate, albeit important part of the whole context of the development. It is a question of changing viewpoint. The relationship to inhabitants' needs and the viewpoint of living has, due to the fixated character of the production culture, taken a subordinated position because buildings are seen as products first. If you merely imagine how short a period the execution phase is in the whole life span of a building, it seems almost strange how its significance is so emphasized.

The difficulty of getting new housing solutions to emerge is considerably affected by the bypassing of creative potential within the processes because of the limited horizons. The emergence of social innovations is closely linked to the way processes allow them to emerge and be incorporated as everyday practice. Inhabitants could also act as the producers of social innovations, which, within the context of architecture,

may bring new spatial interpretations to both inside the buildings and on the interface of the city structure, as well as during the life span of the buildings. However, this is not made easy in the existing processes in Finland.

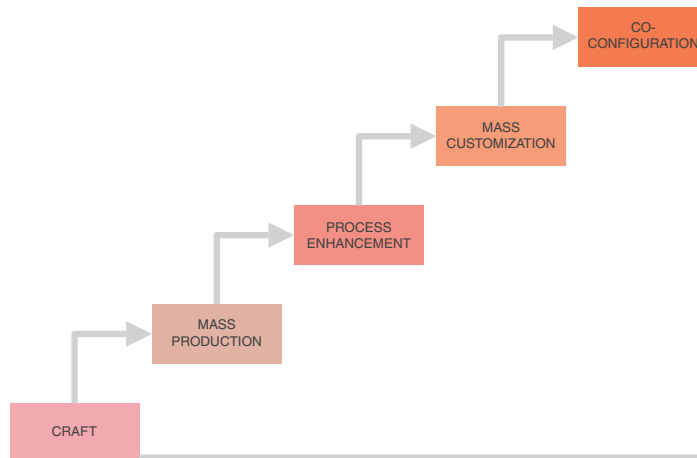
FOR WHOM ARE WE BUILDING?

In professionally-led housing production the architect's client is usually the developer or the contractor, and the future inhabitants are rarely known beforehand. Only in smaller projects and in co-housing projects is the architect employed by the future residents and therefore known to the architect before starting the design phase. Because the housing production process follows its own consumer product logic, everyday housing is produced to fulfill average demands that might please the majority. Because of the structure of the closed housing markets, people are merely seen as consumers of housing goods, buying what is available on the market; this reinforces the repetitive market logic even more. There is a case for asking who we are truly building for. The question is significant from the point of view of resilient development and fulfilling peoples' aspirations, but also considering the national economy, which always comes in as the last resort to deal with the problems and mistakes made in producing the built environment.

In recent decades, there have been approaches that try to expand customer choice, such as making use of mass customization. The choice in the solutions of mass customization in Finland has, however, been very cosmetic, usually merely concerning the generic choices of materials, such as choosing between "grey and beige ceramic tiles" for the dwelling. Because of the limited range of products, mass customization has had very universal and mediocre tendencies as well, not really differing from the choices already available in everyday housing production. Mass customizing has become another way of billing the customer. There are, however, some approaches that also tackle the spatial choices in the sphere of the dwelling, but the results have not yet extensively improved people's life situations and nor taken into consideration the varying resources and needs people have during their lives.

Victor and Boynton (1998) have pointed out the new role that consumers are starting to adopt in the actual production of goods and services. Through studying organizations and their competitive potential they have noticed that there are distinctive developmental stages in production culture in general, which all perceive value in a different way. Victor and Boynton identified five stages in the history of industrial production, namely: craft, mass production, process enhancement, mass customization and co-configuration, which all generate and require a certain type of knowledge and learning. See Fig. 17.

They suggest that organizations should look more closely than earlier at what the customers actually want and need.



You look what your customers really want, not what you think they want or what you wish they'd want. You figure out your capabilities for getting work done and what distinctive capabilities you will need. (Victor and Boynton 1998 : xiii)

Even though Victor and Boynton perceive things from the point of view of the organization, their departure point is the customer. The co-configuration stage, which according to them we have already entered, demonstrates a strategic understanding of developing added values for products, the customer becoming a real partner with the producer (Victor and Boynton 1998 : 199).

And that partnership can also endure as long as the product or service platform can continue to grow and adapt to the customer's needs. (Victor and Boynton 1998 : 199)

Victor and Boynton point out that mass producers often use product strategy that includes “planned obsolescence”. This means intentionally designing products to become outdated. As a good example of this, they use the automotive industry (Victor and Boynton 1998 : 199). In Victor and Boynton’s thinking, however, there are no final products, rather the product becomes a process and even a service.

Instead, the boundaries between learning and work, customer and product, customer and company disappear. What replaces those boundaries are tightly coupled linkages, which feature constantly shared information, ideas, and experiences around the product or service

Fig. 17. The stages of industrial production, according to Victor and Boynton.

experience. [...] But for those products and services where customer intelligence is desirable and possible, the firms that can move the most rapidly along the right path may be able to secure an extraordinary robust competitive advantage. (Victor and Boynton 1998 : 207)

Mäntysalo and Puustinen (2008) have recognized similar developmental stages and tendencies in Finnish housing production, also identifying the emerging fifth stage, co-configuration, as a potential basis for new concepts and social innovation in housing developments. According to them, the co-configuration seems to require collaboration between networks of different partners. Housing production regarding co-configuration is remarkably more ambitious than is the case in everyday housing production. In that too, the influence that people exert also tackles the spatial criteria of the buildings. The co-configuration in Finland can be seen manifested in the various forms of co-housing developments. The bigger challenge lies, however, in everyday housing production and how the professional housing production sector could be developed towards more co-configurationally-led approaches without a rise in costs but creating viable choices within the housing production sector.

However, as stated before, to be spatially and socially sustainable, the focus in production also has to be over-generational. In all production, the best way to accomplish the fulfillment of individual needs in flux in space is the adaptability and flexibility of spatial solutions. It is also considered to be a source of sustainable design as has frequently been pointed out in research.⁹⁴

ENABLING SOCIAL INNOVATION

At the same time as the living culture is opening up, the concrete physical realms of built environment and how we experience it is still narrow and impoverished. The built environment and its production still possess the totalitarian systemic characteristics of a very constrained building culture, in which renewal and socio-spatial innovations have been marginalized. The demand for sustainability has imposed a new challenge and an opportunity for the production of the built environment to develop. This needs to be approached with a long-term perspective and from several viewpoints, simultaneously emphasizing the human initiative as its basis. The forms of influence in housing solutions and urban space needs to be understood and redefined in order to be developed.

So far, the two main approaches for self-conditional living conditions have enabled the inhabitants' influence either through *participatory design*, which can be seen to emerge in the 1960s, or through flexibility of the dwelling. Participatory design is understood as direct co-operation and involvement with the architect over design.

94 Op.cit. 83.

The other as promoting flexibility of space, has been part of the design agenda since the dawn of modernism, but as a concrete concept promoting self-conditionality it is probably most widely evident in the open building that emerged in Finland in the 1980s.

The idea behind this socio-spatial approach has been to serve the people's attachment to place and their possibility to affect their own immediate environment. However, the solutions of participatory design have been rather conventional in their housing patterns (Horelli-Kukkonen 1993), so they cannot be generally called innovative and flexible in the spatial respect, except regarding the method of development and its social objectives. Today, co-housing developments are the closest type when it comes to participatory design that emphasizes communal aspects and social innovations linked to them. Within co-housing developments, new practices have emerged that also tackle the services provided to the co-housing group but that are to some cases meant for other people to use as well.

Today's urban housing blocks are challenging and complex design tasks, and they have to fulfill the many regulations, aspirations and demands imposed on the building. The participatory design approach, in which the inhabitants also act as designers, is easier to accomplish in individual and smaller projects because the conditions and context as well as the constraints to the design are less demanding. Compared to the 1970s and 1980s, the design of buildings in an urban context requires the ability to comprehensively control many technical, structural as well as ecological aspects at the same time within the whole architectural approach, starting from the spatial configuration of the building and the context of the city. This cannot be accomplished without the cooperation of several professionals and the expertise of the architect to manage the architecture and the whole process as the principal designer. Particularly regarding big apartment-block projects in a dense city structure, at the overall building level it is rather easy to define the general programme for the building with the inhabitants as well as concerning the use of common spaces, but it is a more complex task to accommodate every household's wishes, given the systemic connection of all the dwellings within the building and how they affect each other. Changes in one dwelling usually means changes in other dwellings as well as the overall technical arrangements unless there is a certain strategic flexible solution already in design phase that make these changes easier. The influence of the inhabitants should then find other ways for participatory tendencies to be implemented. Flexible solutions can help to accommodate different spatial aspirations either in the production phase or in the use of the building. In this kind of adaptive context, the influence over the design solution could take into consideration people's own self-generated way of living over generationally.

However, participatory design per se does not necessarily lead to self-organizational space and promote the needs of future generations using the space. The idea of flexible and self-organizing space in general departs from the participatory

design approach. Its scope is very wide and it is more closely linked to the notion that the space is designed in a manner that makes it possible to use, live and be part of the space, according to one's aspirations. Regarding spatial innovations, the flexible features of space have usually been the way of promoting participatory tendencies in building. The self-organizational complex character of apartment building requires a professional approach and skill in design, in order to design the building in such a way that it will comprise this strategic potential. Nevertheless, it does not exclude participatory tendencies in design with inhabitant groups, based on their views and aspirations. On the contrary, this kind of interaction and feedback with inhabitants is essential in defining the self-organizing character of the building and space so that it truly springs from the people and their demands. The self-organizing quality of the building is then developed by the architect in such a way that it takes into account the aspiration of people as well as guaranteeing the adaptability of use for future generations as well as other crucial aspects of design.

It is possible to simultaneously accomplish the more short-term participatory tendencies and people's aspirations today as well as long-term adaptability. Strategic or tactical flexibility and adaptability can also benefit the many aspirations of the inhabitants during the design process. Nevertheless, flexible solutions make the designing more challenging, because the focus is equally on the long-term view beyond the existing objectives in housing design. It thus concerns strategic ways of creating adaptability for future inhabitants within the same configuration. A skilled architect who is tuned into the needs of inhabitants can accomplish both objectives but it demands new attitudes and approach in design. To fulfill these new objectives the various approaches have to be part of the design agenda and the policy objective from the very beginning.

ENABLING INNOVATIONS IN THE BUILDING SECTOR

Any kind of innovation, be it social or technical, demand change in the existing building culture. The prevailing building culture also to great extent defines the parameters for innovation. Even when people are building for themselves and do not need to make a profit from the building, they still always need professional builders, who cannot operate and develop the production without some profit margin. This means it is very important to understand what kind of building culture has to be developed to sustain innovation in building in its all manifestations. Such reform requires systemic innovation, versatility in approaches and potentiality for adaptable solutions, as well as risk tolerance for failed experiments. This reform is, however, very difficult to achieve, because of the stagnated ways and repetitive modes of action that still are at the core of the building production practised in Finland today. In delivering a sustainable environment, the impetus for change plays a crucial part (Carmona 2009 : 73). The market

of building production does not provide this change as part of its natural character (Ball 1999), because market logic has developed in a manner that it is not conducive to innovation. Ball claims there is a need for public support for new innovation. He has drawn attention to the fact that the formation of innovation also requires some form of public-sector involvement and policy-making processes. He refers to the UK, where the housing markets have evolved in such a way that they actually militate against innovation, but a similar tendency has also been perceived in Finland.⁹⁵ Ball (1999 : 20–21) proposes four measures, which could deal with this kind of “market failure”, as he calls it:

- 1 Reducing the volatility of new housing markets
- 2 Lowering the focus of land development profits
- 3 Subsidizing innovations in housing productions
- 4 Reforming building regulations to make them more innovation friendly

If we apply Ball’s arguments about the UK housing markets to Finland, which has similar uniforming tendencies, it would also mean changes in policies here, in order to force the building culture onto a developing path.

As the first measure to implement change, Ball sees that reducing volatility of the housing markets could be accomplished through policies in which the subsidies would be phased in a manner that operate with a counter-cyclical bias (Ball 1999 : 21). The second measure Ball emphasizes is the lowering of land development profits. A good example of this has been the impetus for the diverse co-housing developments that have boomed in Berlin, which has distributed resources into projects and also benefitted social innovations in housing (Ring 2013). The allocation of lots in Berlin has been, for its part, the cause of experimentally-oriented co-housing development because the sites have been quite small infill sites which the city has not tried to profit from, and as such have been very suitable for co-housing developments (Ring 2013 : 34). According to Ball, planning authorities could also promote competition through planning permission procedures. In the Finnish system, as in the Nordic countries generally, there is no planning permission system, mainly because the planning is conducted to great extent by the city. In Finland, particularly in cities that own a lot of land, the land allocation practices have, however, been considered to be a tool for promoting competition and innovation. For example, in Helsinki, in recent years, lot allocation practices have progressed. The allocation of larger areas has been changed to the allocation of smaller sites, in the hope of promoting competition in construction when more production companies have been able to compete over the

95 A very modest proportion of net sales in the construction industry is used in research and development (Lättilä 2011).

sites.⁹⁶ As a third point, Ball also emphasizes that targeted subsidies in innovation and housing production is needed (Ball 1999 : 21). Another way of promoting innovation in the housing market in Helsinki has been the new *Kebittyvä kerrostalo* project (Advancing Apartment Building's Programme), which is also tied to the lot allocation practices in Helsinki. It does not include subsidies as such to projects, but the projects can be linked to developmental projects that are financed by the Finnish Funding Agency for Innovation, TEKES. Site assignment in Helsinki is optional and linked to the content of innovation proposed but the results are not monitored by an impartial body. Ball's fourth measure is based on his view that practised guidance can also hinder innovation. He sees that the regulations and norms need reforming so that they become more innovation friendly. This also means, according to Ball, better training and an informational focus on the potential of innovation (Ball 1999 : 21).

THE ROLE OF THE ARCHITECT IN INNOVATIONS

The important role of the architect in technical and spatial innovations is easily perceived, even though technological innovations in particular require the cooperation of several actors with various types of expertise. In spatial innovations, the role of the architect is self-evident even though the impetus for it may come from another source or party involved. The role of the architect can vary greatly in the creation of social innovation. The architect may be the source of the innovation, a co-creator in the design process, or primarily an accommodator and creator of the spatial conditions required by the social innovation created by another party.

The linear and hierarchical design process that is intrinsic in the everyday housing production process today in Finland, does not actively promote social innovation, because the processes are harnessed not to do so. Manoeuvring by the architect is also usually too restricted to enable it. The high hopes for co-housing to develop innovation can be dashed by limited resources, if they are intensively resource bound. However, some social innovation does not need any "extra" financial resources (albeit human resources), but instead calls for changing attitudes and developing new ways of applying measures and conducting new procedures (Korpela 2014). Then the architect's role is not necessarily at the source of the social innovation, but rather to apply creative ways to put it into practice, involving, for example, flexible solutions that make it easier to

96 In Helsinki, in the past, new construction sites were released and sold in large areal entities, which meant only the major developers and construction companies were able to realize them. This has had an impact on competition and caused the rise of dwelling prices, because the small and medium-sized construction companies have been played out of the competition and real competition has not been accomplished. This tendency is now being corrected by the city authorities in Helsinki by distributing building sites one by one and creating long-term co-operation models for small and medium-sized construction companies, which are more geared towards innovative production, to improve their conditions and prospects. (Interview 3).

accommodate new ideas. Social innovations, rather than being just “eureka” moments, are often processes, which involve vision and creative implementation interactively with people (Johnson 2010). It also means a new role for the architect that could represent a much more active stand in the design process.

The architect’s role also as an instigator of projects is becoming stronger than ever before. It is particularly architect-led smaller co-housing projects that have become more common in Finland (including co-housing developments led by architects, e.g., by Jaakob Solla 2007, Markus Ahlman & Viivi Snellman 2009 and Karin Krokfors 2011). The redefinition of the architect’s role is leading to new interpretations in which the architect is a more proactive player from the point of view of co-creation and as an impetus for change. A good example of this is the work that architects have been responsible for in developing countries. For example, the architects Hollmén, Reuter and Sandman Architects have been involved in projects in Africa, such as the Women’s Centre, built in Rufisque, Senegal, in 2001, which included active co-operation with the locals and even found the means and resources for the new initiatives from within the community. See Fig. 18.

Fig. 18. Women’s Centre in Rufisque, Senegal, designed by Hollmén, Reuter and Sandman Architects, 2001.



1.4

ON THE CONDITIONS OF THE EXISTING
DESIGN CULTURE

D

DESIGNING CONTEXT

As discussed so far, the systemic connections and path dependencies of the processes creating the built environment come to the fore when considering how the design of the built environment could best promote sustainable solutions. To gain a full understanding of the culture of how the built environment is produced and how it could be developed requires knowing the whole system and studying the systemic connections between its parts and the practices used by stakeholders involved in the production. Such an understanding will open up the well-established practices within the system, including those under the apparent “tip of the iceberg”, and will thus make it easier to analyze and develop the designing context.

Because design and particularly building design is so intertwined with many other issues and scales that play an important part in the execution of the built environment, design is by no means an autonomic operation within the process, but it is very much affected by the whole process and the line of action inherent in it. It is guided throughout the process by public and private stakeholders and as well as being affected by many more forces active within the processes than usually meets the eye. By this I refer to those systemic relationships that the systems tend to possess.

I have divided the effecting bodies into the *immediate* and *indirect effects* and forces that have an impact on design. The *immediate guidance* system is comprised of the public authorities and regulations that act as the regulators of the system, and the guidance of the private sector stakeholders, such as developers and other private clients that provide the resources for building. The *indirect* guidance is apparent as systemic connections that the different parties involved impose on the design as part of the overall production culture and its common practices. This kind of indirect power is exercised, for example, by the building industry along with other parties involved in the process like building control. A general understanding of the landscape of the systemic design context is mapped as the external impacts on design, which is portrayed in the diagram in Fig. 19.

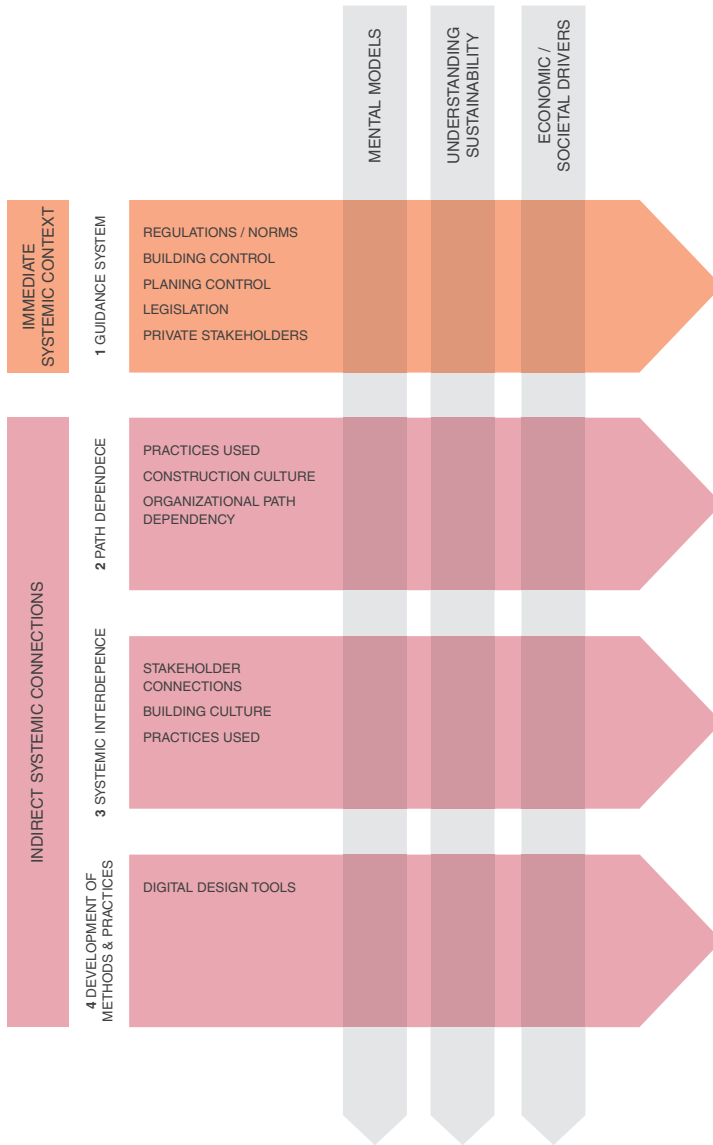


Fig. 19. Diagram of the systemic conditions of the design context.

IMMEDIATE SYSTEMIC CONTEXT

A study of the processes shows that they do not necessarily support the understanding and objectives of resilient design presented earlier. The old processes, which were comprised of very linear and hierarchical processes, cannot necessarily deal with the complexity of problems and variety of stakeholders involved in the systems. Also, the processes and practices tend to evolve and apply practices usually based on earlier practices that were generally short term in their view and constructed for contexts that differ considerably from present day needs.

The EU Working Group concluded in its report *Urban Design for Sustainability 2004* that obstacles in processes are widespread, and the biggest problems in the guiding processes are usually the lack of political will, difficulties with planning and administration systems, laws and regulations, appropriate training, the lack of knowledge-sharing systems, the traditional sector-based approach in planning and execution, the complex character of a holistic sustainable vision and the reluctance of the city planners to accept it (Kau.edu.sa 2004 : 41). This general line of thought was to some extent also shared by the interviewees in Finland. Several of them also pointed out that the stakeholders often experience impotence when attempting to have an effect in the sector-based and hierarchical building culture. According to the interviewees, in the making of massive decisions, people⁹⁷ also feel that they cannot have any effect. This contributes to the fact that they become passive and indifferent in relation to the built environment (Interview 2). There is also a tendency nowadays that people are more prone to make complaints to the developers, which could be linked to the high price of living or the inability to affect the solutions beforehand (Interview 4). In general, the interviewees thought that the system is to a great extent based on assumptions of what is experienced as possible in the strict process (Interview 2). One of the interviewees pointed out that the quality of public space was not considered to reach the same level as it did in other countries with the same standard of living. With the same resources, less was being achieved. (Interview 2). Several of the interviewees argued the fact that the outcome of the built environment is directed towards the least possible bad, relying on minimum criteria, and thus representing a mediocre built environment, instead of working towards the best possible environment within the limits of the resources available (Interview 2). They also felt that resources are being wasted in the current processes (Interview 2 and 3). Thus the process reinforces the mediocre character of the built environment and also promotes diminishing resources.

Most of the interviewed stakeholders in Finland considered the complicated and hierarchical process to be anonymous and arbitrary (Interview 2). They noted that nobody takes responsibility for the whole, and the process then becomes anonymous,

97 Some of the interviewees were referring to all people, not only stakeholders with a position in the processes

which is also then reflected in the anonymous built environment. Some of the interviewees longed for a “principal designer”⁹⁸ for the built environment, who would control the whole in a holistic manner (Interview 2 and 3). On the other hand, the view was expressed that the actual principal designer’s role should be strengthened in the building design and that could affect the urban design as well (Interview 3). In general, the interviewees felt that in a sectorized system, which only follows the execution of parts, building by building, and because the issues cannot be influenced in the due course of time, the holistic approach can never really be reached (Interview 2 and 3).

GUIDANCE

The production of the built environment is mainly guided in the forms of public and private guidance. The public guidance is known to most as legislation, but beside that there also exist various norms set by the Building Information Group as well as regulations set by the planning authorities and the guidance conducted by Building Control. Private stakeholder guidance is, however, much less known to the general public. The present system that produces our built environment consists of an ongoing discourse – sometimes interpreted as a tug-of-war – between public and private interests.

Public design guidance

Public design guidance is responsible for ensuring the public interests and overall development of a sustainable and high quality environment. It should also take into consideration the equal treatment of all stakeholders and the protection of the needs of the general public. It is for this reason the legislation and norms were developed in the first place. Planning guidance on the other hand has been developed to secure the balanced development of cities and communities. The building control guidance has the effect, particularly at the building level, of ensuring technically safe and lasting solutions and a healthy environment. The procedures conducted throughout the decades have however locked them into certain operational models. The organization’s development and the tasks it performs are also created through path dependencies as an evolutionary process.

Private design guidance

The private stakeholders in housing design guide the design mainly at the building or block level with the aim of meeting the expectations of the business. They are

⁹⁸ In Finland the “*pääsuunnittelija*”, which can be translated as the principal designer, is responsible of the overall design process and leads the design team including a wide range of experts involved in projects. However, because in Finland the architect’s profession is not officially authorized, the main designer’s responsibility and potential to affect the process is more limited than in countries where the architect’s profession is authorized and the principal designer takes more responsibility for other stakeholders’ work such as that of the engineers.

mostly developers and construction companies responsible for the execution of the built environment. Public social sector developers can also be included here, such as ATT (Helsinki Housing Production Department),⁹⁹ which can be understood as practising a similar form of design guidance as private stakeholders, even though it represents a grey area of practice considering its public/private context. In the actual design guidance, their objectives are to some extent very similar, particularly regarding the efficiency and optimization demands of design, which are linked to the economic feasibility of project developments. However, these efficiency demands also reduce the flexibility of dwellings and direct the typology of dwellings into a very uniform trajectory.

The developer's design guidance is usually based on the organization's own strategic objectives. In social subsidized housing led by cities the strategic objectives are also, additionally, linked to the city's more strategic objectives that the city tries to promote, as in the case of ATT (Interview 4). The developers, both in market housing and social housing, guide the housing design solutions with the help of efficiency objectives defined for dwellings (Interview 4, Krokfors 2016b). This is partly affected by the regulations that promote the construction of common areas in building. There are stated objectives for the common spaces in planning as well as building permission guidance that have to be linked to housing and which for its part affects the cost of saleable square metres of dwellings. The developers compensate for this tendency by minimizing the other common areas that they can affect in the buildings. Because of the cost management, the guidance is generally based on certain indicators. These objectives particularly concern the number of dwellings connected to a stairwell landing per floor, which seems to be a very Finnish characteristic. The indicators are either defined by the number of dwellings or as square metres per stairwell on one floor. In ATT, for example, this is over 250 m² of useful gross floor area per stairwell on one floor, and in market housing the demand can be even more, usually between 4–8 dwellings per stairwell on one floor, depending on the project status (Interview 4). The size of the stairwell and the semipublic passage areas in housing has been minimized in housing design, so that there is as little as possible extra cost per saleable square metres. This guidance is also due to the fact that in the planning regulations the building rights are connected to square metres. In Helsinki in recent decades there have been attempts to curb this tendency by allowing the building rights concerning the stairwells to be exceeded.¹⁰⁰ This has been based on the idea of creating more spacious and higher quality stairwells. However good the intensions are, plus the fact that it can also promote the production of circulation space that in turn affects the multi-usability, from the point of view of housing development it is still more a question of tinkering with

99 ATT is owned by the City of Helsinki.

100 Only 15–20 m² of the stairwells are calculated as part of the building rights given as gross floor area. Everything over that does not reduce the building rights.

the problem rather than effectively solving it. This is because the rest of the guidance affecting efficiency has such strong presumptions as to how a dwelling and its spatial configurations are defined. This will be tackled more closely later on.

Towards learning systems

As dwelled upon before, the city planning and the implementation of housing are considered as very different phases lacking comprehensive interlinkage with each other, except in the local detail plan that guides the housing design in the implementation phase. In Finland, although there are new interventions under experimentation that try to incorporate more interaction between actors across hierarchical phases, the composing of the local detail plan does not normally involve the parties responsible for the execution, so the designer that works for the developer or contractor is also not yet involved.

Because of the sectored character of the Finnish process, the objectives of both public and private actors tend to follow their own premises, and these are reflected in the processes. For example, the interviewees saw that the various public offices, such as the planning and building permission offices, interpret the regulations in different ways based on their own starting points [particularly considering the metropolitan area]. (Interview 2).¹⁰¹ Also, both the public and private sector can have their own premises, which do not aim necessarily towards the same objectives but are based on the organizations' internal guidelines and objectives. An example of this was how the designing of public parks and green areas in Helsinki is not simultaneously tied to the general planning of the nearby buildings, in which design solutions generally emerge that tackle the public space as well (Interview 2). Because the parks and green areas do not usually need separate building permission,¹⁰² they are not viewed or valued by any other body than the specific sector of the local authority that is responsible for the guidance and execution of parks and other similar public spaces (Interview 2). This means that the local actor also responsible for the execution phase is acting without any responsibility or need to defend their own decisions and actions to others. The objectives in execution phase might arise from other issues than have been premeditated in the planning. Also, because each party involved governs the process in their turn almost equally, the visions change in the course of the process almost unidentifiably (Väyrynen 2010).

According to the interviewees, the lack of openness and dialogue were one of the most significant problems in the production of the built environment that also affects

¹⁰¹ The same problem was also recognized in the final report *Asuntotuotantoprosessin sujuvoittamistyöryhmä* (*The task force report on streamlining the housing production process*) by the City of Helsinki dated December 31st 2013 (Hel.fi 2013).

¹⁰² They are not eligible to apply for building permission unless they include structures or building that demand building permission.

the design. On the other hand, expertise and comprehensive vision was sought for in the decision-making process, so that it would not be so haphazard. A stakeholder like CABE in the UK, whose bold, encouraging and advisory role was seen, by several of the interviewees, as significant in the formation of a high-quality built environment.¹⁰³ (Interview 2). In general, it was felt that the Finnish system lacks a facilitator of discourse, who could bring the actors together face to face in real-time. However, two of the interviewees did point out that in some smaller cities like Oulu the kinds of practice have been developed that involve the stakeholders in open discussion of issues during the whole process of planning and building control (Interview 2). In general, the interviewees believed that creating a conversational culture comprising the various professionals and professions nowadays involved in the processes could help to define and commit the stakeholders to common goals. This is especially needed for solving the manifold and complex problems that the built environment embraces. (Interview 2). At the present, the written statement culture, which does not necessarily include much face-to-face communication, emphasizes the sectorized character of action, was seen to affect the quality of the environment, at least in the metropolitan area.¹⁰⁴ It was felt that the balanced development of the metropolitan area may be threatened by the sectorized character of planning and control. Several of the interviewees also claimed that Finnish culture, which does not encourage open discussion and argumentation, is one of the reasons for this kind of development (Interview 2). One of the interviewees described the written statement culture as an absurd Orwellian form of communication, in which the actors do not necessarily encounter each other at all (Interview 2). It then bypasses the characteristics of learning organizations in the wider context of the society and as part of the system. The stagnation to sectorized “dugouts” does not increase mutual trust and understanding. The coordination of the cooperation between different communities was also noted by interviewees as being a wider problem in the Finnish context, particularly in cases where the projects are located near the municipal boundary.¹⁰⁵ The resources could be better targeted with the help of cross-communal supervising body (Interview 2).

Affecting timely right

According to some of the interviewees, the timing of the planning solutions guiding the building design takes place at an irrelevant phase within the process. They

¹⁰³ The interview was conducted before CABE merged with the Design Council in 2011 (Designcouncil.org.uk 2017).

¹⁰⁴ The statements themselves were not criticized, because up auditing and memos are required for the decisions and their record. The object of criticism was targeted at the forms of communication that do not involve face to face meeting.

¹⁰⁵ The interviewees saw that the control inside and on the fringes of the communities breaks down to a guilt patchwork (as one interviewee described it), in which the split in views does not always lead to appropriate action (Interview 2).

felt that the parameters for building solutions are tied too early on in the planning phase, which makes the process complicated in the execution process (Interviews 2, 3 and 4). Planning phases have been characterized in Finland as being responsible for producing the housing typology as well as the innovations. Therefore, because of the Finnish system, the production of contextual housing innovations, based on a particular building typology, has been very limited and almost non-existent in every day housing production. These include adaptive solutions, which are very difficult to get executed within the boundaries of the existing process (URBA flexibility working group). The main message of the conclusions of the experts meeting in the URBA working group that concentrated on flexible solutions in housing was that if the local detail plan does not allow or necessitate flexibility in building design it is extremely difficult to accomplish it in the implementation process, or the plan directs the contexts of flexible solutions too much. This is particularly the case if the flexibility is an organic feature of the housing type and typology. Also, the character of the present process, which assumes that all the innovations and all visions are created in the local detail plan phase, bypasses to a great extent the possible innovations in the building phase, which can be social or typological innovations tied to the execution phase. It is particularly the social innovations that might not necessarily be created by professional producers, but instead, for example, by inhabitant groups. These actors are also not usually involved yet when the planning decisions are made in the current process. The interlinking of planning and execution in a different manner than earlier would be a step in this direction and would also involve other actors besides professional developers (Interview 2). This kind of trajectory demands, however, the development of guidance and building control and their relationship over the whole process. The interviewees also emphasized the threat of possible development, which could also lead to a deterioration in quality, if the guidance and control cannot affect the quality in the strategically important phases of process, if the planning phase becomes too flexible (Interview 2 and 3).

Considering life after implementation

Because the Finnish planning system, as well as building design, is very much based on the assumptions of what the future will be, it is taken almost for granted that the city structure drawn in the local plans does not change considerably in time. In the long timespans for the bigger picture, the problem, however, is that the local plans are not comprised of the parameters that could allow for change in the long run. The idea is also incorporated in this kind of thinking that the inhabitants are not a defining party in the city development. The problem lies in the background assumptions used in the realization of the built environment. These assumptions are largely based on predictions of future needs and preconceived ideas about housing solutions as good living. It sees the local plan as the final vision. The processes do not always recognize

a culture in which inhabitants get involved in city development (Staffans 2004). Nor does the system generally acknowledge the inhabitants as creative and developing parties, who could affect the space they inhabit and use it for creating new social contexts. They could even use the space as a source of risk management of their own investment, for example, by renting part of it away, as mentioned earlier. The financial risk management in the prevailing system is monopolized to great extent by professional producers and their business objectives because it is they in the end that define and decide the context of the housing design and its flexibility.

INDIRECT SYSTEMIC CONNECTIONS

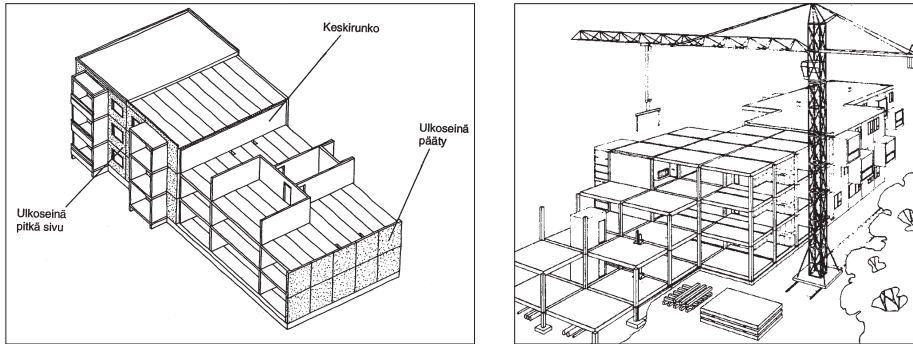
PATH DEPENDENCY

An understanding of path dependencies is particularly important in perceiving the indirect systemic connections. Path dependency is usually taken to mean the development of system in which earlier decisions affects the later possibilities of choice. The choices may be either enabling or delimiting. A good example of path dependency in building culture is the industrial period of housing production in which the building culture and its earlier trajectories have forcefully affected the design solutions. In Finland, the majority of apartment buildings today are built using prefabricated elements. The element construction has been produced from the construction perspective and is linked to the concept of mobility by the fast, easily movable and flexible elements in the construction of buildings. Although architects were the early visionaries of prefabrication, they were quite quickly pushed more or less to the margins in the development on prefabricated element construction. While architects have struggled to find architectural expression in element construction, the development of element construction has followed its own tracks (Davies 2005 : 9).¹⁰⁶

Possible the best example of path dependency in Finland regarding the whole building culture is the choice of the element construction method that permeated the whole building culture in the 1960s. The architects were very much involved in developing the PLS system (pillar slab construction) (Hankonen 1994 : 212), which was based on Le Corbusier's Domino skeleton (1914) idea. Domino made the flexible design of space and elevations possible, but it was displaced in Finland by the clumsier BES system¹⁰⁷ (load bearing wall elements) (Kahri & Pyykönen 1984 : 149). Different perspectives and approaches to housing construction are clearly visible in the two

¹⁰⁶ Examining the history of industrial element construction within the entire context of architecture and building, we see that it is remarkably short, not even a hundred years old. Colin Davies sees that its short history is the reason why architects are not yet in tune with element construction. Mass production fits badly in the creation of timeless values in architecture, which are so paramount to architectural design in general (Davies 2005 : 9).

¹⁰⁷ *Tutkimus avoimen elementtijärjestelmän kehittämiseksi* in Finnish.



element construction models, of which the latter became the prevalent model and rule in Finland. BES element construction was developed largely by construction companies and the construction industry on the basis of their own interests.¹⁰⁸ Industry and construction companies were more interested in an inexpensive and quick installation in precast concrete construction. The profits were significantly higher because of the easy assembly with the BES method of construction and the less demand on skills on the construction site (Hankonen 1994 : 206). Element-based construction methods reduced the time on construction site and it was also possible to build with less skill. BES, however, is very inflexible for future amendment, because the system is executed by defining the perimeters of dwellings usually by load bearing elements, which are impossible to edit later without fundamentally addressing the structures and the load bearing capacity of the building. In the 1990s the BES construction method was further developed, as a result of ongoing critique, to allow more variation in elevation design, but the development was rather modest and did not really advance the flexibility (Neuvonen 2015). See Fig. 20.

Nowadays, buildings based on the BES system are more frequently demolished because they do not allow spatial changes easily, as in the Kortepohja example presented earlier. The forms of construction are essential for gaining adaptability and to the development of housing solutions in general.

While the producers' objective was to speed up the construction and make it more profitable, the architects' objectives were more a matter of how element construction could serve design diversity. The viewpoints of the architects were largely focused on

¹⁰⁸ This point of view was shared by Kristian Gullichsen, who also took part early on in developing the BES construction method. Interviewed by architect Aino Niskanen, October 27th 2000 (Niskanen 2000), The Museum of Finnish Architecture.

Fig. 20a. Example of BES construction.

Fig. 20b. Example of PLA construction.

the housing design solutions whereas the producers' viewpoint was on long series of element production, which meant easy constructions based on the standardization of solutions. The current Finnish element construction is still largely based on the solutions of the early years of the element technique in the emergence of the industrialized housing production era, in which sandwich elements and hollow-core slabs have been the general way of building housing in Finland (Neuvonen 2015). For facades, the construction on site has been partly applied to the outer shells, for example, as brick surfaces or new innovative element construction. This is due to the demands of the local authorities to achieve a more aesthetic quality in the finished facades compared with sandwich elements.¹⁰⁹ This has given the architects some more freedom in the elevation design of buildings.

Advancing a new and innovative idea, however, requires considerable effort and a change in the preconceived ideas before it can be recognized and become part of common practice. A good example of this is portrayed by the interviewer (Interview 4) when describing the development in Finland concerning fibre concrete balconies. Fibre concrete had originally been developed for strong and slender concrete structures. However, the balcony structures developed in Finland to test the potential of the new material became as thick as before and the balcony slab only ended up being lighter in weight (Interview 4). The old paradigm of dimensioning balconies directed the development so strictly that the potential new way of making more slender balconies was not even considered and the whole point of the progressive idea was lost.

Today element construction in Finland can be roughly divided into two main approaches; first, as space frame element construction in which the structure of the building is assembled out of the various parts, and second, as a re-emerging modular space element system, in which there is not always a space frame, but the building is comprised of different modules. The modular construction, in particular, has been actively developed lately in Finland (Kotilainen 2013). Most construction does not purely represent either of these two approaches, and the construction can actually contain both simultaneously. The extreme form of modular construction is the modular space element, which contains the whole dwelling and in fact is the building itself. The most commonly used form of modular construction is the use of prefabricated toilets and bathroom elements. Compared to the early element construction of buildings there has been an increase in constructing on site. However, in housing design, where there is often a lot of repetition, the objective is to construct as much as possible by element construction, which is also usually considered to be less expensive. Another reason for the increase in modular construction is that it offers the possibility to construct in factory conditions, thereby avoiding difficult conditions on construction sites (Kotilainen 2013).

¹⁰⁹ E.g., the City of Helsinki encourages this kind of development in planning initiatives.

Nevertheless, in spite of these relatively minor developments, the renaissance of modular element construction largely follows the same modernist visions of prefabricated element construction, which focus on the production phase. It does not usually consider the whole life span of use. In all element construction the challenge lies in design solutions and how well they contribute to flexible and adaptive solutions during a building's life span. Therefore, conclusions cannot be drawn as to whether construction on site is preferable to prefabricated element construction as a technical performance. It is important to specify what the problems are to be solved and what the objectives are: are they long – or short-term objectives, do they benefit construction or use, or are they just inherited ways of thinking based on earlier choices and beliefs in building culture. The differences lie in the instrumental design solutions. In other words, how do they contribute to the development of housing design and people's possibility to affect the housing solutions during the life span of the whole building? To be able to "break" the path dependencies is, however, very demanding and calls for a rethinking of the processes as well as policy agenda.

SYSTEMIC INTERDEPENDENCE

Stakeholders

As regards indirect systemic connections, the execution of a building usually involves several parties and modes of operation in the overall building culture. A good example of systemic interdependence is the close connection between builders, the building industry and building control. Construction companies try to rationalize and replicate the processes, so that building would be a smooth and profitable business. That is why, for example, they acquire the building materials through contract suppliers who give a reduction on the products because they can sell them then in large quantities. This means in the end that the materials used are in reality often defined by the contractor.¹¹⁰ The supplier chain and its maintenance are very important for the contractors. It is also important for the contractor to stick to the products they know and a way of building that is already known to them. This is a particularly important factor if the workforce is not skilled enough to adjust easily to new materials and methods.

The building industry also forcefully lobbies its products to parties involved in production. It is possible that new and better products have difficulty entering the markets and may be bypassed by a cheaper product from the contract supplier. This practice does not always promote competition and the advancement of products.

¹¹⁰ In contract negotiations before the construction some of the materials presented in the working documents can be changed to a similar product proposed by the contractor and approved by the client. Usually those products that are not supplied by contract suppliers are highly priced, which means that the contractor can change the product into a similar one distributed by the contract supplier (URBA flexibility working group).

This procedure can also monopolize the production markets, which means that finding new ways of applying building materials is challenging in a small country like Finland with a limited construction industry. The designers' as well as the developers' prospects of affecting the products and components used can be diminished in practice by the pricing of the products, which makes it difficult for new, high quality products and solutions to enter the markets. In this way, the systemic connections act as regulators of the competition in the product markets.

For its part, building control can sometimes also follow the same trajectory. Because building overall is based on standardization and also largely based on accepted building practices, building control can delimit the range of products used. For the introduction of new construction materials, building control can force the builder to deliver extra statements or research on the product if the product has not been used in Finland before, even though it might already have CE certification. This can be a long and expensive process (Interview 4). The officials in building control want to promote safe and well-known solutions and in this way they are reluctant to allow the use of new, more unknown material. This can, however, easily eliminate the use of novel materials, because of the extra investment and time involved in the extra research and bureaucracy. Thus, the system can easily return to square one and no progress is made in widening the product selection nor in the advancement of new construction methods.

Building culture

The methods used in building and the skills needed in construction also have an effect on design, particularly if they are uniform and permeate the whole building culture. Prefabrication has eliminated laborious solutions and thus eliminated some of the skills needed on construction sites. It has been possible to manage with less professional skill now that builders have become assemblers (Bosma et al 2000 : 19). Clarke & Wall (1996) argue that the house building technology applied is particularly connected to the skills of the labour force.¹¹¹ The level of construction skills relates to the likelihood of applying different modes of construction and so directly affects the architectural solutions. Those countries that have a culture of skills advancement, whether on site or in element construction, tend to show greater diversity in housing solutions as well.

In those countries which have benefited from a culture of building on site as well as enhancing building skills by the active development of tools and methods, it has also been possible to produce high quality housing at reasonable prices (Clarke & Wall 1996). Therefore, the diversity of construction methods, which is clearly linked to skills

¹¹¹ In comparison with the UK, they particularly studied Germany and the Netherlands where the housing construction technology is better and the use of skilled labour is higher.

in construction, does not necessarily lead to accumulating construction costs in the long run.¹¹² Because the construction methods as such are less standardized, almost all construction has become “experimental building” in skills-advancing building cultures. For example, in Graz, Austria, there has historically been ambitious cooperation between architects and industry, for instance in the glass, steel and aluminium industries (Blundell Jones 1998 : 21). The development of construction skills is also connected to the ability to apply different methods in residential construction and thus also create alternatives from the spatial perspective.

However, building on site per se does not necessarily lead to a better quality of construction. In the UK, element construction has also been promoted because it was seen to enhance the quality of construction (Interview 1). On-site construction has not necessarily guaranteed the development of skills in housing production. In Britain, housing production is to some extent built on site partly because the UK never took the turn towards rationalized element construction due to the tragic collapse, in 1968, of Ronan Point, an element construction apartment block in East London. Building on site is thus still part of housing production in the UK. However, as Ball argues, market logic has delimited the tendency for contextual development in housing production, and this has not been skills enhancing either (Ball 1999, Clarke & Wall 1996).

Skills enhancement is connected to many things, but its influence on the overall production process is significant. The whole process should contain a strong developmental tendency, in which every actor’s role is important in relation to the design diversity. There is a need for innovation, the progression of development processes, a demand for an ambitious will to develop the construction industry and also diversity in ways of construction. It is needed also on the path to reasonably priced housing. Neither prefabrication nor building on site should be the overwhelming and mutually exclusive method of construction. The problem lies in the pervasive standard method of construction, which limits the developmental tendency in other methods. If prefabrication could be developed, through genuine competition, from bulk construction, it could be more skills enhancing, and prefabrication would also develop more easily to offer emerging new housing solutions and a wider understanding of sustainability. Construction in wood, that has lately been promoted in Finland, has created new initiatives in building construction that could also challenge the existing building methods, even though the advancement of wooden construction has been very modest in Finland compared, for example, with Sweden, (Laine 2009).

The current technology already enables very complex and diverse element construction, in which the logic of long series no longer applies so strongly. The new developments in 3D printing will most likely also develop the element construction

¹¹² This was one of the conclusions of the FIAT research project (Rakli.fi 2016), which studied the reasons for the difference in building construction costs between Finland and Austria.

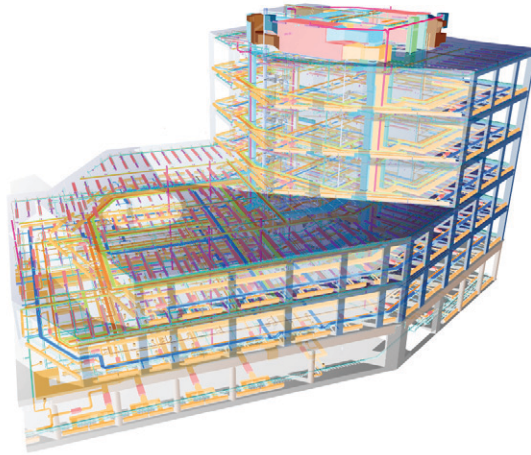
in a more ambitious direction. However, the Finnish building industry has been very slow to move in new directions not least because of prejudices and lack of skills, so there is a risk that the more advanced element construction will be largely developed elsewhere.¹¹³ When bulk production becomes marginalized, the development of technology and risk taking in the building industry becomes a necessity.

The experience in Finland has also shown how big a role the overall organization of the construction phase plays. The division of projects into several subcontracts and subcontracting chains under one principal constructor responsible for the whole project has also caused side-effects that have affected the quality of building. In recent decades it has had an impact on both construction quality and the rising costs of building. The ability to handle various sub-contracting chains requires leadership, organizational skills as well as an ambitious building culture and full cooperation with all involved in the construction.¹¹⁴ It has been easy to simply raise housing prices, because the housing will always sell within the boundaries of a closed market operating system. The development of building process and production culture is therefore not always seen as the lifeblood of operations, and this has had a huge impact on the development of housing design and its diversity – as well as the price of building construction. It has not been crucial to invest in construction processes and building culture in general as it has been in more skills enhancing and competitive markets.

Nevertheless, even though there are some developmentally-g geared builders, in general the focus on development for construction companies has been very different from what the demand for social sustainability would aim at. For builders, the emphasis has been on producing housing with methods that help the construction process, whereas in society the emphasis in general is on producing diversity in housing solutions and on sustainable solutions that withstand time. For cities, diversity in housing and high quality housing is also considered as important driver for overall development of societies. However, because the development has been emblematic in Finland, where anything unconventional is considered experimental and the formation of new solutions has often been excluded in the bidding processes, the building culture has stayed on a non-developmental path (URBA flexibility working group). The builders' risk management has decreased the developers' desires for experimental building unless the development has been enforced in one way or another. A comprehensive auditing system of developmental projects has not yet been successfully introduced.

¹¹³ An example of this is the start of fibre concrete façade element construction in Finland. The prizewinner in concrete façade construction in 2013 was social housing in Lontoonkatu 9, Helsinki, designed by the architects Kirsi Korhonen and Mika Penttinen. The façade elements were in the end developed and produced by the Austrian company Rieder GmbH and the elements were transported from Austria to Finland.

¹¹⁴ This state of affairs was also emphasized in the final report *Asuntotuotantoprosessin sujuvoittamistyöryhmä* (*The task force report on streamlining the housing production process*) by the City of Helsinki, December 31st 2013 (Hel.fi 2013).



Very often the experimental projects have remained as one-off experiments without developing the products and construction methods as a viable business (URBA flexibility working group). The motives for experimental construction have often been founded in instrumental benefits, such as gaining a site or other support for the construction. The results have often been rather modest because there have been no sanctions for compromising the objectives of an experimental project (URBA flexibility working group). Nowadays, however, Helsinki at least is more aware of the results shown in previous developments when allocating new sites for developers and constructors.¹¹⁵

DEVELOPMENT OF NEW DIGITAL DESIGN TOOLS

The cooperation and coordination of all the fields involved in the design, architecture and engineering, are very important factors for improving quality in the implementation and technical innovations in projects. Currently, design culture is experiencing a major shift brought about by new methods and practices in building design. Building information modeling, BIM, is becoming a part of everyday building and it has an effect on construction as well. Digital modeling has been part of design practice for already approximately two decades, but BIM has developed even further as a bridge between all the design fields and production. BIM represents a three-dimensional virtual model in which the whole building can be meticulously modeled, so that all the structures

¹¹⁵ The creation of the new development programme, “*Kebittyvä kerrostalo*” (Advancing Apartment Buildings Programme), tries to deal with the problem, although there is no official auditing executed after the construction. However, an auditing method has to be specified by the applicant in applications for the status of *Kebittyvä kerrostalo* project.

Fig. 21. Image of a BIM model.

and technical systems contained in the building are perceived and reconciled together in a manner that can benefit the construction phase as well. See Fig. 21.

The model contains exact information about the spaces, components and materials, including specific characteristics linked to them. With the use of BIM modelling very precise cost estimates can be drawn and it can help the fluency of the construction as well as the construction site logistics. The model can also be used as actual production drawings for the prefabricated elements.

The benefits of BIM modelling are readily perceptible. All the various technical systems are studied in relation to each other and inconsistencies can be easily noticed very early on. The BIM model serves the developer and the contractor very well, reducing mistakes in the construction phase and helping to schedule and organize the construction, which was referred to earlier in this thesis as a problem in construction. The benefits are apparent, but there are also effects on the design context. The drawing of the model and the way it is connected to the design process assume that design is very linear process. In practice, the way the model is used, things are sewn up quite precisely during the very early phase. Because of the timetable and the resources invested in design, the actors involved do not necessarily want to willingly change the model. This is due to the fact that with such a precise model the changes are more laborious than with a more traditional design process in which the solutions are more ambiguous until a later phase of the process. In housing design, because the dwelling units are generally quite small and each dwelling has effects outside its own realm, the changes tend to have cumulative effects. Small changes in one space can have wider effects on other spaces, particularly due to the configuration of technical systems. Finding the best possible solution requires a creative process in which the architect operates on very different scales and systems at the same time and has an overall view of all issues concerning the building. The best solutions require dedication and time to develop and the objectives and context of spatial configuration can change considerably during the design process. The engineers' working process is much more linear in character, because they operate within the boundaries of fewer variables than the architect whose task is to configure everything together.¹¹⁶ The architect creates novelty out of nothing, which means going through several options and variables and considering them also in all technical solutions. New solutions could be found during the design that better serve the whole when considering all the parameters together.

BIM modeling has mainly been developed to focus on the production. BIM, as well the design process, could, however, be developed in such a way that it recognizes this issue and takes into consideration the way the creative process is conducted. In developing BIM modeling it will be important to ensure that the medium does not excessively control the way we produce housing and housing concepts. The challenge

¹¹⁶ However, the engineering work is also being reorganized because of the use of BIM models.

is that the use of BIM modelling should not lead to compromises in design and thus diminish housing typology by allowing the tool to lead the context, as happened in the early era of prefabricated element construction. However, BIM modelling has lot of potential and could be developed so that it could also be used during the life span of the building, potentially showing how flexible solutions and premeditated transformations could be arranged in the building. It has an enormous potential in the management of the building as well as in keeping track of the changes conducted during the life span of the building.

REDEFINING THE OBJECTIVES OF DESIGN GUIDANCE

As pointed out in the portrayal of the systemic context in housing production, the general production culture does not promote choice in building. The building is very strongly linked to the use of certain practices and even products that do not always promote diversity in housing solutions. The formation of choices has affected construction skills and the development of production materials as well as technological advancement in the building sector, which all has an instrumental influence on socio-spatial innovations in housing.

More long-term views and strategic starting points are also needed in the overall production culture. When the focus is mainly on the construction phase and the process of production, the construction objectives are served first and foremost. This can have extremely wide instrumental effects on the society as a whole. If the viewpoint could become longer, and also take into account the life span of buildings after execution, the procedures would also change radically. This could also enable more flexible and adaptive solutions in building, which are not considered viable in the prevailing production culture because in many cases it means rethinking the procedures.

According to Carmona (2009), socio-spatial sustainability implies that we need to tackle the processes in the built environment that after the war have acted to undermine choice (Carmona 2009 : 62). This also means understanding and amending how they are put into practice and how they deliver the outcomes instead of just developing theoretical approaches or legislation. Carmona (2009) points out that we need to work towards common objectives concerning sustainability, which has become difficult due to the fragmented and undermined way of approaching design in the processes. Because of the scale of the problem we are dealing with, in a wider sustainable development agenda, all the stakeholders are required to support shared visions of a more sustainable future (Carmona 2009 : 70). The international, national and local actors are slowly recognizing that these lines of action are not only necessary but inevitable (Kau.edu.sa 2004 : 30–38). Good city planning and building design are at their best sustainable, but this means much more than dealing only from the point of view of one sector in the process, or narrowly understanding energy efficiency to be the sole

starting point of measures. It refers to a more profound and wider understanding and approach as the basis for decision making, which in turn affects the social, economic and ecological sustainability. It is crucially important that good design is also understood as criteria not only in theory but even more so in practice (Carmona 2009 : 73). At the core of creating new lines of action lies the dilemma of how short-term and long-term objectives can be achieved simultaneously.

The development of the system requires new standpoints for all actors as its basis; understanding the systemic connections, long-term policy making and legislation, and above all changes in practices in which the whole system and its systemic connections are made transparent. This requires that all actors can explain their points of view and decisions, as well as argue their reference points to others in a discursive manner in order for the best possible design solutions and developmental tendencies to emerge.

CHAPTER II



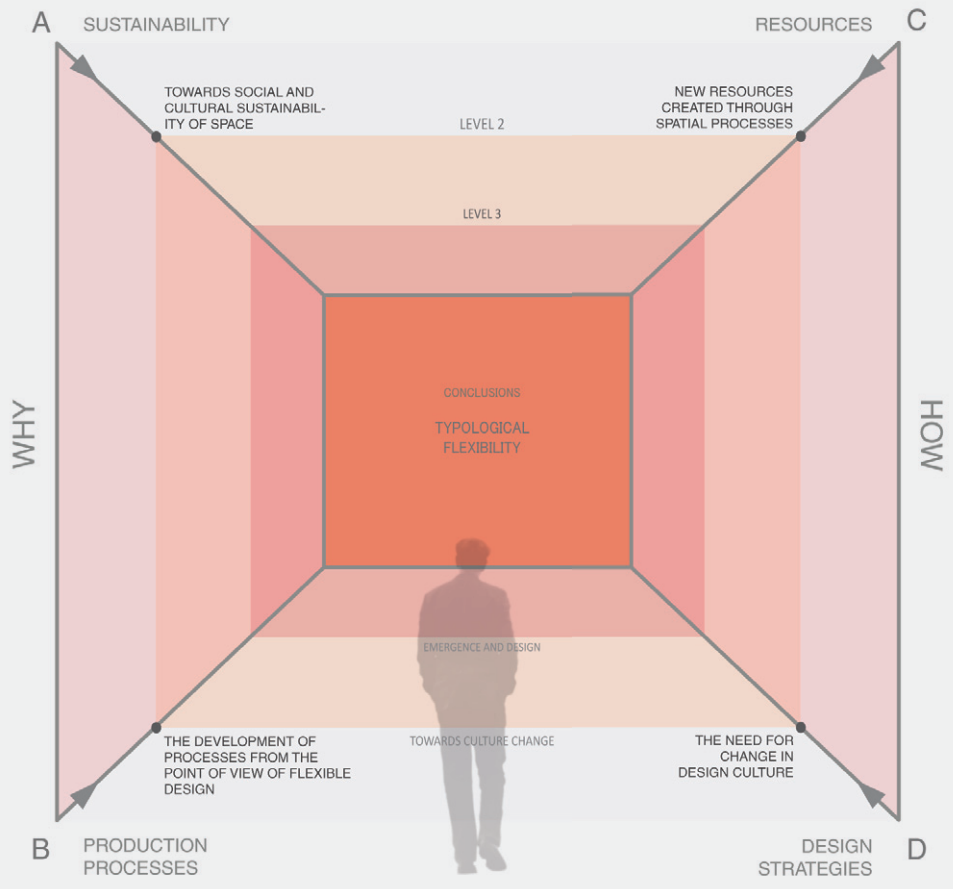


Fig.22.

II TOWARDS CULTURE CHANGE

2.0 DEVELOPING THE LINE OF ACTION

The previous chapter mapped the current character of the overall systemic context of housing design and production, the focus being on the external effects on design practice. Working at level 2 in the framework presented above, this chapter shifts perspective to look at design processes. Like Chapter 1, this chapter approaches the design processes through the four viewpoints by understanding the contexts of sustainability (2A), the overall production processes (2B), and the resources (2C) connected to design strategies (2D). The basis of this rethinking of the processes from the contexts of design is the belief that innovative adaptive solutions could be obtained more easily by drawing on timeless starting points and the long-term focus inherent in resilience thinking. Even though the emphasis here is again on Finland, similar tendencies can be observed in many other countries, particularly where significant changes in housing are on-going – both culturally and production-wise. The dynamic of change in housing production has largely happened with mass production and efforts to build up the national economy through the construction sector, as occurred in Finland during the 1960s and 1970s.¹¹⁷ The problems created by that very period of mass production are now being corrected with considerable spending, in Finland as well as in many other countries.

In most of the new construction in Finland the sustainability focus is, within the context of energy efficiency, quite advanced, but social criteria in building design, which also have a causal link to ecological issues, are only marginally tackled at the building design scale. The most common understanding of “the social” in spatial contexts is linked to the design of common spaces in buildings or in their vicinity. The need to better understand the social sustainability of the spatial contexts of buildings arises from the way it affects wellbeing locally and, on the other hand, on the ecological effects it has on a global scale. This chapter focuses on the prospective objectives of housing design caused by cultural change and the demands of social sustainability.

¹¹⁷ For example, in China the volume of building has been massive and the speed unprecedented (Luova 2010). The cultural change that China is undergoing can be compared to Finnish experiences in the 1960s and 1970s, even though the scale of construction in Finland and China cannot really be compared. In Finland during that period an enormous number of people moved from rural areas to cities and the country changed from being an agrarian society into an advanced industrial society, where the objectives for housing construction were based more on quantitative than qualitative drivers.

It looks at the nature of the meaningful goals and enablers of sustainable development in the social and spatial context. This inevitably means a redefinition of the problem assessment in housing design and production.

As Schön argues (2009), at the core of all professional practice is the notion of the continuous redefinition of the problem as part of any solution. That is why it is so important to find strategic and tactical tools for the basis of action, tools that can cope with continuous change. It should be possible to turn the course of development when necessary. Then the processes should also be self-correcting in character and comprise a developing tendency within the production of space, and in the guidance systems comprehensively. To understand the developing tendency it is necessary to recognize the systemic connections between all components and parties involved in the processes, as mapped in the first chapter. It means understanding the whole frame of action in which the nonfunctioning parts are unraveled or modified in relation to each other. It is important to notice that new lines of action cannot be introduced unless there is an understanding of their effect on the context of the whole. This also means changes in the structures and relationships between actors that guide the system.

Because of the housing sector's tendencies towards monopolistic practices, and the strict operating environment, its development demands paradigmatic change in how we perceive housing production in general and how we develop our processes. The change in guidance should follow an in-depth study of its objectives and of the development of the relationship between regulation and control. On the other hand, the interpretation of guidance and how it is applied in practice usually shows that it has a stronger role to play than actual legislation.¹¹⁸ When we compare, for example, Finnish and Dutch land use and planning legislation, we see that they are very similar in character, but in the Netherlands the legislation is interpreted and used in a different way (Soudunsaari 2007 : 58–60). The perceivable developmental tendency in housing in the Netherlands is more development orientated than in Finland, although it can be argued that this has been a typical tendency of Dutch housing culture in general.¹¹⁹ This suggests that the direction of change in Finland need not necessarily mean major changes in legislation, as the underlying causes for non-developmental tendencies are rooted more in the practices and processes of guidance. To be able to better perceive the change and deal with it through design, one must understand the context of spatial social sustainability in the production of built environment and develop some parameters for it.

It is particularly important to identify how we value human resources implicit in housing production. Our understanding of the city and the world we are dealing with

¹¹⁸ Finnish legislation on housing design is rather flexible with a few exceptions such as those related to technical systems like ventilation. The application of indicative norms has much more effect on housing solutions (Krokfors 2010, Krokfors 2016b).

¹¹⁹ There is a vast number of initiatives for developing housing typologies, as well as a theoretical standing and research in architecture that originate from the Netherlands.

also affects how we practice planning and design. Sieverts has presented one notable view of the city and its social context in his concept of *Zwischenstadt*, which interprets the present essence of a city and how it should also be perceived in its socio-physical context, which is very much linked to resilient space. *Zwischenstadt* is a metaphoric term that describes the complexity of the city and its formation. It portrays the city of today and its intermediate space as in constant flux between the place and the world. Global changes affect nation states and international actions affect cities and communities. By the information flow and people's constant traveling, the old contrasts between city and rural areas vanish. Sieverts uses the concept of *Zwischenstadt* to refer also to the more ambiguously built up area between the historical city centre and the countryside, and to the dissolution and decomposition of cities. He portrays these places as non-places, and recognizes the interdependence of local business and global markets. (Sieverts 2003). Even though this is generally considered to be the main interpretation of Sieverts' concept, it is much wider in its context (Pakarinen 2010).

With his metaphoric concept, Sieverts also tries to dismantle the myth of the old city. He emphasizes the significance of producing space locally, something that can act as a mediating element in social change. Because the city is a complex system, it should be understood as such and composed of very different spaces, spaces that can transform, change and adapt. Sieverts sees a risk in differentiating city regions politically, socially and culturally into competing urban fragments, something that can be seen already in the development of the European city but cannot, according to him, be accepted. Sieverts argues that a feeling of togetherness and cohesion can be developed through living awareness, which is not seen only as a technical or specialized administrative whole, in which the city regions compete for the same resources. Solidarity is born, according to him, from the local and democratic possibility to affect. There is a need for communities and places. Without the community there is no culture. (Sieverts 2003).

Furthermore, according to Sieverts, the *Zwischenstadt* is an existing space that society has not yet formed an attitude towards. He sees that there is no going back to the historical Polis. Rather the openness of the concept of *Zwischenstadt* enables new relationships and interpretations between working life and life experience. Sieverts emphasizes the potential and the possibility of political choice. For him, total control is a past ideal; current reality makes the possibility of choice necessary. Sieverts sees that urban systems are more like fictional links, rather than having easily perceived and formed connections with each other and with the "mother" city. (Sieverts 2003) The whole appears as systemic chaos, in which the parts collide. The single parts that seem rational work together in a totally irrational manner. As lived space this context is dysfunctional (Sieverts 2003 : 87). He sees that the more we live in a globalized world, the more we need to create new symbolically meaningful places next to the places that have a historical aura. The more our life is defined by globalization, the more we need permanent places for children, families, and sensual experiences, that

make it possible for people to become attached to real things and for solidarity to emerge, which also has a place-attaching character. (Sieverts 2003). Mere accessibility does not contribute to the quality of the regions unless at the same time it means approachability and intelligibility (Bölling and Sieverts 2004). From the point of view of Sieverts' analysis of city and place, the production of space currently appears to be based on a rather limited understanding of the city and its processes. If we take Sieverts' understanding of the city as a starting point for developing resilient space, it means new visions and contexts imposed on design and city development.

VISIONARY VERSUS REACTIVE APPROACHES TO HOUSING DEVELOPMENT

The production of the built environment and the challenges of resilience – in all its aspects – are also scale wise one of the most relevant issues to be addressed. In the light of the existing production culture, this objective is almost a utopian project. What possible ways to proceed are there that would maintain the balanced development of the planet and create the resilient socio-spatial existence that Sieverts talks about? David Harvey (2000) refers to utopias of spatial form as materialized utopias for visions that propose a model,¹²⁰ and to utopias of social process as idealized versions for visions that take the existing society as their starting point and try to create possible steps in a different direction (Harvey 2000 : 173–174). Harvey argues that we need them both in order to build utopianism that is spatiotemporal in order to achieve change in social and moral goals, and experiment with possibilities of spatial forms and contexts (Harvey 2000 : 182). In the formation of the built environment both approaches are relevant. On the other hand, there is a need for examples of what might be possible as well as moves towards the visions as an integral part of the process. With the lack of diversity in the housing stock, it is difficult for people to conceive what is possible, because there are so few examples of doing things differently. People are reluctant and afraid to invest in new solutions if there is a chance that they will also stay marginal in the future housing markets. Because of the currently self-perpetuating nature of the system, the creation of new directions is extremely difficult. The form of regulation and some standards have actually militated against the goals of the legislation and of EU standards promoting social sustainability. Existing housing design and production paradigms have been taken for granted. At a minimum, the objective of planning and regulating should be that the process itself does not prevent the formation of new concepts, but rather acts as a seedbed for new directions in housing production and helps the realization of resilient solutions.

¹²⁰ In this interpretation his use of the word model is closer to the concept of type used in this thesis.

Achieving resilient development in housing construction is a wicked problem, because a building can never be considered as sustainable in itself due to its energy consumption and excessive use of natural resources. Another important issue is that construction affects so many complex aspects of society that it can hardly ever be covered by a standard solution, which continuous social change also calls into question. There is also another problem that hides behind the universal solutions. When mistakes are made, they are of large scale. Sustainable building is a discursive term, which also requires constant re-definition. Thus, the idea of one meticulous and well-defined set of standards and tinkering with them without a comprehensive view of the whole is largely to ignore the essential points of resilient development.

The housing regulations and norms in Finland are largely quantitative and the end product is well defined through details. The development of standards is often very reactive in nature. A new problem or need is usually corrected by a new standard or new regulations, and the effects of these different norms are not considered in connection with each other or comprehensively as part of the whole system. As a result, there is usually only one possible solution to be adopted, and alternative solutions to choose from are not produced. The design process thus becomes very reactive in character.

Instead of design guidance that is too specific, housing production could be guided by certain strategic objectives that should be met, leaving open the possibility for many manifestations. From the perspective of resilience, guidance should be able accommodate alternative ways to reach the goals, as this would allow the contextual development of spatial production. A good example of working towards a more strategic approach in regulating is the way energy standards have become a part of building performance standards in Finland by reflecting the EU standards. Formerly in building construction guidance, energy consumption was controlled mainly by specifying the U-values of a building envelope¹²¹, which, given Finnish weather conditions, has meant that the thickness of the insulation material has increased cumulatively. This was based on a very narrow understanding of ecological sustainability and sustainability in general, one that saw energy efficiency as being accomplished mainly through sealing space. This development has, however, started to threaten already healthy buildings, because buildings have become “bottles” in terms of their physical behaviour, and this can be harmful for the structures as well as for the inhabitants because of the

121 "A U-value is a measure of heat loss in a building element such as a wall, floor or roof. It can also be referred to as an 'overall heat transfer co-efficient' and measures how well parts of a building transfer heat. This means that the higher the U-value the worse the thermal performance of the building envelope. A low U-value usually indicates high levels of insulation." (Architecture.com 2017).

development of mold in the structures and indoor air.¹²² Today, the standards can take into consideration alternative ways of creating energy efficiency and they can also take into account different ways of achieving the desired goals, for example, through the use of renewable energy. The approach has shifted from mainly controlling a single detail towards a more strategic and comprehensive direction where the objective is defined, but the mode of sustainability is less narrowly defined in advance. Nowadays you can compensate the higher U-value with renewable energy to some extent. However, the context of understanding energy efficiency is still quite strict and needs future amendment, because as used today they still exclude many viable material and structural choices unless renewable energy is used.¹²³

A change towards a more strategic direction in defining the content of standards would encourage practices looking for the best solutions rather than simply carrying out a pre-determined formula of housing production. Competing points of view would also bring forward a variety of options, which could and should be monitored for the development of better alternatives. Breaking out of the vicious circle of model based stagnated production to enable new approaches requires holistic structural reforms in the system instead of piecemeal changes in the regulation.

122 The professor of building physics at Tampere Technical University Juha Vinha (2015) wrote in *Rakennuslehti* February 21st 2012 about how the rapid pace of making new demands on buildings as energy norms is a risk for healthy building while the practices of the construction sector change very slowly. According to him, the details are increasingly in focus while the overall management of the varying aspects in buildings that all have systemic effects on each other is getting more complex over time. (Vinha 2014).

123 The professor of architecture at Oulu University Jouni Koiso-Kanttila, who is specialized in wood construction, criticizes the Finnish building culture for its “who cares” attitude (Koiso-Kanttila 2012). He thinks that if this attitude does not change to become more skills enhancing it will inevitably cause increasing indoor air problems as the growth of mold in sealed buildings will rise as we move towards energy-saving building. The energy regulations (2012) have not, for example, allowed the building of log wall structures, which are breathing and healthy structures, unless renewable energy is used.

2.1 TOWARDS SOCIAL AND CULTURAL SUSTAINABILITY OF SPACE

A

THE DEFINITION OF SOCIAL AND CULTURAL SUSTAINABILITY

Social and cultural sustainability are usually combined as sociocultural sustainability, because they are so interwoven with each other. There can, however, be a different emphasis in the interpretations of the two viewpoints. The understanding of the concept of social sustainability depends on the viewpoint it is approached from, but it is usually seen from the sociological point of view as referring to social cohesion and balance, which is met by fulfilling the needs of people for good living, education, health care, the need to belong to some community, and for satisfying psychological and spiritual needs. A balance in community and wellbeing promotes social sustainability, which is formed by justice, equality and the possibility to affect one's own environment (Blewitt 2008). Social capital (Putnam 2000, Coleman 1990, Hanifan 1916) is considered to be a very important element of sustainable development. Social capital refers to the ways in which people communicate, network, create trust in each other, engage in dialogue, solve conflicts, and identify and understand collective and individual potential for affecting sustainable development (Putnam 2007).

Today, the creation of social capital has also moved into the social media and has had an effect on how people take an interest in their environment and even how they want to affect it. The social media can also contribute to the development of the physical environment through the reflections of the media community, critique and new ideas (Blewitt 2008). It has contributed considerably to the way the people have taken possession of their city, as seen for example in the spontaneous organization of different kinds of events and happenings. However, even though social capital and community can be created through social media, the moment a person steps out of their home they will be part of a place and its social context and cultural landscape. Alienation from one's own environment is related to the quality of the environment, its character and the possibility to be proactive in it.

If the environment does not offer a safe and meaningful life outside the dwelling, including comfortable and active urban space, recreation possibilities, diverse local services and transport, social interaction and the possibility to influence it through collective activity, the place is not experienced as something one belongs to or identifies with. Life then moves to a great extent inside the dwelling, and social learning from one's own environment and other people becomes narrowed down. This also contributes to suspicion and racism. If a growing number of people live in communities in

which they constantly face limitations to affect their life and are unable to influence the development of the community, the society may also break down. Increasing violence, alienation and anger are manifestations of a socially unsustainable society. (Blewitt 2008 : 78–79).

Ecological sustainability is also dependent on social sustainability (Cook 2004 : 45). New habits and values as well as the formation of new ideas require social exchange that can challenge in a bottom-up manner the organizational practices and can also affect sustainable life styles (Blewitt 2008 : 82). In socially functioning society we can talk about the empowerment of the people. According to Schuftan (1996), empowerment should be understood as a continuous process that increases people's understanding of the meaning of anti-oppressive behaviour and at the same time can develop people's possibilities to affect the life of their community (Schuftan 1996). According to Putnam, people's participation in communal activity is usually a byproduct of their leisure time and hobbies (Putnam 2000).

In turn, the cultural context of sociocultural sustainability is primarily linked to values; how people perceive things and traditions as their shared cultural memory. Building is always a cultural act (Bosma et al. 2000 : 14). Culture also constantly evolves. Cultural identity is developed by artistic expression and the enabling of creativity, amongst other things. Attachment to the past makes culture iconographic (Argan 1963). Cultural sustainability connected to the built environment is mostly linked to the notion of *place* and *genius loci* and their potentiality to create meanings for people. Among architects, cultural sustainability is generally seen as the architectural quality attached to place and its timeless quality. Even though the discussion about sustainability within housing production has been mainly linked to ecological building and the use of energy, there is a widely shared view among architects that a high quality environment as a servant of the sociocultural context is the prerequisite of a sustainable building stock.

UNDERSTANDING HUMAN BEHAVIOR

The built reality in which we live largely reflects how we understand housing in society. Prevailing viewpoints and attitudes guide the production of housing (Puustinen 2010). In the background, there is always an understanding of how the individual is seen in the societal context. In Finland, housing design has, since the start of the industrial period, been harnessed to serving the development of economic life and the so-called social good for all (Hankonen 1994). The individual's needs have been often bypassed by the assumption that the common good, advanced in a top-down manner, also serves the needs of the individual (Juntto 1990). The development of apartment blocks in Finland has also been generally guided by the demand of universal applicability (Silvennoinen & Hirvonen 2002). People as individuals have not always

benefited from this kind of mindset because it has made housing solutions extremely one-sided and has not truly served more spontaneous and independent lifestyles. Nor has the predominant view or rational industrial processes produced reasonably priced housing. Genuine choices in housing markets, that spring from people's very personal aspirations in living, have not emerged in overall housing markets.

Today, the consumer has almost become a synonym for human being. In the jargon of the design field, people are also called users, which is not that far away from the notion of consumer either. This too can limit the way we look at human needs. Can architecture actually answer needs that spring from the very essence of being human in a way that does not follow the logic of consumerism? Enduring architecture, based on sustainable principles that emphasize the distinctiveness and resilience of space, could be understood as something much more than just using or consuming space. The spatial realities manifested in architecture tie us to a social context and at best can give us a chance to personalize, cultivate and transform the spatial context according to our needs and aspirations. In housing production, however, place often has no significantly wider meaning than just being a site of action. The connection between a human being and space is a much wider and more ambiguous experience than it is when just seen unimaginatively as doing something in the space.

THE CONCEPT OF HOME AND DWELLER

The concept of home is probably the most vigorous mediator between human being and space. For philosopher and poet Gaston Bachelard (1964), the home is a powerful force that unites a person's thoughts, memories and dreams. According to him, it is a condensate memory bank and is analogical to the human body. Housing design, which creates the framework for people's lives, like the formation of a home, is a multiform process. According to the architect and writer Witold Rybczynski (1986), the concept of home was created as a consequence of the increase in privacy and the development of identities in the 17th century.¹²⁴ The dwelling became the stage for private action and personal moments – the home (Rybczynski 1986 : 51–75).

Solutions that are based on overly simple and theoretical understandings of housing can be sidetracked from sustainable solutions if they do not also recognize the

¹²⁴ The birth of the home can be situated in 17th century Holland, because the interior and décor developed there in an original way. Rybczynski links the concept of home to the development of city dwelling and the expansions of world trade. Dutch society was then more democratic than other class societies at that time and the "class" of traders formed the first bourgeois nation to also encompassed a wide middle class. According to Rybczynski (1986), it was also connected to the development of family relationships. Unlike in other European countries, in Holland in 1700th century children lived with their parents until they married, and relationships were tight and warm. (Rybczynski 1986).

human, more “irrational”, condition.¹²⁵ Understanding the home as a multi-dimensional concept that comprises many meanings and archetypal needs could lead to housing solutions that are more capable of answering inner needs and aspirations. As the philosopher Martin Heidegger emphasizes in *Bauen Wohnen Denken* (Building Dwelling Thinking) (Krell 2000), expanding the understanding of *building* (as a verb) and *dwelling* (as a verb) so that all their dimensions could be taken into consideration, would help avoid the homelessness of people and their alienation from the environment. Heidegger compares the concepts of building and dwelling with each other. Building does not necessarily lead to dwelling, but because we are dwellers we build. He distinguishes between the terms dwelling and accommodation. Accommodation can be understood as merely conserving people, simply occupying space. Dwelling, on the other hand, is part of humanity, stability and freedom, a term that emphasizes the way people become part of the environment – the stage for building – as *dwellers*. The site that we build on is not only a base, but rather, through the formation of space it becomes a place in which all the meanings of dwelling are united. Its conditions cannot be separated from each other (Krell 2000 : 344–350).

Heidegger also saw that the renewing of housing is an inseparable part of the concept of dwelling. He did not undermine the need for speed in responding to the lack of housing, but he emphasized the way it should be realized contextually. It is a case of answering the eternal need in-depth of humanity. Thus, the longer we want the building stock to last, the more important it is to create meaningful and high quality environments. Heidegger thinks that it is adequate if building and dwelling are seen as worth questioning and thinking about. Thinking is also part of dwelling.

THE RELATIONSHIP OF PEOPLE AND SPACE – TOWARDS LIVED SPACE

The production of housing in Finland in the industrialized period has constituted a very universal understanding of housing that is still based on designing for nuclear families with small children, who are expected always to remain as such (Saarikangas 1993). The perception of people in space has also concentrated on bodily functions and health issues as well as spatial functions and was recognized as the basis for housing design already in the functionalist period one hundred years ago. Particularly in the industrial era, housing production has neglected the psychophysical and spiritual character of people as feeling and creating creatures whose individual needs and sociocultural habits exist in interaction with the environment.

In the period of functionalism, living, recreation and work were separated in the city structure, but in the digital age, work and other areas of living have re-entered

¹²⁵ The focus of technocratically oriented housing design tends to exclude points that are difficult to measure or standardize (Hankonen 1994).

the premises of the dwelling. More and more functions, separated by functionalism, have, in one form or another, crept back into the home, and the dwelling has become a node of public and private action (Mitchell 1996). As a result of cultural and social, as well as technological change, the spaces meant for living in today's industrially produced housing have not been able to follow that contextual change. According to Sieverts (2003 : 77), people have become nomads who cannot become attached to a place because they have been unable to affect their own environment.

In humanistic thought, one of the central theorists of space is the French philosopher Henri Lefebvre. The key issue for him has been the relationship between the human being and space. Lefebvre divides the notion of space into three aspects through which he analyses this relationship. They are 1. perceived space, 2. conceived space and 3. lived space (Lefebvre 1991). The first, perceived space, refers to the way space is understood from the perspective of every day experience. Conceived space refers to more professional and theoretical understandings of space. There is also, however, the third dimension of space, which Lefebvre describes as lived space, that is, the space of imagination and moments. It has the power to question the balance between the popular perceived space and the conceived space of professionals, which Lefebvre sees as the space created by capitalists. Lived space is held as vital by art and literature (Shields 2002 : 12). Lived space also comprises the tendency to question. Lefebvre's third space approaches the problem of space from a new point of view, in which the traditional dialectic two-pole division into material and mental space is seen as too narrow an approach. Meaningful qualifiers and approaches are bypassed in it.

Lefebvre (1991) creates the concept of lived space alongside the historical and social understanding of space, that is, removed from their conventional interpretations. He thinks that material space and mental space have always affected each other simultaneously and cannot be separated from each other, nor can it be determined which came first and so affected the other. His phenomenological approach approaches material and mental as part of each other, and he does not believe in the interpretation of the world in which the subject and object are separated. The human being is always connected to space with her/his senses and understanding. According to Lefebvre, socializing does not just happen in space and there are no social processes that are space-less. Space is not just a stage of action, but it is a vital part of lived experience, the production of social space – individual and social spatiality. Social practice also includes the production of space as social and political activity. According to Lefebvre, architecture is seen merely as autonomous action that denies reality, even though architecture produces space and determines the possibility to affect its formation. The production of space is, in his view, both autonomous – the artistic condition – and dependent – the social context. Also, the autonomic context of producing architecture is created by social relationships in which mental and social concepts are interwoven. (Lefebvre 1991). According to Lefebvre, and his interpreter Edward Soja, space is

generally seen in philosophy and science in a very naïve manner as natural and given. They say it is also believed, in a very primitive manner, that space can be measured and exactly defined. They criticize spatial analyses as well as empirical research for their one-sided interpretations. (Soja 1996 : 63).

Sociocultural sustainability as part of the holistic examination of humanity encompasses everything that touches on human life. A criterion for sustainability, then, also becomes the way people experience the built environment as lived space and how they are part of it. If people do not find space meaningful it will vanish in the long run. Lived space continually redefines itself and it is also very personal in its definition, so the meanings created by people cannot be consciously defined beforehand by any design. Nor can meanings, at least other than the archetypal meanings of being human, be considered eternal. Culture and individuals are continually redefining what is experienced as meaningful. In a multicultural world, where cultures live shoulder to shoulder, it is even more difficult to design built environments that could be considered meaningful, and it cannot be considered as being something just planted in architecture. Similarly, designers and developers cannot override people's desires as to how they want to dwell, live and develop their own environment. Nevertheless, patronizing design paradigms are still branding housing design as stiff and undeveloped building culture. Design is facing the enormous task of dealing with unpredictability. How people will experience their environment and how they want to live cannot be foreseen, and yet at the same time the built environment should last from generation to generation in a meaningful way. All this makes the creation of future built environments more than challenging.

THE PREREQUISITES OF TIME-WITHSTANDING HOUSING AND URBAN SPACE

Besides a structural and material quality that enables longevity in buildings, there seem to be two leading-edge approaches that are present in all architecture that withstands the test of time. The first, just mentioned here, is based on the meanings space can create for people, while the other concerns the strategic and tactical spatial qualities of space that, in some form or other, can promote the self-conditionality of space through adaptability and flexibility. Understanding the different aspects of architectural quality seems to be the common force of both approaches. Even though the meanings created through the concept of lived space and the strategic character of space do not necessarily immediately seem to be connected, on a closer look the relationship is easier to observe. Lived space is connected to all the unmeasurable qualities of space that spring from the unconscious as well as conscious personal experience, aspirations, as well as of ways of being. The strategic character of space is a way to promote this, the self-conditionality of space as approached from individual and social starting points.

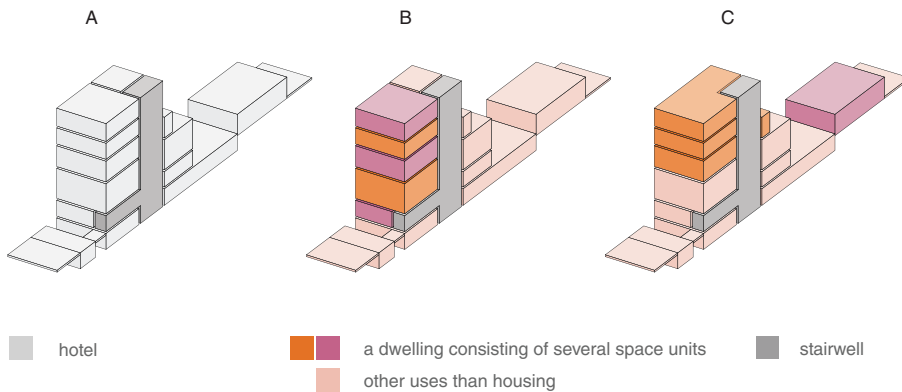
However, to promote this, the character of self-conditionality in the context of space should be better defined. Because there are such different connotations and interpretations of space, from whatever starting point and background assumptions we approach it, very different conclusions emerge.

The meaningfulness and strategic quality of the built environment can also be studied by observing where it has withstood time and stayed in everyday use, for instance, in built environments where people feel at home and that can be adjusted according to their needs and aspirations, even when old. Usually this happens in easily adaptable architecture of high quality that the inhabitants have found meaningful generation after generation. This is very much connected to the housing typology as well as the city structure they create. The built environment such buildings comprise has been able to adapt to very different kinds of use as seen both within the context of the building and in the context of urban structure. The qualifiers of time, space and self-conditional use simultaneously play a major role in their long existence. Time is understood in these examples as the time-withstanding quality. Space is understood as architectural quality that creates meanings and is strategic in its character. Self-conditional use that springs from them relates to people's own way of being as well as the creativity that the conditions of space in time can promote and inspire. A good example of this kind of environment is the townhouse typology mentioned before that has lasted for centuries, and that even the modern era has not been able to shun or abandon. This originally European model has enabled very different ways of use and meanings as part of urban structure. The town house typology comprises examples from Dutch merchant houses to Victorian townhouses. It is not so much a question of style as architectural and typological quality in the urban context. The house type then possesses spatial and architectural qualities that have made it possible for the space to be used to respond to very different needs and aspirations.

For example, Victorian town houses in the UK have proved to be extremely multi-usable over their life span. They can be reconfigured as flats of differing sizes, or even altered to accommodate commercial use, especially on the ground floor because of the spatial organization, which is based on a singular stairwell feeding the spaces beyond. See Fig. 23.

The size and configuration of the spaces that the stairwell feeds seem to be typologically very suited to this kind of multi-usability. It is not overly efficient in the context how many square meters on each floor the stairwell feeds. The stairwell acts like a vertical corridor that via which the different spaces can be linked, independently of each other. The spaces can even be divided into smaller units according to need with the same logic still prevailing allowing the spaces to be used independently for different uses. Due to their internal spatial configuration and appropriate unit size, town houses can also play a role in creating a mixed occupant profile in the city structure. The typology and the emergence of occupant profiles are connected (Hanson 1998).





The resident profiles of the urban areas are connected to the production of space through the housing typology. Flexible typology can, at its best, generate very different kinds of uses of space and inspire novel uses. Then urban areas can develop from their own starting points in various ways in different times, leaving the development of the area less closely tied to dwelling types or fixed to certain uses. This also promotes the social sustainability of the area.

THE LONG-TERM VIEW IN STRATEGIC AND TACTICAL QUALITIES OF SPACE

Housing comprises on average 85 % of all building stock in Finland (Stat.fi 2012), so how its sustainability goals are understood and reached is a crucial question. The diverse housing production that has been usually considered as the answer to differentiating needs and for the development of city structure is according to resilience thinking not really enough. This condition of understanding diversity in the context of housing solutions is actually based on several assumptions that can be questioned. At the level of the organism, diversity is considered to promote sustainability but in applying ideas about natural organisms to manmade ones, such as the built environment, this kind of general interpretation can be only very narrowly operationalized. If diversity in the built environment is understood solely to be a matter of having as its purpose the creation of diverse entities it is like interpreting complex systems by their manifestations, not by how they operate. In fact, the self-organizing quality in organisms refers to how they are able to interact with each other in diverse ways,

Fig. 23. Example of a Victorian townhouse showing how the spatial configuration of the building allows many permutations of use within the same building: e.g., A as a hotel; B as mixed housing, offices and commercial space; C commercial space, housing and workspace.

Fig. 24. On the left, interior photograph of a Victorian townhouse today. © Studio 30 Architects

not so much to the outcomes that the self-organizing creates. For allowing the self-organization, the constant act of creating goes beyond the results it creates. Then processes that continually create diversity are where we should focus, instead of just emphasizing the production of different kinds of dwellings. This important difference between approaches can be observed from the point of view of lived space, the continuously changing condition that the individual and the era the individual is living in. Those building types that withstand time, like the town house typology, have qualities that allow creative solutions to emerge and promote creative action in general, ones that do not need to be predicted in the design phase. The building could be then seen more as a process for generating a resilient built environment than just as a fixed spatial entity. This means new strategic demands imposed on the built environment that can generate diversity as inbuilt. The longer the time span the flexibility tries to convey, the more strongly the urban structure comes into focus when developing adaptable and flexible spatial contexts. It is very important to understand and define what kind of objectives and what kind of processes is envisaged as resulting in spatially resilient solutions.

2.2

THE DEVELOPMENT OF PROCESSES FROM THE POINT OF VIEW OF FLEXIBLE DESIGN

B

The issues in processes that particularly affect the formation of flexible solutions in buildings will be studied next. There are certain tendencies in regulating and guidance that, in their current form, can even conflict with the long-term resilience objectives in building. As a basis of this condition, as mentioned earlier, is that in some form they guide towards certain manifestations rather than promote change and self-conditionality of actions of people. However, regulations and guidance are very much needed to protect the overall development of cities and the quality of building construction, which is the long-term view embedded in different forms of public guidance. It is very difficult for a single stakeholder in their own enterprise of construction to perceive these issues as part of the bigger whole of area or city, because the viewpoints on city development are so multiple and complex. The rigidness of guidance, nevertheless, can lock emerging solutions into certain configurations, which, in the long run, do not necessarily serve the social sustainability of the areas or the resilience of the built environment in general. This is because the guidance attaches itself so much to details instead of strategic objectives, the systemic influence on conditions of housing can be haphazard and promote negative developments in city regions.

STANDARDS AS ENABLERS OF RESILIENT SPACE

HOUSING DESIGN STANDARDS

The development of housing solutions in Finland is seen to occur largely through statutory guidance and other guidance in the form of standards and norms. Measurability has been their fundamental attribute, which has largely determined the spatial characteristics of the resulting housing. There are two main types of guidance through standards: the statutory guidance of the Land Use and Building Act of Finland namely MRL¹²⁶, which has legally binding force, and the norms or instructions developed to guide housing design in general by the Building Information Group.¹²⁷ The norms are based on generally acknowledged ways of producing dwelling typologies, and arise from assumptions about what good housing is. They both work through setting the minimum parameters for housing solutions. In statutory guidance these are, for example, minimum ceiling height and measures linked to accessibility. They also concern technical systems, such as ventilation, that have an effect on the spatial solutions of dwellings.¹²⁸ The housing standards as norms, meant largely as instructions, give more precise definitions for producing spaces: these actually govern the housing design far more strongly than the actual legislation of statutory guidance.¹²⁹ Even though the statutory guidance has become looser since the introduction of MRL in 1999, the number of norms to follow has steadily grown. The norms and standards are considered by the different stakeholders almost as regulating as the statutory guidance. (Interview 1, 4). The stakeholders that rely most on norms are the planning and building control authorities as well as the developers and practicing architects seeking to fulfill the criteria of good design demanded also often by local authorities. Although the national standards in Finland are mostly indicative, they are used widely by the different stakeholders and have been a good starting point for design where there has been pressure to slip from minimum criteria.¹³⁰

¹²⁶ MRL is the Finnish abbreviation for “Maankäyttö- ja rakennuslaki”, which refers to the Land Use and Building Act.

¹²⁷ The legislation is also included inside the Building Information norms (RT-kortisto/net).

¹²⁸ In the study (Krokkfors 2016b), which examined the development of spatial solutions, one very clear result was that the amount of space for technical shafts have grown considerably during the period of the survey between the 1997–2012 and have had an effect on spatial solutions and their quality.

¹²⁹ The housing standards (*ohjeet*) are developed by Rakennustietosäätiö (Building Information Group) and they give guidance based on good housing solutions ranging from situating the bathroom fixtures to organizing the building and its surrounding. They are not legally binding but they are meticulously followed or to some extent demanded by the Building Control. The designing architect, the Building Control and the developers base their operation on them. It is also for them not always clear how binding the regulations are and whether they should be applied. However, they are generally considered helpful for the practice of housing design. (Interview 4).

¹³⁰ The research conducted over housing design in Helsinki shows also that after the abandoning some measured properties over bedrooms like the width of the bedroom, the sizes of secondary bedrooms have decreased.

The increasingly stringent guidance developed in Finland over the decades is, to a significant extent, also guiding the context for housing solutions. The initial goal of evolving and high quality construction has been degraded to a rule jungle. One significant problem in the way the standard guidance is practised is not the guidance per se, but the way that these standards are based on existing housing models that can unintentionally prevent the development of new solutions. When standards emphasize measurable dimensions, they can also block innovation like emerging housing typologies as well as flexible solutions. Doing things differently, using solutions not fixed in standards, has become difficult in every day housing production. In the standardized construction culture, control via individual features can also lead to arrangements in which compliance with the rules can pass the appropriateness of the design approached from new starting points. For example, because the standards for calculating the building right¹³¹ are different for different housing types, like blocks of flats or townhouses¹³², it is very difficult in Finland to develop a building typology that can adapt from one house type to another and where the understanding of the typology might even make it possible to transfer it from housing use into some other use.

Research conducted on the housing solutions between the years 1997–2012 showed how homogeneous the housing solutions are context-wise. The research studied lamella type housing solutions both in private and social housing over a 15-year period in Helsinki. Solutions were very similar in both tenure types, a situation that points to the argument that the guidance homogenizes the housing solutions in general (Krokfors 2016b). The measured standards usually concern usability, for example how the fixtures in the bathroom should be positioned in relation to each other so that they can be used easily. These instructions are also very valuable for a designer, because they do help in the design process if you are still less familiar with housing design. Bathrooms are usually so universal in their character that measured properties and parameters are usually considered to promote good design solutions. With other spaces, measurability can, however, have much more contextual effects on spatial organization.

The criteria based on measured properties can also be contradictory, and exclusive for other features in dwellings. The current way of standardizing stresses individual spaces without considering their relationship to other spaces and, at least to some extent, it guides the configuration of other spaces (Krokfors 2010 : 229). An example of this are the directive standards on designing for people with reduced mobility. Even though it is extremely important to guide and accomplish design for all, it has had unintentional consequences in the systemic context of overall housing production.

131 In Finland the building rights as the maximum square meters the building can comprise that is stated in planning documents, guide to great extent, the design solutions. Building rights are stated in planning documents before the actual housing design is executed.

132 In the Finnish context the townhouse is understood as small scale housing, occupied by one family, which is usually three floors high. The Finnish definition of townhouse is closer to small scale terraced house in English language.



The standards and standard-like instructions concerning the needs of disabled persons define the size of the entrance area and any bathroom linked to it. Within the overall system, this has meant that living areas or bedrooms have been decreased in size to compensate for bigger entrance and bathroom areas. This can have meant, for example, in two-room dwellings, that the bedroom has become so small that it cannot even fit a baby's bed. See Fig. 25.

This is partly because the demands imposed on one particular space have, for other reasons, not caused the general size of the dwellings to grow in practice. People have as much money available to pay for their housing as before and housing prices are very high in Helsinki. By only optimizing one area by regulation, other objectives have suffered. Change in one part of the system does not necessarily produce a desired result in the system as a whole.

The overall tendency in recent years, at least in the Helsinki area, has been that the size of dwellings has decreased (Krokkfors 2016b), reinforcing the negative tendency of overall housing solutions and the lack of choice in plans. Some developers have joined the discussion, demanding the abandonment of the design-for-all standards for the entrance and bathroom areas in most dwellings. The meaningful goal of design-for-all can actually be jeopardized because of the way the standards and instructions have been drawn.

How to guide is a very difficult issue because a lack of national standards can be a problem. In England, where many different types of standards drawn up by the various actors are applied, standards also contain inconsistencies that may make the process difficult (Fulcher 2013). For its part, the lack of national norms and regulations has also led to a low standard of housing delivery, especially in the upward spiral of the economy when almost everything was sold due the insufficient delivery of housing (Interview 1). In England, the standards have also been seen to challenge the way the

Fig. 25. Two-room dwelling in Vallila, Helsinki.

housing is produced, when quality has not always been the key objective (Carmona & Dann 2007). The form of regulating has been under discussion in the UK with opinions ranging from the advocacy of less regulation to the development of more precise or strategic guidance (Fulcher 2013). The way the building coding is used in Finland has made it possible to maintain, however, a certain level of quality in housing production.

Guiding that encourages new solutions becomes very difficult when the starting point is based on common and rather fixed practices. It is partly a question of problem setting. Because the markets have not promoted an increase in the size of dwellings, it would be more fruitful for typological development to ask how housing solutions could be designed so as to be also suitable for people with reduced mobility but without compromising other spaces as a consequence. One starting point could be flexible solutions that could adjust the space for required solutions and have more space available for households.¹³³ This would also ensure resilience objectives that would not fix the housing solutions for decades to certain spatial configurations that could not adapt to future needs.

With a move towards flexible solutions and being able to guide the system towards resilient solutions, the role of building control would be slightly transformed. This would mean more interpretative practices conducted by building control, depending on whether the potential solutions based on flexibility work or not. Because for the Finnish guidance system it is also very important that all applicants are treated equally, the emphasis has been on common building criteria. The question that arises then is whether the way the guidance is presently conducted is too obstructive, or whether we should take a different approach to the problem, one that would also fulfill the equity criteria. The problem of housing standards has been quite widely recognized in Finland because of its unifying tendency as well as the financial effects.¹³⁴ For business reasons, the construction industry has been keen to promote the relinquishment of standards,

¹³³ The regulating of sizing toilets for people using wheelchairs in all dwellings is based on the assumption that although the person who owns the toilet is not disabled in any way, her/his guest might be. Solutions to this problem that require transformability might be too complicated for solving the temporary needs of visitors. This would then require other approaches that offer bathrooms for disabled people in the vicinity of the dwellings shared by several dwellings. The best solution would clearly be to be able to have more space available in dwellings with less cost.

¹³⁴ A report by the Finnish Ministry of Environment *YMräio_2009_Rakentamisen normitalkoot*, was published in 2009 which emphasized the cost effects that certain standards have on building. The focus was not, however, on other effects the standards have on building and housing in general. The URBA research project, however, brought attention to the role the standards play in homogenizing housing (Puustinen 2010, Krokfors 2010). In the research material the word *normi* (direct translation into English is *norm*) is used, which usually includes both the statutory standards and other standards that refer to guidance. In a panel discussion at the Museum of Finnish Architecture on December 10th 2015 on the norms of design, the architect Aila Korpivaara from the Ministry of Environment and the architect and MP Anders Adlercreuz stated that the new government is seeking to decrease norms in all fields. Those that will affect building construction have not yet been precisely defined.

even so far as giving up a large part of the planning guidance¹³⁵, which would most likely have a negative impact on the quality of the built environment, as was already experienced in the system building period in Finland. Alternatives to standard guidance have, however, been studied by the Ministry of Environment, including the possibility of giving up the standards in some form or another, and changing them into more operational direction.¹³⁶ This could mean, for example, tying them to objectives rather than to exact spatial parameters. Thus, instead of saying what the space should be like, it should guide what spatial character should be aimed at in more general terms. Then the interpretation as to whether these objectives have been met or not should be done by the Building Control, which demands appropriate design skills. The Building Control has also emphasized the significance of best practices and the use of good designers in gaining the best possible solutions in projects that would also compensate for the high demand for different norms and standards.¹³⁷

The Building Control of Helsinki has been also keen to promote new, more flexible practices that would take into consideration various interior configurations, particularly in kitchens and bathrooms, which can be developed by the inhabitants themselves, especially in co-housing developments.¹³⁸ Building permission has then taken place in two stages, the first relating to the raw space without fixtures, and the final permission of deployment following, after the necessary equipment has been fixed to reservations that were made available at the raw space permission stage. However, this usually benefits the first inhabitant but not necessarily any future inhabitants who might purchase or rent the dwelling later on. If we think of the long-term development of the building stock, a further question arises as to whether the standards recognize resilient development in a manner that promotes sustainability both in the short term and long term. The strategic objectives should be such that also enable flexibility for future inhabitants without limiting responses to current needs. This means dealing with the potential of space to have multiple uses and accommodate present and future aspirations.

¹³⁵ Rakennuslehti web news 27 March 2013. The title of the article in the finance section was: *Talonrakennusala: Kaavoituskäytännöt nostavat rakentamisen hintaa*. (Building construction sector: the practices of the planning process raise the cost of construction). It is, however, very controversial if the planning is the cause of the high cost of housing. The FIAT research seems to point also in other directions.

¹³⁶ Kirsi Martinkauppi of the Finnish Ministry of the Environment talked about operational standards as one option for guidance at the URBA flexibility working group meeting in 2009. The understanding of operational standards is close to the strategic objectives of standards.

¹³⁷ In a panel discussion at the Museum of Finnish Architecture December 10th 2015 on the norms of design, the senior architect Henna Helander from Helsinki Building Control Department referred to building renovation projects in which there is much less guidance on projects that tend to be of high quality. The demands for high qualifications and competence of the architects of renovation projects are however higher than in normal projects.

¹³⁸ Even though this is common in many other countries, in Finland it has been very difficult to build kitchens and bathrooms yourself “from scratch”, in the context of everyday building production led by professional developers.

DE FACTO STANDARDIZATION

Another form of standardization, particularly effecting housing construction, that also has impacts on issues beyond what they are meant to control, are standards affecting the components used in building construction. They also affect design and overall building culture. Within industrial housing production the standardization of components and housing standards affect each other quite prominently. This is partly due to how closely tied to measures the standards are. Tying housing standards to certain measures was a historical effect of developments in industrial building, but in present day practice it also reinforces very fixed solutions. The de facto standards of building components have been largely drawn up according to minimum standards. De facto standards are extensively used in implementation and to some extent have reached the position of standard without the official status of standards. The solutions are based solely on the choices made by whoever developed the components or methods of construction, without considering broader objectives as official standards usually do (Brem, Nylund & Schuster 2016). For example, the minimum ceiling height has led to dimensioning of the building products (Interview 4, URBA flexibility working group). To deviate from normal measurements has been seen as expensive special solutions, which have also narrowed the spectrum of building components and their availability.¹³⁹ The concern with extreme standardization that Alvar Aalto saw as a threat is then not such an alien thought in the current Finnish production system.

GUIDANCE CRITERIA

Drawing up new objectives for guidance could be an opportunity to concentrate on the more qualitative and strategic objectives of spatial design and context, and thereby avoid general guidance that encourages more homogeneous design and only certain dwelling typologies. The problem for this setting of objectives has been also defining whom the standards should serve – the industry or the people. This kind of polarization has also been very prominent. The basic reasons for having these standards have been that the building stock in general would be good and would last from generation to generation. The interpretation of what it should comprise and how this should be accomplished has so far been very one-sided and fixed. In the practice of housing design the search for alternative approaches like flexible solutions has not evolved because it would mean some change in production processes and bypassing, to a certain degree, the regulations and the need to interpret how they are applied. Guidance on

¹³⁹ Diverging building components are often overpriced by the contractor so that design solutions are not adopted easily if they involve different measurements or new ways of using building components (Interview 4, URBA Flexibility working group). In their own design guidance, developers also very rarely want to apply new solutions because they do not necessarily get compatible offers in the bidding process from contractors (URBA flexibility working group).

resilient space would need new ways of guidance and standards that would arise from a different problem setting than before. It is also important to recognize that flexible solutions are actually being accomplished and it is not just a bypass lane for “bad” solutions, that is, using flexible solutions as an excuse for something else. This puts the emphasis on the building control resources and skills to evaluate potential flexible housing design solutions and assess whether or not they support the objectives in the guidance.¹⁴⁰ The criteria and objectives for accomplishing flexibility and its guidance have to be carefully thought out and implemented, because not every kind of flexibility advances resilient objectives.

One starting point for regulation could be to restrict it to general objectives. More precise guidance could concern only the part of the regulations that have a direct effect on people’s health and security. Health issues, such as standards for noise, could be treated as nowadays because they are not really bound to any particular design solutions. The normative standards could be steered in a more operational direction, so that many of the standards only tied to measurements could be abandoned. The important point about developing standards is not to tie them to any specific method of construction or pattern of living. Planning and building control would most likely need to apply a new form of control agenda and there would be a need to develop new dynamics between the different stakeholders.

PLANNING AND CONTROL AS ENABLERS OF RESILIENT SPACE

In Finland, the rationale that guides regulations and standards, as well as the building culture as a whole, is also embedded in planning procedures. The *URBA* flexibility working group studied the many issues in planning that affected housing typology in ways that made flexible solutions at building level difficult to achieve (Krokfors 2010). In Finland, the existing planning guidance of the building stock is done through rather fixed parameters, which on the other hand has often also promoted the quality of architecture. Building controls have further affected the design by adding their own design guidance on top of the planning guidance.¹⁴¹ The problem has then been the emergence of potential flexible solutions as new typologies, which planning in its current form does not yet promote as design agenda. In practice, in addition to the

¹⁴⁰ In bigger cities in Finland the local officers who grant building permission and are responsible for evaluating the design are usually educated as architects so the skills for interpretative control agenda generally exist.

¹⁴¹ In Finland planning and building control are conducted by two different organizations, which is also reflected in their practices. They can have very different approaches and objectives in their operations (Interview 2 and 4). Even though housing standards are usually optional in planning guidance, some of them, particularly regarding communal spaces, are made mandatory by building control at least in some cities. Building control in Helsinki has recently introduced some more flexible guidance criteria on the organization of common spaces in buildings, which have been the major concern in their particular guidance in the past.

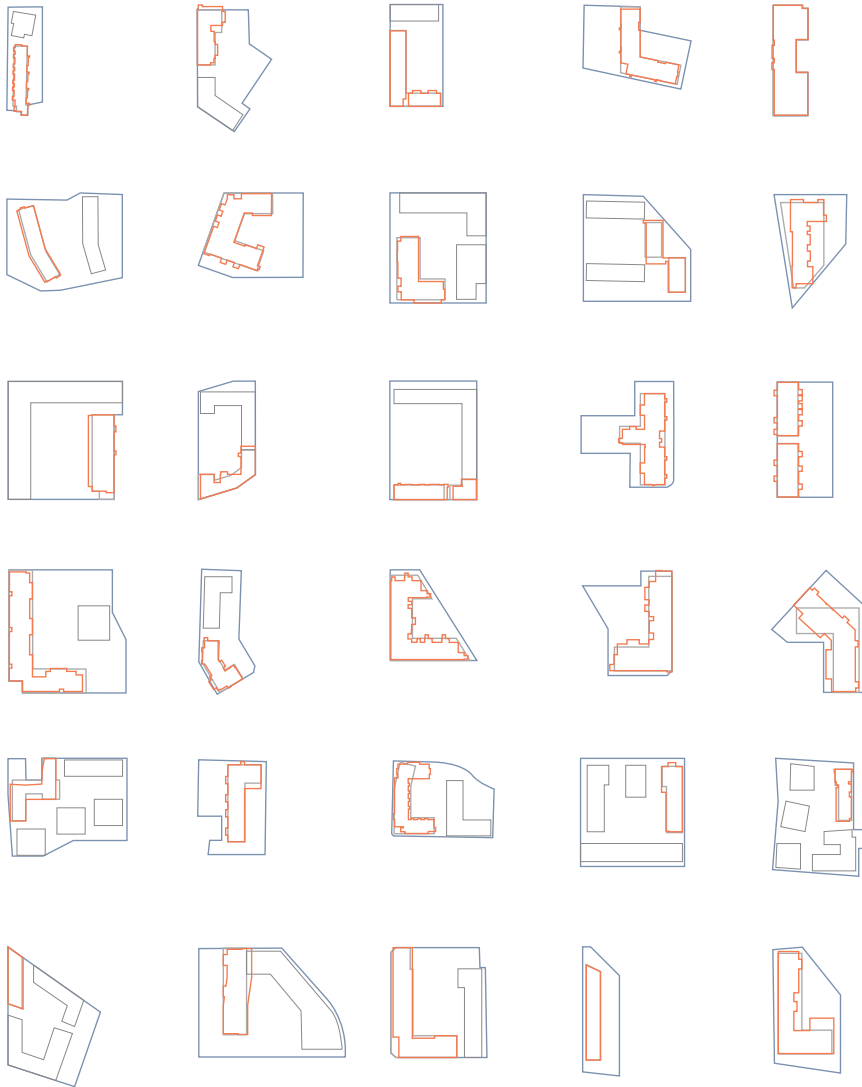


Fig. 26. Research data from report (*The development of spatial solutions in residential housing blocks in Helsinki between 1997-2012*). (Krokfors 2016b). The blue line refers to the site boundaries; the gray to the allowed building area; the red to the finished building contour.

qualities of the cityscape, existing local detail plans also define very precisely other characteristics that significantly affect the design of the typology of the building (Krokfors 2010).

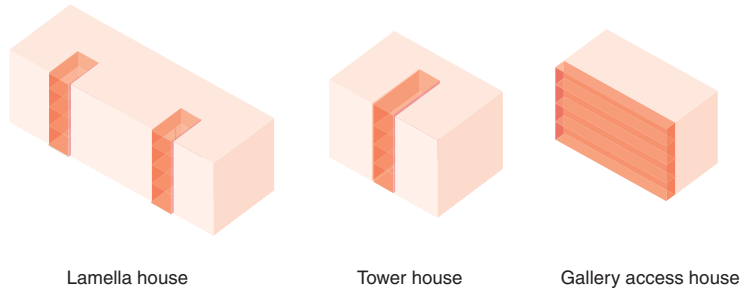
The regulated issues that have the largest effect on the dwelling typology and flexibility are the area of the building, the number of floors, the height of the building and the organization of the courtyard. The lack of internal flexibility in these planning regulations usually leads to standard solutions (Krokfors 2010). Very often in planning the existing housing typology is used as a basis for the strict planning regulations, cutting the wings of development in housing typology comprehensively. This existing condition was also identified in the *URBA* flexibility working group's conclusions (Krokfors 2010) and the report (Krokfors 2016b) that described how the dwelling solutions for apartment buildings have developed in Helsinki between 1997–2012, as well as in the empirical research data gathered from 2013–2014 in the *PEKA* research project. It mapped the deviations in planning regulations in new housing areas in Helsinki.

BUILDING AREA, NUMBER OF FLOORS AND RIDGE HEIGHT

The regulations on cityscape are usually given with these parameters as part of local plans, particularly in Helsinki. The building area is defined in a very specific manner connected to the floor area of the maximum permitted gross floor area allowed on the building area. This is a very specific character in Finnish local detail plans and usually defines the parameters of the building quite tightly, so that any other way of implementation is not very easy. See Fig. 26.

The boundaries of the building area are given with great precision and usually the dimensions are based on a particular kind of building type (Krokfors 2016b). Deviations are allowed but they have to be approved by the planning officials, which sometimes also involves local council decision-making and can delay the building process depending on whether they are major or minor deviations. In the *PEKA* research material on the cities of Helsinki and Vantaa, most deviations concerned building area in planning documents (Staffans et al. 2015). The building area defines the depth of the building and so usually also the used housing type. This means specifying the stairwell system and the grouping of the dwellings around the stairwell as well as the common spaces. The content of common spaces is usually very specifically defined in Finland. The gross floor area – the building rights – which the local plan allows, is generally determined beforehand, based on lamella, tower block or gallery access house apartment house types, the most commonly used building types in Finnish housing production. See Fig. 27.

In conjunction with the guidance towards efficiency in the plans drawn up by developers, the overall guidance affects the dwelling typology, particularly in lamella



house types, which are the most common types for housing in Finland. The ridge height also fixes the number of floors and is generally defined in planning by the minimum floor height that the industry uses as a mainstream.¹⁴² If the local plan defines the side of the balcony sector, at the same time it determines the exposure of the dwellings and also affects the choice of apartment type. For flexible solutions and for developing a new housing typology, it would be beneficial not to define the building area or the floor height so tightly. From design objectives, planning should focus mainly on cityscape issues such as defining the block in the context of the city and streetscape, and should not direct the building area so precisely.¹⁴³ See Fig. 28.

Gross floor area definition and specifications for use of space

In planning, one of the problematic issues that has an effect on housing design is the precise definition of the gross floor area, the building rights, for a certain building area, which is defined in the planning documents. They can be defined even long before the building design phase. This is considered to be a very Finnish characteristic in the planning system, less widely used elsewhere (Interview 3).¹⁴⁴ According to the PEKA research, the second most common deviation was from the gross floor area of the building rights regulations for a certain building area. Regarding the multi-usability of the space, the problem also lies in the precisely defined use of space, also tied to gross floor area definition for all the different uses. In practice, this restricts those

¹⁴² In the report (Krokkfors 2016b) it was found that the minimum floor height was used in every single apartment block studied.

¹⁴³ This has previously generally been defined by pointing arrows in planning documents to indicate where the building should be attaching the boundary of the block. There might also be demands on inner courtyard organization but there should be potential for flexible solutions in those too, that would not tie the typology of the building to certain manifestations so exactly.

¹⁴⁴ Historically the gross floor area of the building rights has been very important for constructors and developers, because it has been linked to the potential sold square metres. Nowadays the developers do not focus on the amount of building rights solely, but also on the quality and branding of the areas, in which the pricing of the sold square metres is higher (Interview 4).

Fig. 27. The most commonly-used apartment house types in Finland (Neuvonen 2006).

forms of flexibility in which the housing space can also be used for something other than housing. The current practice of using a gross floor area-based definition does not encourage building high spaces either, that could be divided into several floors inside the dwelling, because usually the contractor or developer wants to build as many sellable square metres as the building rights will allow. Gross floor area as a parameter for defining space connected to the building rights does not then benefit developers and contractors who can sell fewer square metres in the volume of building. The cost of the site is usually also connected to the amount of building rights, which does not promote this kind of development.¹⁴⁵ To accommodate and promote multiple uses, classifying use of space could be done in a manner that allows some fluctuation between different building rights and uses, thereby making the solutions more viable for changing needs more spontaneously. This was one of the conclusions of the PEKA research project (Staffans et al. 2015). Change of use in general is very difficult at the moment under the Finnish planning and building control system.

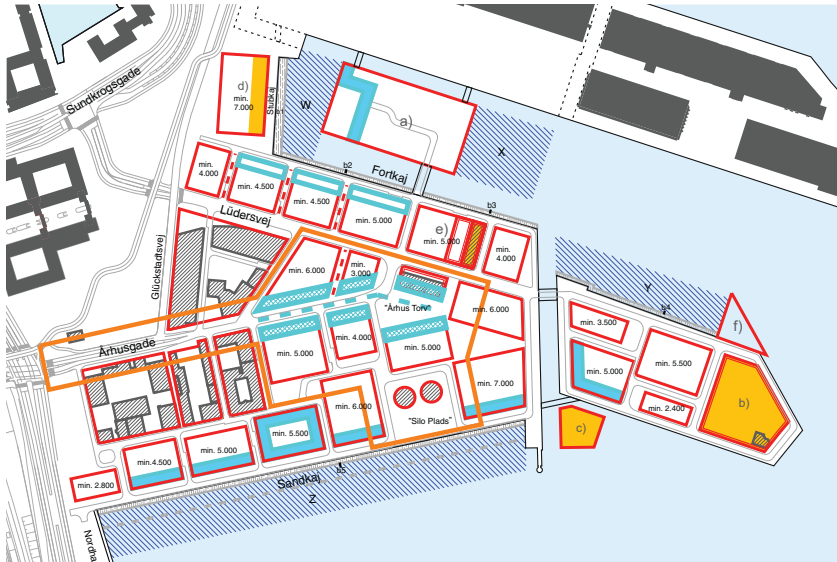
One solution for this, as well as the problem of defining building area that surfaced in the URBA flexibility working group, was to define the volume of the building in cubic metres and not in floor area, namely square metres.¹⁴⁶ The challenge for planning by volume in Finland, however, lies in the legislation and regulations, which use the square metre as the basis for financial aid (URBA flexibility working group). To change these parameters would mean refiguring the parameters for those as well. However, the introduction of cubic metres would very likely lead to similar tendencies as the square metre definition of building rights unless the tight building area definitions were changed. Probably the best practice would be to define the contours of the block in cubic form and disconnect this from exact building rights as well, which would be defined more precisely in the implementation phase. See Fig. 29.

A numerical indicator does not define the physical spatial realm so well. The issue could be handled in a manner that guides the procedure to find the best possible solution, not to define the end result as such. The building right would then depend on how high quality a scheme the developer can present for that particular site. Different solutions can have very different manifestations and qualities, even if the numbers are the same. This kind of procedure is more common in Anglo-Saxon practices where planning and implementation are more intertwined with each other. A master plan is then used as a tool to define the basic parameters and strategies for urban space and planning.

As mentioned before, in Finland the gross floor area regulations are also defined differently for different building types. If the building type changes as a result of flexibility over the life span of the building, the possible change concerning building rights,

¹⁴⁵ This is common practice in Helsinki, which owns a lot of land. Also, in general the value of the land is based on the amount of building rights.

¹⁴⁶ The idea, according to members of URBA, originated from the city planning office of Helsinki.



BUILDING PLOTS, FUNCTIONS AND PRESERVATION

- Building plots
- Building plots with tall buildings
- At least 75% of the building's floor area above ground floor level must be housing facilities
- At least 75% of the building's floor area above ground floor level must be housing facilities in at least one of the three plots indicated.
- At least 75% of the building's floor area must be housing in at least three of the plots indicated, so that there will be housing facilities on at least one side of the entire dotted line.
- Possible connection between building plots
- d) Building plots subject to special regulations
- min. 5,000 Minimum floor area in the building plot in question.
- Facilities open to the public in some parts of the building
- Retail zone
- Wharfs
- Building to be preserved
- Areas zoned for water activities

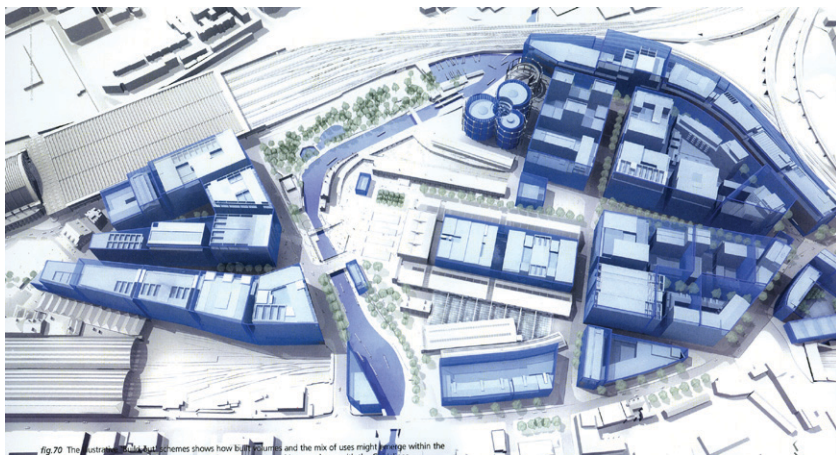


fig 70 The extra-plan view of the schemes shows how buildings and the mix of uses might emerge within the

Fig. 28. Example from Inner Nordhavn local plan, Copenhagen. The blocks are defined, but all other aspects are more strategic in character (Nordhavnen 2012).

Fig. 29 King's Cross area master plan by Allies and Morrison Architects, 2008. The blue contour boxes define the block and where the buildings should be located. It gives some clue of the volume but does not dictate type and typology of the building.

for example exceeding them, does not encourage this kind of change even if the volume stays exactly the same. For example, if the inner stairs of the townhouse turn into a stairwell and the building is understood as small apartment building, this affects how the gross floor area is calculated. Also, certain planning regulations like relating to an AP (terraced house) can limit the use of more dense, European-style townhouses of 2–3 floors, in which the floors consist of separate flats. As regards secondary objectives of using space, the way the definitions and regulations are drawn up, greatly affects the development of typology and flexibility.

THE GUIDANCE ON OTHER USES THAN HOUSING

Particularly in big cities in Finland, planning regulations as well as building control's special guidance directing common spaces, greatly affect the appearance and functions of ground floors.¹⁴⁷ The building of common spaces has become very uniform in their character. This is partly caused by the specific relict in Finland of building bomb shelters in apartment block buildings. These are usually situated in ground floors because of the cost effects of building cellars (Krokkfors 2016b).¹⁴⁸ This usually leads to situating storage space inside bomb shelters because these do not need windows, making the ground floors very numb and blind and with no connection to the street Fig. 30.

These spaces for bomb shelters cannot be changed to other uses later on either, because the outer walls are usually load-bearing element construction walls comprising no windows. The execution of commercial or any other space than housing on the ground floor, or for the organization of any other kind of common space, does not happen unless the construction is specifically required in the local plan (Krokkfors, 2016b). The ground floor defines then the character of the building and also immensely affects the street space and its use. To ensure lively ground floors, planning regulations have been forced to define the other uses that the buildings should comprise (Krokkfors 2016b). However, there have been problems with finding small-scale businesses to occupy these spaces. There are international examples of regulation, as in Copenhagen, that demand that all ground floors should be flexible, be as high as 4 metres and contain big windows to be able to change uses even if they are currently used for housing (Nordhavnen 2012). Because the Finnish system does not make it easy to

¹⁴⁷ The instructions by building control define quite precisely the common spaces such as personal property storage, bicycle, sports equipment and baby carriages, laundry and drying, clubroom, cleaning cupboard, management space and the sauna department. They are indicative but in practice because of the building control instructions it is regulatory, giving the sizes of these spaces with an accuracy of half a square metre. To the normal 5-floor lamella-type building the ground floor area goes according to these instructions to common areas, which to a great extent are situated in the mandatory bomb shelter. Even though building a cellar would solve this problem it is considered usually very expensive and not built, so the ground floor is then used for storage and other secondary servicing spaces. (Krokkfors 2010).

¹⁴⁸ There are also local planning solutions that built area bomb shelters, like Jätkäsaari in Helsinki, which has much less effect on the building typology.

make changes in uses over the life span of a building, the high potential of the ground floor for mediating between housing and other use, is often lacking.

PARKING

In master plans the car parking is usually defined very precisely, in terms of extent and location as well as form, that is to say, whether it is at ground level, in a parking garage above or below ground level. The amount of parking is connected to housing, for example, through regulations defining that there should be space for 1 car per 100 m² of dwelling space. The strict parking regulations usually also restrict housing solutions because the typology of the building can be restricted by the parking solution defined in the local plan. This can also in some cases limit innovative solutions in building design as well. There is, however, a tendency at least in the planning of Helsinki, as there is internationally, to plan new areas near city centres with less car parking and to promote the use of public transportation or car sharing practices. Also, the new technological developments in robot cars will most likely change the logic as to how we will use and own cars in the future (Hs.fi 2016).

It is usually parking solutions that are the deviations that the developers are most willing to pursue even though it involves time and investments. This is because the financial benefits of not building parking garages are easy to calculate.¹⁴⁹ The siting and quantity of parking affects not only the economics of the building design but also the character of the whole area extensively. The parking breaks up the cityscape, but on the other hand cellar parking is considered rather expensive. The PEKA projects showed, however, when they studied the parking solutions of the Kalasatama area of Helsinki that definitions of the number of car spaces per dwelling square metres do not reflect the reality (Staffans et al. 2015). It also revealed a piquant detail, namely that some people living in car-free blocks did own cars but parked them in other areas of the city. In the systemic context of different parameters linked to parking, the public transport and inhabitant profiles define the need for parking more strongly. During the life span of the built environment the need for parking also varies, something which was reflected in the Kalasatama simulation model of parking (Staffans et al. 2015).¹⁵⁰ This means that the definition of parking should also be conveyed in a manner that such changes can be taken into consideration in a flexible manner, such as being able to use the car parking for other uses when its demand decreases.

¹⁴⁹ In the Jätkäsaari case of the PEKA project the full deviations mostly concerned parking solutions.

¹⁵⁰ After the execution of a new area, the demand for car parking is usually higher and decreases slowly, at least outside city centres where the areas are profiled to certain inhabitant groups. Usually an area is first inhabited by young families; later, when the children move away people use fewer cars because there are also fewer people inhabiting the dwellings in general. (Interview 3)



TOWARDS PLANNING DEVELOPMENT FROM THE POINT OF VIEW OF BUILDING DESIGN

One more very influential demand in planning that affects housing type and design is the average floor area of a dwelling required by planning regulations or as a general strategy of the city. Under the current understanding of dwelling this directs the housing type and the dwelling sizes within the block. The origin of this demand has been the concern about the lack of larger flats for families. This regulation has been the result of a situation in which it was more profitable for the developers and constructors to build smaller flats, and this has led to homogeneous inhabitant profiles. This need to build small dwellings has also been obviously caused by the high price of housing. However, the length of time from planning to execution can be long in Finland and the predictions stated in local plans for average floor area do not necessarily reflect demand at the execution phase. Thus, even though the objective of the regulation has been well-intentioned and also seen to aim at increasing the amount of space per person, it can also backfire. Furthermore, on being left with unsold dwellings, the developers have criticized the average floor area requirement, on the grounds that the markets are not predictable and have not corresponded with the visions in planning.

Flexible dwelling sizes within the building context could also solve many problem connected to average floor area demands. Flat sizes could be changed so they could follow emerging needs and would not need to be as precise as they are at the moment. It would also promote resilient development and the same objectives as the average floor area for dwellings aims to. Even from the wider viewpoint of the social sustainability of areas, the possibility for flat sizes to change over the life span of the building would be a significant improvement to the current situation. In the systems thinking context, using the concept of “average” usually shifts practice on a non-resilient track because the regulating does not address the real causes of the problem (Walker & Salt 2006).

Fig. 30. Streetscape from the Latokartano area of Helsinki.

It can even bypass the sustainable solutions that could be created in the more strategic approach to building design that would produce diverse ways of handling the problem. It is, then, crucial that the flexibility is made easily applicable and perceivable, so that it can come into use one day.

The conclusion of the URBA flexibility working group was that planning and its execution have an immense effect on flexible solutions and their emergence. In the Finnish context as mentioned before, if the local detail plan does not allow for it, the realization of flexible use is very difficult. This is the case particularly if flexibility is a characteristic incorporated in the typology of the building. Both the URBA project and the PEKA project discussed a two-phase planning procedure that is closer to the Anglo-Saxon model, in which the local plan phase is more strategic and the second phase of execution is intertwined with the planning phase more clearly. The aim is then to enable new ideas and spatial innovations within the boundaries of planning and execution. The PEKA project, which studied the Finnish planning system, proposed new processes from planning to execution, whereby it would not be necessary to apply for permission to deviate from plans and where innovation in the building phase would be possible. There are several approaches being applied in other countries, ranging from rule-based planning to the application of more strategic master plans. In Finland, the PEKA research project studied the rule or principle-based planning. The underlying idea is that as the future cannot be predicted, master plans should be processed without laying out the physical content of the plan so precisely or restricting its development during the course of time.

Rule-based planning has usually been strongly linked either to simulation models that can effectively portray the different expressions of a physical environment, or to testing different scenarios with the help of the extensive computation capacity available today (Staffans et al. 2015). These simulations do not usually comprise the typological context of the building, also because typology is so closely linked to the complexity of the building design, which is the key to adaptable solutions of the building stock and very much dependent on design skills of the architect. If the building design is used it is usually based on existing, most commonly used building types. Rule-based planning and its simulation can also be seen to reinforce existing tendencies in the built environment if it uses parameters drawn from existing housing typologies, just as is usually done in planning practice.

What rule-based planning can offer at its best to the design processes of buildings is that it would be much more economical, and easier, if there were no need to have deviations from planning regulation at all. Housing typologies could be guided within the demands of the cityscape as represented through more strategic planning guidance and in a way that would allow the typology of buildings to promote flexibility throughout the whole life span of the building. In the present Finnish system, efforts have been made to fix the problems that have surfaced by tinkering with and

optimizing the detail of the regulations. However, the problem is much more structural and therefore would require restructuring of the processes (Staffans et al. 2015). The system could at its best help the designers to concentrate on finding the best possible solution instead of just following regulations that do not really fit the desired building typology. The introduced 2-phased planning procedure for local plans in PEKA was based on earlier suggestions made by planners (Interview 3), as a more strategic general plan – a “principle plan” – that would be the basis for planning initiatives – and this would then be zoomed into “project plans”, closer to implementation. This could occur in co-operation with the developing body under the supervision of planning officials. Resources could be allocated at the appropriate time to better meet the objectives of resilient building design.

THE CHANGE IN OVERALL BUILDING CULTURE

The overall building culture also has great relevance in the way flexible solutions can come into existence in housing production. In the stakeholder interviews (Interview 2, 3 and 4) a significant number of interviewees called for some kind of cultural change across the whole operating environment, which could contribute to the creation of one that would be more discursive. Projects have changed during the past decades and become much more complex and multifaceted in character, but this situation is not really reflected in the processes (Interview 2). As mentioned before, creating a more discursive culture with the help of some sort of facilitator could also contribute to the formation of objectives and visions (Interview 2).¹⁵¹ It could make it easier for stakeholders to commit themselves to projects and make their objectives more open and transparent, if discussion is based on constructive argument and all the relevant actors are involved. At its best, a discursive culture could also promote trust between the stakeholders and help them work towards shared goals, or at least the visions and objectives of the various actors could interface within the project and thereby foster mutual learning.

Most of interviewees (Interview 2) longed for very ambitious structural changes in Finnish processes from planning to implementation. They were afraid that just

¹⁵¹ The operation of CABE and its urban panel work in the UK improved local democracy and quality of projects. This happened when pressure by local actors and their financial interests resulted in increasing pressure on local authorities. CABE was able to support local planning offices to hold onto the sustainable and high quality solutions. Also, CABE was able to convey information from similar projects and their solutions from one location to another, which helped local authorities to avoid mistakes elsewhere. Even though CABE had no decisive role in the process, its presence was obligatory in all significant projects. This is why its viewpoints were listened to with sensitive ears, even though the decisions were made locally. Although there has been also criticism by some developers and media targeted at CABE over its evaluations, many stakeholders have appreciated the information and insight, which has been transferred from project to project through CABE (Interview 1, Krokfors 2011b).

tinkering with the process and creating a new facilitating stakeholder¹⁵² without altering the whole system would make the processes even heavier and more bureaucratic (Interview 2). A more integral linking of planning, building control and stakeholders involved with implementation would also necessitate changes in the structure of the urban panel operation, which works presently within the building controls in Finland and thus operates in a very late stage of the whole process, even though there are efforts to conduct similar actions in much earlier phases of the project.¹⁵³ The interviewees emphasized (Interview 2) that the structural changes should be implemented in a manner that would not demand disproportional resources for the planning and building control administrations.

The biggest challenge lies, however, in the time span of the scope of intervention between the different stakeholders. Whereas cities can be more long-term in their operations, private stakeholders usually operate on much shorter time spans. A very important feature in this discussion is how short-term financial objectives can be fused with long-term objectives for the area development. A good example of a long-term developmental focus is the Nordhaven development area in Copenhagen operated by By & Havn, as mentioned earlier (see page 184). Its focus covers a time span of 50 years. To stretch the scope of private business enterprise further would demand new ways of conducting production and developments in risk management, which to some extent is taken over by the city, like in the Copenhagen example, through their elongation of profit-making aspirations to extensive time spans, however, at the same time being prepared for unpredictable socio-spatial changes.

2.3

NEW RESOURCES CREATED THROUGH SPATIAL PROCESSES

C

An extended understanding of human resources makes us face the fact that the built environment also contributes to the use of human resources. The information age promotes new potential for “unleashing the power of the mind” (Castells 1996). The internet and the variety of mobile devices available today give us new freedom and possibilities to live in and affect our environment. How could this state of mind

¹⁵² The answers of the interviewees were in the context of creating a similar body to CÅBE as part of Finnish production processes.

¹⁵³ A similar panel working in the context of Hitas projects was conducted very early on in the project. Hitas is a name for a special type of owner-occupied housing developed in Helsinki, in which the buildings are built on land leased from the city. The city negotiates the contract price after the bid for the construction with several contractors. The inhabitants pay a lease every month to the city, but the cost of the construction is generally cheaper than in market housing. The members of the Hitas project come from the local authorities of Helsinki (Stat.fi 2009).

become spatial as well concerning one's own living condition? It is particularly suburban spatial contexts that lack significant ways of affecting personal living contexts that appear rather far from the proactive way of understanding human resources. When we think about how novel spatial solutions could best promote the self-conditionality of space in all contexts, the shortcomings in the production of built environment come to the fore. Then the question arises as to whether the built environment should be seen in a much wider scope as a more significant resource than before. So far space has been seen merely as a resource in economic terms, either as capital in real estate or in the general economic terms of boosting industry and the national economy (Gottdiener & Hutchison 2006 : 30–31; Hankonen 1994), both with a very short term perspective. Could space also be seen as an instrumental resource springing from human resources as a result of self-organization in its spatial terms? The local service economy that Jackson (2009) is also calling for means reorganizing the spatial premises of cities. It would require locating new service enterprises and social innovations in a rather spontaneous manner. Space would need to be produced differently in general to be able to promote more unprompted bottom-up ways of providing services and new ways of taking possession of the city. There are potential benefits to having a small business venture as part of a flat, work-space, small internet show-room or space for services produced for neighbours as such or as part of a sharing economy, or making it possible to accommodate changing and temporary spatial demands in the future. This kind of possibility does not yet exist in the vast majority of existing buildings because the intended use of spaces is fixed for housing purposes. Making changes is laborious both in terms of physical solutions as well as bureaucratic procedures.

“Space is luxury” as the title of the AESOP conference organized in Finland 2010 stated. We can no longer afford to waste it and continually replace it when it ceases to serve emerging aspirations. Neither can we base our production of space on wishful thinking – how we would like a space to function. It should be based on more resilient and long-term starting points that understand the unpredictable. This means that the spatial understanding of “housing” has to be rethought. Most likely, space will not be so tightly defined as housing or some other use in the future as it is today, but will put the emphasis on the quality of architecture and its transcending temporal capabilities.

RESILIENCE THINKING IN THE PRODUCTION OF NEW SPACE

Adopting new ideas is not easy, but usually necessary, as Walker and Salt (2006) state. Resilience thinking helps us to perceive in what way spatial production could be developed. It helps to perceive the world as it operates instead of how we suppose or would like it to operate, and it helps to set objectives for sustainable spatial development. To be able to understand systemic change we must accept the notion that how we guide

and lead the processes does not necessarily lead us to a resilient future. Even though at present the processes look adequate from a certain angle, in the long run they might not be that. This means rethinking ways of perceiving change in general in design. Understanding adaptive cycles increases insight into why and how systems change, and it helps us to develop the capacity to manage the system's resilience (Walker and Salt 2006 : 95). But for that, the capacity to ask the right questions and implement change is crucial (Walker and Salt 2006 : 114). From the resilience thinking point of view, the question of sustainability becomes:

[...] what kind of system regime do you want to be in [...] and] how do you manage the system so that it avoids thresholds and collapses? (Walker and Salt 2006 : 118)

The capacity of a system's resilience is known as adaptability. This can be interpreted in the built environment as how to avoid building so that there is no need for demolition, which in the long run furthers unsustainable development and the loss of natural resources. As noted before, the options are to move the threshold, to move the current state of the system away from the threshold or to make the threshold more difficult to reach (Walker and Salt 2006 : 119). Dealing with the threshold of the system means building resilient adaptable space that does not need to be dismantled but can be used in other ways without making excessive changes to the building, which in turn encourages the ecological development in general. If the system is stuck in an undesirable state (basin of attraction) then it might be best to transform the very nature of the system so that it can avoid collapse (Walker and Salt 2006 : 119).

Resilience is often ignored because maintaining it comes at a cost (Walker and Salt 2006 : 119). But it is important to seize the window of opportunity when it opens, when the change is easiest according to an adaptive cycle. This does not come without investing extensive resources on changing the system. The most apt approach, based on resilience thinking, for innovation and the ability to spot new possibilities, usually involves skimming the cream off the markets before the adaptive cycle moves into conservation phase, the phase which is linked to maintaining the system (Walker and Salt 2006). This kind of development and changing of the system is, however, quite difficult, given the characteristics of the current processes. Structural changes in the processes of producing the built environment are, however, least expensive and easiest to implement in the release phase of the adaptive cycle when new ways of doing things and innovation are emerging. The conservation phase can nevertheless also lead to a collapse of the system if the resources that were available in the past become unavailable for the future. This is very much the case at present, with both natural and economic resources diminishing. So, to avoid the collapse, the structures of the processes need rethinking and conscious implementation.

The ability to tolerate risk, and society's capability to make risk-taking "gentler", are important factors in the evolution of built environment processes. In the production of the built environment, both the authorities and the producers have been characterized as limiting experimentation and favouring lines of action that sustain procedures and products as before. This has been generally considered good risk management and a safe solution, because the procedures are tested and working (conservation phase). Unfortunately, this kind of approach can, in the wider context, prevent all development, because the system does not encourage innovation in its various forms and so will curtail progress in housing solutions. For innovation to occur and risk-taking to be smoother, the objectives must be redefined and the production culture reorganized.

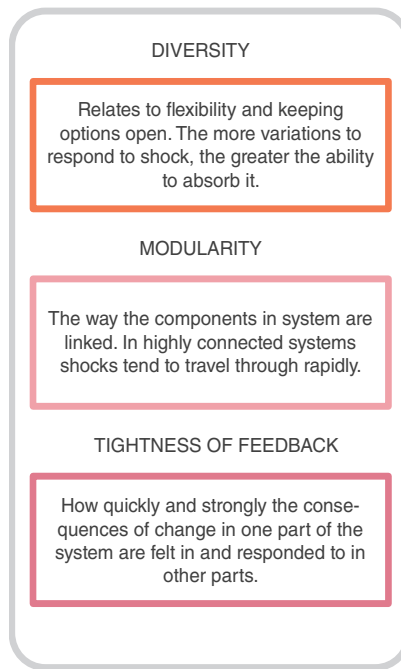
GENERAL AND SPECIFIED RESILIENCE

It is important to define the key variables for resilience in designing and producing the built environment. However, this is not nearly enough; resilience thinking needs to go beyond just managing for variables and disturbances, which are very specific in their nature (Walker and Salt 2006 : 119–120). This can be seen for example in the optimizing of the key components in the system, the regulations and other guidance based on measurable dimensions and specific aspects.

There are two kinds of resilience that needs to be dealt with and it is important to manage them both. They are called specific resilience and general resilience. Specific resilience deals with known disturbances. General resilience, on the other hand, is the system's capacity to absorb unforeseen disturbances such as changes in market logic or people's needs. See Fig. 31. For example, we cannot predict the needs for dwellings or space in the future, or how future markets might allow people to invest in space. In general resilience, three factors play important roles: *diversity*, *modularity* and *tightness of feedback* (Levin 1999).

According to Walker and Salt (2006), **diversity** refers to the number of species, people and institutions that exist in social-ecological systems. The term can be widened to understand anything else that tackles the socio-ecological systems such as the built environment that creates the conditions for social interaction to happen. Diversity relates to flexibility and keeping your options open. The more variations there are available to respond to shock, the greater the ability to absorb it. Increasing efficiency, such as by determining how many dwellings should be entered from a stairwell landing, usually leads to a reduction of diversity, as can be observed in executed housing design and production that are very similar to each other (Krokfors 2016b).

GENERAL RESILIENCY



Modularity relates to the manner in which the components that make up a system are linked. Highly connected systems imply that shocks tend to travel rapidly through the system. A degree of modularity in the system allows individual modules to keep functioning when other modules, loosely linked to them, fail, and the system as a whole has a chance to self-organize and therefore create capacity to absorb shocks. An example of this is when certain kinds of dwellings exist somewhere in the city structure, but not where they are needed, so they can be considered loosely connected modules.

Tightness of feedback in turn refers to how quickly and strongly the consequences of a change in one part of the system are felt and responded to in other parts. Walker and Salt (2006) state that institutions and social networks play key roles in determining the tightness of feedback. According to them, centralized governance and globalization can even weaken feedback. This can be understood, for example, in how guidance and regulation direct the size and context of dwellings. As feedback times lengthen there is an increased chance of crossing the threshold without detecting it at the right moment (Walker and Salt 2006 : 121). To avoid this, we need to invest in building adaptability on all levels. Resilience is a tradeoff of short-term profits and long-term persistence and reduced costs from crisis management (Walker and Salt 2006 : 123).

Fig. 31. Diagram of general resiliency.

Resilience thinking is about weighing up options, keeping options open and creating new options when old ones close. (Walker and Salt 2006 : 140).

There will be more people with fewer resources on a planet that is losing its biodiversity and ending up with shrinking options. A resilient world, however, promotes social capital and innovation, which can be also social and spatial in character, affecting socio-ecological systems. At the core of innovation lies learning and experimentation (Walker and Salt 2006 : 140).

Invest in building adaptability [...] and promote (do not hinder) experimentation and learning. (Walker and Salt 2006 : 123).

The way we currently understand efficiency and optimization in building design is actually leading us away from that path. This is why we should rethink how efficiency and optimization are executed in housing production, in spite of the fact that they have been the corner stones of housing production for decades.

THE REDEFINITION OF OBJECTIVES FOR DESIGN

Developing new approaches and enabling change in design culture depends largely on the development of processes and an understanding of resilient action and its potential implementation. The processes should enable new objectives and approaches to be continually developed in design. What is significant is to understand the logic of creative work and its capacity to expand the outcomes of a resilient environment.

One very meaningful and significant enabler of the approaches is to develop viewpoints and practices in planning, as discussed earlier, and not seeing plans as final products but instead as a strategy for implementation. This is based on recognizing the fact that spatial innovations are mostly created at the implementation phase, not in the planning phase. This can also mean radically changing the ways we execute planning in Finland. In those cities where resources have been scarce, as in Vantaa (in the Helsinki Metropolitan area), the tendency has been to promote more flexible planning regulations (Interview 4). But flexible planning regulations differ somewhat from a strategic approach as a vehicle of flexible solutions. They might even be mutually contradictory. It is a fine line of difference but a very meaningful one. For a developer, flexibility could mean the ability to deviate in terms of quality, whereas for society in the strategic context it is more a question of making the process smooth by taking decisions in timely phases and, of course, creating a resilient environment. The flexibility that the built environment embodies through its whole life span can be result of flexibility that is based on the strategic character of the local plan, which in turn allows the adaptive character of the built environment to emerge as intrinsic to it.

So, in the best case, the flexibility of the process enables the flexibility of the built environment to emerge, but there is no single path from one to another without quality control and conscious implementation.

If the production system is self-correcting in character, there is no need for poor solutions and continual deviations just because the local plan does not allow better and flexible solutions to emerge after the planning phase. Self-correcting refers to a process by which the starting points of the master plan and local plan do not define how objectives should be met, but rather implementation can be reached in various ways that promote adaptive solutions, expanding the possibilities for innovation in other sectors of society also. So, a plan should encompass two goals: on the one hand, it should enable different approaches to implementation (short-term) while, on the other hand, it should help create an adaptive built environment on the site under implementation (long-term). The creation of adaptive built environments is also a question of policy making that recognizes its importance and has the will to implement those policies.

The production of self-organizing space demands, to some degree, the abandonment of the efficiency requirements of floor plans, particularly those concerning circulation space and structures (Krokfors 2006b). The dwellings produced today usually have only one entrance and their boundaries are usually very precisely defined by the structure, which is fixed (Krokfors 2016b). In the production of self-organizing space, a very important issue is variation potential in spatial configuration also on the building level. Within resilience thinking, together with the urge for adaptive solutions, lies the idea of producing diversity, which from the point of view of self-organization, means different possibilities to reorganize spaces in connection to each other. This can be created, for example, by having several entry or connection possibilities to the space. A certain kind of ineffectiveness at one level can produce spatial configurations that promote a high level of flexibility at another, based on abstract modularity that promotes differentiating use of space. This can also put pressure on semi-public circulation within a building, which usually affects exactly the spaces that the developers and contractors want to minimize for the sake of efficiency and profit.

Walker and Salt (2006) see the tendency for effectiveness and optimization as understood today as the very opposite of what is needed for creating resilience and sustainability. Because of the high cost of housing, optimization and effectiveness – to the finest details – have become a driving force in housing design. Architects are educated to make effective floor plans that are understood as economization of space and make it appropriate for certain uses. It is of course appropriate to produce spatial arrangements that do not waste space unnecessarily, which is usually considered bad design, but there is a difference to the forms of effectiveness presented here. The effectiveness should be approached by the notion of what kind of variety and diversity it can create as a consequence. If optimization can only produce one way of use, and

if it does not promote diversity, it can work against resilient solutions and waste resources or even push the produced built environment nearer a threshold in the future.

To reach resilient long lasting solutions there is a need to shift the focus from perceived space to lived space with the help of conceived space. Lefebvre (1991) emphasizes the self-expression of people in spatial terms and talks about these moments as liberation from alienation (Cit. Shields 2002: 10). For Lefebvre, alienation is a result of how we produce space and that is a result of societal, political-capitalistic action based on the production of added (financial) value. According to him, the new spatiality means to shift the notion of equilibrium from perceived space to lived space. Shields has interpreted Lefebvre to the effect that the adoption of lived space is a medium whereby its revitalizing potential can be harnessed to redirecting the perceived space of everyday practice (Shields 2002 : 15). The concept of lived space refers to the questioning tendency, which has the possibility of going beyond conceived space – the theoretical space formed by professionals (current production processes). The emergence and formulation of new demands means new understandings of space as human resource and comprehensive changes within the processes for reaching the lived space.

In housing production, enabling creative potential through architectural design is connected to how the process as a whole is understood, namely as one that would have an impact on the development of new ideas and products, which also enable the development of a high level of quality and long-lasting solutions. The understanding of the creative impulse, which can be located at any phase of the process from planning to throughout the life span of the building, is crucial to it. The problem of the current state is that the architect's role as the interpreter of the strict planning guidance, the developers' financial objectives, and serving people and societies largely happens with hands tied, being unable to enable the adaptable solutions to emerge easily.

2.4

THE NEED FOR CHANGE IN DESIGN CULTURE

D

SHEPHERDING DESIGN

As the interview material reveals (Interviews 2, 3 and 4), much of the guidance on design in Finland is reflected in the quality of the built environment. Seen from the perspective of the processes and production, the one-sided and socially-poor building solutions are not necessarily caused by the lack of skills of designers but rather by the way the strict control system, operating on many levels, shepherds design (Krokfors 2010). It is also dependent on the resources invested in design. Under present processes, the creative process from which new solutions might emerge has very little room for manoeuvre. By the time all the guidance on housing design and implementation has been taken into consideration, the main lines of the design will have been sewn up – even before the architect responsible for execution has started to work on the building design. The stagnated situation of housing design has also started to affect the way in which architects themselves see their role in housing design in general, which is usually as mediators of generally accepted conditions of housing design (Interview 4).

Avoiding risks is one of the main motivators for housing production. The risks usually emerge when the developer or contractor experiments with a new approach to production, something that is further reinforced by the fact that in Finland experiments are usually one-off trials and do not generally develop into more viable business propositions (Krokfors 2010). New approaches in housing design and housing types, which might also make adaptive solutions possible, demand long-term work and initial investments before new methods in construction and design become everyday operations. A critical mass of practical examples is needed for it to be possible to perceive what might be achieved in housing design and production. Thus the role of innovative pilot projects, which can be also serially expanded, becomes significant. The opening and marketing of new solutions and special features is essential, so that inhabitants who are used to common housing production can see the relevance to their own needs and have the courage to acquire them. Very often the marketing sector in production organizations also shoots down the new solutions as “impossible” to sell (URBA flexibility working group).

THE MORE PROACTIVE ROLE OF THE ARCHITECT

To be able to develop flexible housing types in the best possible way, the architect has to have an influential enough role in projects in order to deviate to a significant degree from generally accepted solutions in housing design. For the development of the typology, the architect's role is essential right from the beginning. The architect creates the typology, but currently the architect's role is seen more as an applier of the parameters of design, comprehensively defined by the process. The architect, as well as the engineer, is too often considered a high-cost item and, as a consequence, their work is shepherded. So the designer's role has become more reactive in relation to the set objectives and boundary conditions, which the different parties involved in housing production have generated. The norm sieve concept developed by Puustinen (2010) portrays very well the one-sided solutions that penetrate the process when, at each level, alternative ways of approaching the design are diminished. The possibility to affect the contexts of the typology usually emerges through architectural competitions, which form, however, a small number of all housing projects.¹⁵⁴ In everyday practice, architects generally invest a lot of effort trying to turn a set of fixed objectives into good enough housing design, when a slight change of viewpoints and parameters at the beginning would facilitate finding the best possible solutions.

For the emergence of flexible and innovative solutions, the architect should already be involved at a very early stage, when the decisions are usually made that affect the spatial terms of the design. Alternatively, the process should be so flexible that it allows the typology to be developed at the implementation phase, as discussed earlier. In developer-led projects, a better understanding of the architectural profession and the utilization of its proactive capacity could also promote spatial innovation. The risk factor and profit margins, however, usually cut the wings off this kind of the development. In the present system of housing production, architects have become "facade acrobats" as Martin Pawley (1998) puts it, even though design could benefit people and a wide array of sustainability and resilient development issues in spatial and typological terms. In present processes and in the way the professional system operates, architects have drifted far away from the people they design for and have largely become copiers of generally accepted typologies interpreted as model mode of operation.

THE NEED FOR PARADIGM CHANGE IN DESIGN

It is rather easy to see that to achieve resilient space and culture change and generally in building culture there is a need for change in housing production practices. It is, however, difficult for the many actors that work in their own sectors to perceive

¹⁵⁴ New typologies particularly emerge in competitions that are not based on fixed local plans. The execution is, however, very often developed towards more conventional practices in housing production after the competition.

that their own actions as developers, as local and national stakeholders or as designers should be rethought. They often have no power of attorney to even do so. The other problem is the different objectives of the different segments of the developing organizations, can have conflicting views. As mentioned before, the marketing sector in developer organizations is not keen to apply new ways of doing things, although the more development-gearred sector in the organization may be willing to pursue it (Interview 4). This means a change in operational culture and realizing the short-term as well as long-term objectives simultaneously, as well as their systemic interrelatedness. The objectives for architectural design are always twofold; to take into consideration people's current needs, together with a comprehensive understanding of the sustainability of the built environment for generations to come, which concerns the long-term investments. It is also the case for developers that even though they can see the benefits of long-term investment in flexibility, the short-term business logic of viable business that they are supposed to fulfil often bypasses the long-term perspective. However, the developers who manage property once completed, or drive for better quality criteria and business with a long-term perspective, can it be easier to accept.

To fulfill all these diverging long-term and short-term objectives simultaneously, the architect needs more strategic approaches in design. New needs may however, only manifest after several decades. In the production process we do not consider solutions that will be implemented after such a long time span – we are most likely not even alive then. The safest way to gain this twofold temporal objective – short and long term – without considerable risk of false prediction, is to “programme” qualities into the building that will create potential for space to be self-organized in such a way that it will promote people's options for using space spontaneously from their own starting points at all times. At its best, a building would then have qualities embedded that also enable adaptation in the wider context of the city structure.

CHAPTER III



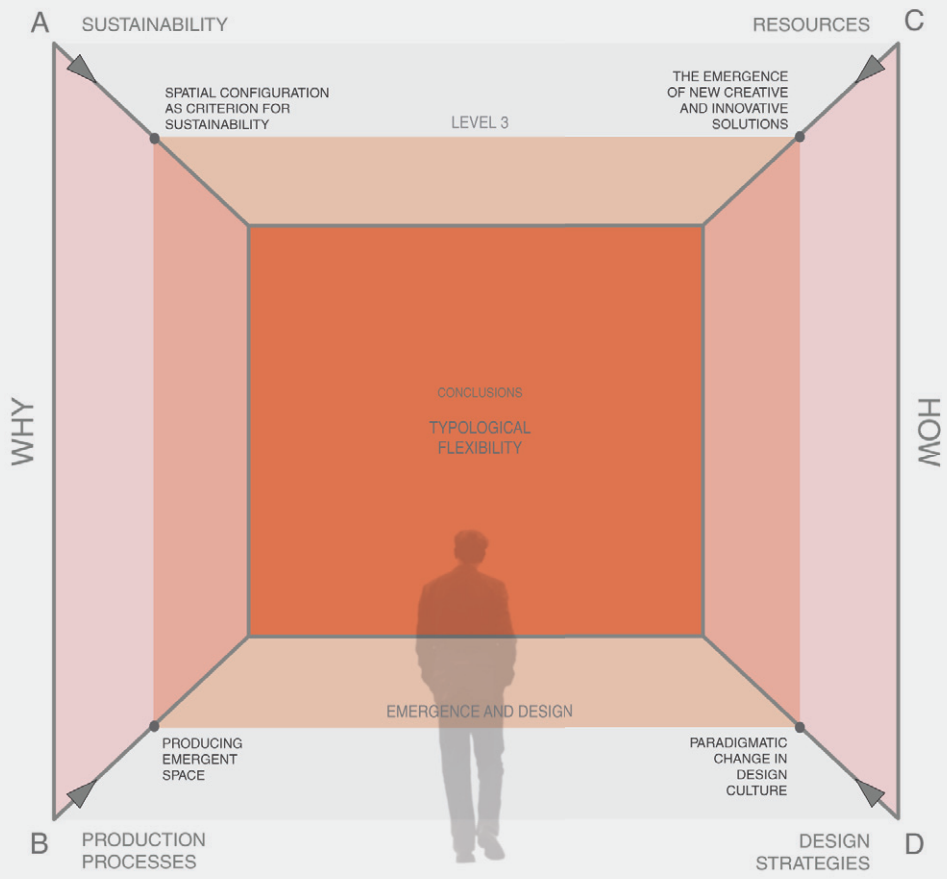


Fig. 32.

III EMERGENCE AND DESIGN

3.0 ENABLING EMERGENCE BY A STRATEGIC DIMENSION OF DESIGN

The previous chapter concentrated on examining the needs imposed on the processes of producing the built environment and how the processes should be developed in order to obtain a sustainable and resilient building design. This chapter, and level 3 in the framework, studies the already existing thinking behind this kind of approach, and asks how adaptable and flexible design strategies for housing could be developed further towards resilient objectives. The chapter dwells on what the different concepts of adaptability and flexibility contain and how they promote self-organization and emergence through space. As in in the previous chapters the strategic design dimension is studied through four viewpoints by understanding the contexts of sustainability (3A), the overall production processes (3B), the resources (3C) and design strategies (3D).

The examination of existing strategies and ideas concerning adaptability and flexibility emphasizes the background assumptions concerning conceived and lived space. The focus is on how the understanding of adaptability and flexibility could be developed into a more self-organizing direction that would promote the emergence of new social and spatial contexts shifting the focus onto lived space.

MODES OF PRODUCTION IN SOCIO-SPATIAL CONTEXTS

In studies on the different understandings of adaptability and flexibility the focus has rarely been on the different modes of production and how they can promote and assist the execution of adaptable and flexible solutions. This is most likely due to the fact that developer-led top-down production has been so prevalent. However, the mode of production can affect and be affected by the context of the production.

The emergence of bottom-up housing developments like co-housing developments, that to some extent existed in Finland before the industrial building phase in the form of cooperatives developing housing for themselves (Nupponen 2008), has also had an effect on housing solutions in spatial terms. As discussed earlier, there are two main ways of understanding the bottom-up processes that promote people's self-conditional living: either the people take the responsibility for developing the building themselves, or the self-organizing quality of the building is promoted through

design that supports the self-conditional use of space for the lifespan of the building. There are, however, processes of production, of which the top-down and bottom-up are mixed. For this reason, I have introduced a new category alongside top-down and bottom-up development, which I am calling *with-in* development. The concept of with-in refers particularly to the production processes that arise from the impulses inherent in the society. For example, it can refer to so-called prosumeric processes in the production of housing in which people themselves decide to some extent about the context of housing but do not act as developers. The bottom-up mode can, however, refer to the production of space, in the way that self-organizing space is also produced by the inhabitants, or only to the character of self-organizing space of the buildings. The difference is emphasized by using different phrases, namely the *emergence OF self-organizing space* and *emergence BY self-organizing space*. Nevertheless, during the life of a building the tenure types and uses can change many times. That is the reason why the self-organizing character of the building should not be tied to its tenure type or mode of production.

3.1

SPATIAL CONFIGURATION AS CRITERION FOR SUSTAINABILITY

A

THE CHARACTER OF SYSTEMS AND EMERGENCE

According to Capra (2002), and based on an understanding derived from ecosystems as self-organizing networks and dissipative structures, systems thinking can also act as a guiding principle for how we could build sustainable communities. Capra sees that one of the key insights in systems thinking is that the network is a pattern, which is common to all life (Capra 2002 : 9). Capra refers to social systems also as living systems. All biological life consists of cells. However, the understanding of the molecular structures is not a sufficient definition of life. Where conventional biological thinking is reductionist, blindly mechanical and sees organisms of molecular structures and individual organisms as the object of concentration, the real clue to understand living things comes from understanding the chemical systems and metabolism as a whole (Capra 2002 : 2-3).

We also need to describe the cell's metabolic processes – in other words, the patterns of relationships between the macromolecules. (Capra 2002 : 7)

All living systems are organizationally closed [...] but materially and energetically open [to continually produce and repair themselves] (Capra 2002 : 13). [...] open systems develop and evolve. Life constantly reaches out into novelty. (Capra 2002 : 14)

The system's view is holistic, seeing systems as living and cognitive networks rather than "click-together" collection of components.¹⁵⁵ A mechanical system works according to its instructions whereas a living system, because of its internal intelligence and complex feedback organization, reacts to the meaning it discovers in the information and evolves to its own response (Capra 2002). Capra sees that social systems create new kinds of contexts, which are intelligent and creative in themselves.

To explore the implications of viewing social systems as networks of communications, it is helpful to remember the dual nature of human communication. Like all communication among living organisms, it involves continual coordination of behavior, and because it involves conceptual thinking and symbolic language it also generates mental images, ideas, and meaning. Accordingly, we can expect networks of communication to have dual effect. They will generate, on the other hand, rules of behavior, in the language of social theorists, social structures. (Capra 2002 : 83)

He, however, reminds us of the difference between organic and social systems because in human organizations there are always both designed and emergent structures. According to Capra both are needed.

Social networks, too, generate material structures – buildings, roads, technologies, etc. – that become structural components of the networks. The structures are created for a purpose, according to some design, and they embody some meaning. To understand the activities of social systems, it is crucial to study them from that perspective. (Capra 2002 : 84)

Wheatley (1999) has studied systems thinking from an eco-philosophical point of view. According to her, life is made up of inventions, creativity, self-organization, order and functionality as well as the relationship between things and networks. Possibilities are created when people connect with each other, when it is possible to try things out in playful manner, to see the world in a new way and enjoy the new and exciting. Social context and interaction produce innovation (Wheatley and Kellner-Rogers 1999). Wheatley puts a lot of emphasis on co-evolution, collectiveness and interdependence. Interactivity leads to new constructions, possibilities and features that are beyond the explicit knowledge and formal structure available in each system. So that the new can emerge, we have to participate in an open and trusting way rather than adopting

¹⁵⁵ Op. cit. 21.

strategies and action plans and just implementing them. According to Wheatley, the vision is the force, not the goal. Systems should be open to new information and new ideas. In nature nothing happens in a predictable top-down manner. Change usually occurs very low on the local level, and often in many places simultaneously. Effects stay local until some connection is formed and change is forced at a bigger scale. We look for knowledge and not for information (Wheatley 1999).

REDEFINING OBJECTIVES FOR PRODUCING HOUSING: ENABLING EMERGENCE

The need for a resilient design culture means redefining the objectives of architectural design. If we take self-organizing space as a starting point, then the question arises: what is the character of self-organizing flexible space and its resilient characteristics that serve a self-conditional use of space and thus the durability of the building stock. Flexibility per se in its various forms does not necessarily always offer self-organizing solutions, so there should be objectives imposed on the ways of producing flexibility. Therefore, this chapter focuses on the thematic of flexibility in terms of design approaches and the different ways of producing flexibility. Flexibility will be examined particularly as to how the different forms of flexibility can contribute to social sustainability in its spatial terms. As concluded in the previous chapter, the enabling of the emergence of social innovation and operations of individuals is a prerequisite for the durability of the built environment, where the meanings it creates in people's lives is its significant characteristic.

SOCIO-SPATIAL CONDITIONS AS MEANS OF RESILIENCY

Dwelling types and the configuration of space have a great impact on the kind of inhabitant profiles housing districts have and on how the social fabric of the area is formed. As a result of adaptive and balanced development, areas have the potential to withstand time. As the demographics of the area change, the need for services changes, and the needs for new kinds of services emerge. It has been a very typical development in Finland, where areas are dominated by housing and services are few or in any case optimized for certain groups, such as services concentrating on schools and kindergartens. Particularly then, when an area does not include good local services and is situated far away from service hubs, it is only the people who have no other choice, because of financial or other restrictive circumstances, that move into the area. When the possibilities for meaningful interaction are missing and when the socioeconomic profile is very homogeneous, it creates situations that are ripe for social problems to emerge.

Because existing housing production has been taken for granted for so long, the effect of building typology on inhabitant profiles and the spatial potential for small-

scale services to emerge in a spontaneous manner, has not been emphasized. The socioeconomic viewpoint has emphasized the size and type of dwellings. The area can, however, withstand the one-sided typology if other parameters compensate for it. A good example of this is the Kallio city district of Helsinki, an old working-class area near to the historic city centre, which, despite several setbacks, has been able to be resilient in many ways. From 1960 onwards, Kallio was strongly shaped by developers who executed new infill housing that consisted of very small dwellings, because profits on small dwellings were much bigger than on large ones. As a consequence of its working-class history and development in the 1960s the size of dwellings in Kallio therefore tend to be very small, which has affected the inhabitant profiles, allowing mostly single people and young families to move into the area. The existing housing and building types, which include small commercial spaces with backrooms on the ground floors, has, however, played a major role in the attractiveness and the resiliency of the area. It has promoted the possibility of mixed use and cultural diversity in the area, in which the new small-scale commercial spaces have created a new public space for social interaction in the area (Ilmonen 2013). Because of the small commercial spaces, restaurants, cafes and its location in the wider inner city structure, Kallio has become today one of the most desirable areas (Ilmonen 2013). Kallio has been able to develop into a local living hub, in Sievert's (2003) sense, as a source of resilient community. The small dwelling sizes have been compensated by the "living rooms" outside the dwellings in the vicinity.

Today, global business does not necessarily require large spatial premises. Digitalization has changed the way small businesses operate (Mettler & Williams 2011). New small-scale businesses can turn their ideas into businesses with less risk and low investment, but with lower costs, instant scalability and no need for large, highly-trained and highly-paid workforces (Mettler & Williams 2011 : 17). Besides being local, they can also run their business on a transnational base via the internet. These freelancers and start-ups are driving growth through new jobs and innovation (Mettler & Williams 2011). Mettler and Williams argue that small business is no longer a liability but an important asset and advantage among bigger players through a new economy of micro-multinationals (Mettler & Williams 2011 : 19). This decentralization of economic power requires policies for new ways of doing and understanding business also in its spatial context. The present success of Kallio can also be derived from its spatial circumstances that promote small-scale business ventures. This kind of extensive affordable spatial potential is rare in new areas.

The physical environment can persist in a resilient manner through a variety of dwelling types, a potential for mixed use in different scales and adaptability in general. Location has a great impact on the development of the area, but it can be compensated for by spatial characters that promote diversity of social spatial contexts. But the situation is much worse in those areas that have not been able to lure people, that is,

that have suffered from a poor location in the context of services and other activities. Then, adaptability of space and the variety of use it promotes can make a difference for the resilient social context of the area. A more strategic approach is needed for those conditions in spatial production (Krokfors 2014), which would help people to be more proactive in their use of space and promote emergence of economic and social activity through the self-organizing spatial potential in buildings.

CONTENTMENT AND WELLBEING AS CRITERIA FOR RESILIENT SPATIAL DEVELOPMENT – THE CREATIVE DWELLER

According to Jackson (2009), in open societal discussion the indicators for quality of life are always negotiable issues. The essential indicators of wellbeing are also the psychological and social points of view in people's lives. Jackson is referring to the original definition by Amartya Sen (1998), who wrote that society should be understood in such a manner that all people should have some sort of basic possibility to prosper. Physical and mental health, as well as democracy, have an immense effect on wellbeing. Relationships between people, meaningful work and the possibility to take part in society are important issues, the decline of which is threatening the whole of society. The challenge for society is to create circumstances in which the basic rights mentioned above are made possible. According to Jackson, this means taking care of social, psychological and material conditions, such as the psychological wellbeing of people, as well as ensuring the sustainability of residential communities (Jackson 2009 : 69).

Underlying the self-organizing of space is the possibility for people to act autonomously and work out creative solutions without the need to continuously adapt to the space they live in. On the contrary, space should be able to adapt to their needs. When a person has the possibility to be active concerning her/his own space, it can benefit development towards the sustainability of the whole district (Wheatley 1999). If, by flexible configuration, people are given the chance to define the use of spaces in their own possession, this can also serve societal wellbeing in a wider context, in the form of encouraging emerging economic and social contexts as well as social innovations of all kind.

A similar line of thought has also been suggested by the architect Jonathan Hill (2003), who criticizes strategies that understand people as users – passive objects of design – and calls for a new kind of understanding of architecture and design.¹⁵⁶ Hill sees that the functionalism of the beginning of twentieth century was one of the most alarming developments of the modernist agenda. According to him, architects,

¹⁵⁶ Hill sees that even though the concept of the user has negative connotations, referring to architecture mainly through practicalities, he prefers it to concepts like occupant or inhabitant (Hill 2003 : 27).

basing their ideas on rather questionable scientific starting points such as Fordism and Taylorism, saw the user as predictable and obedient (Hill 2003 : 17). Hill defines three types of users: *passive*, *reactive* and *creative* (Hill 2003 : 28).

The passive user is consistent, predictable and transforms neither use, space nor meaning, weather performing useful tasks according to functionalist principles, following the sequence of spaces directed by the architect, or contemplating as an artwork. The reactive user modifies the physical characteristics of space as needs change, but must choose from a narrow and predictable range of configurations largely defined by the architect. The passive and reactive users are dependent upon existing conditions, which they are unable to fundamentally transform. With role as important as in the formulation of architecture as that of the architect, the creative user either creates a new space or gives an one meanings and users contrary to established behavior. (Hill 2003 : 88)

For Hill (2003) it is the *creative user* who should be the central concern for architecture. Hill argues that the way architects conceive of the user affects the way they design (Hill 2003 : 3). For him, the new way of understanding the architect's and the user's roles carries the potential to develop new architectural strategies that recognize the creativity of the user (Hill 2003 : 4). Applying the idea of Hill's creative user, I have, however, wanted to resign the concept of user all in all and replace it with the concept of dweller, thereby understanding the creative user as the creative dweller. This is because the concept of user can also be seen as a rather one-sided understanding of people and living by hinting at consuming.

3.2

PRODUCING SELF-ORGANIZING AND EMERGENT SPACE

B

There are different ways of implementing self-organizing and emergent space as a context for the creative dweller, and these also affect how the space enables ways of being creative. It is important notion therefore to study the different modes of production and how they can promote the emergence OF space and emergence BY space. This bottom-up or self-organizing character of space can be produced in all forms of developments through top-down, with-in and bottom-up modes of production. No matter what circumstances give rise to space, the objective is that people become the co-creators of that space. The different modes of production presented next refer to all kinds of material and immaterial emergence through the self-organizing qualities of space that continue during the lifespan of a building.

TOP-DOWN DEVELOPMENT MODE

EMERGENCE OF SELF-ORGANIZING SPACE

Nowadays most housing is produced in a top-down manner. It is only one-family or detached housing, and some still marginal co-housing developments, that fall outside of this category in Finland. Top-down professional production is generally based on profit-making, nowadays also including to some extent the social housing developers.¹⁵⁷ For those developers and contractors that do not manage property, all their profits have to be made in production, which emphasizes the short-term viewpoint that does not consider the life of building after execution. Currently they do not see the potentiality of self-organizing space as being viable for themselves. However, for those developers, generally in rental markets that manage the property after the execution, there might be interest in producing self-organizing space. This could be possible if the self-organizing tendency of buildings would also simultaneously promote the easy management of their property and particularly if the spaces would always be in efficient use, and changes from one configuration of dwelling into another would be easy to perform. Nevertheless, the short-term focus of investments usually hinders the long-term objectives within the building sector. The paradigmatic change in production towards producing self-organizing space might mean investing extra resources in the design as well as in the implementation while the new approach is being de-

¹⁵⁷ This has also started to concern social housing to a great extent because in a short period of time the number of non-profitable actors has decreased in Finland. Many of these actors today have changed their operations on market logic in the rental sector, where the same tendency to seek profit has also been emphasized.

veloped. At least in countries with one-sided industrial housing production it means cost pressures in implementation.¹⁵⁸ It would also mean changes in policies to force the change. Furthermore, the risks in new solutions can always materialize, for example, if a development fails to attract interest. If developers can also handle risks in one way or another, it is much easier for them to take part in producing self-organizing solutions. One of these risk-reducing factors is that they can change the sizes of dwellings, reflecting demand, even at a later stage of the production process. Here the objective is connected to the reduction of the risk of ending up with unwanted dwellings, because flexibility in the dwelling sizes as part of the self-organizing solutions could handle unpredictable markets and the change in demands.

Another way to manage risk in production is to have it partly dealt with through the help of some other party, for instance cities that allocate sites to developers for new experiments in self-organizing solutions. Unfortunately, in Finland this way of promoting innovation has not yet really produced diversity in typology or flexible solutions, partly because of its modest scope and the lack of coherent guidance and auditing or policies in the form of regulations. The top-down category will most likely at least in the beginning consist of developers that own the real estate after the production and can perceive as well as understand the benefits that self-organizing space has on the management of the building.

Concerning the self-organization BY space in the top-down mode of production, the inhabitants will, as earlier, be the customers who buy or rent the dwellings, but what they gain is a better way of affecting their housing and living solutions by innovative design. However, the rental market sector might not be willing to give the inhabitants very broad scope to affect the dwelling solutions unless the markets develop in a manner that competes with customers. Nevertheless, the self-organizing flexibility BY space can also simultaneously facilitate the management of the buildings in time, as mentioned above.

WHY

WITH-IN DEVELOPMENT MODE

Emergence of self-organizing space

The mode of production that I here call the with-in mode of housing production is still very marginal. Where it does exist, it arises from ideas such as the co-configuration of projects. In this category we can situate some co-housing developments where

¹⁵⁸ In a one-sided construction culture and closed market situations, the developing tendency in housing production always means some kind of risk management procedures and extra resources needed to bring out the new ways of doing things diverging from general practice. The solutions can also be such that the new idea for a typology has some reservations or overcapacity that are not included in everyday practices that forms the basis of viewing the costs in general. The cost estimates usually include some presumption about construction methods and their costs.

responsibility for the development is shared between a professional developer and the inhabitants. In the with-in mode of production of self-organizing space, top-down and bottom-up meet. The main manifestation of this is a development which is produced by a professional developer or other similar party, but where the future inhabitants guide the wider contexts.

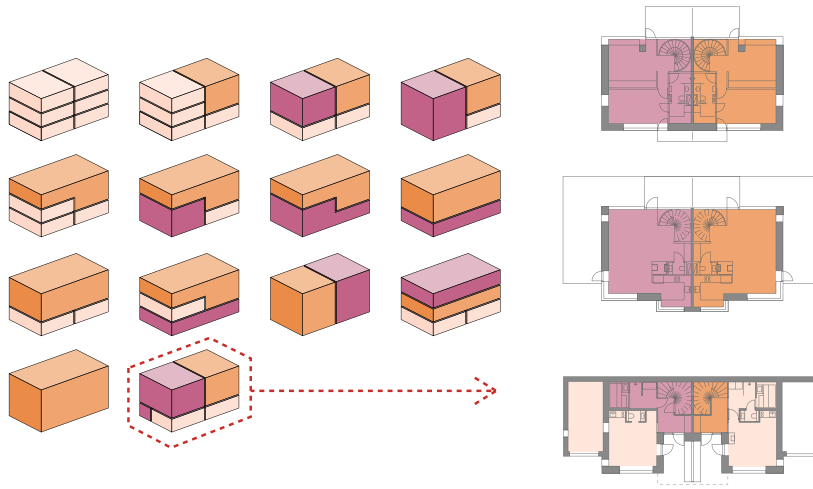
In with-in development it is important to ensure that the way of operating stays genuine and promotes people's own aspirations regarding spatial solutions. This way the results will not be artificial from the perspective of the future inhabitants nor, as in the worst case, only apparent, if the content of the living is mostly defined by the developer and less by the inhabitants.¹⁵⁹ This means that it is extremely important how the co-configuration, mostly interpreted as co-housing, is developed in such a way that the regulations and legislations enable the housing production to serve both the aspirations of the people as well as being resilient development.

In with-in production, people can affect the context of their housing and the idea of with-in development overrides the potential leverage gained in the mass customization of materials. In general, co-configuration is possibly the most difficult and little tried-and-tested joint venture in housing production. The definition of responsibilities and particularly the ways of financing still have to be developed. Sufficient "rules of play" have yet to be developed for it in Finnish legislation as well as operation models, particularly concerning financing and insurance. For the developers, co-configuration is usually a totally new approach. It is probable that interest in this kind of venture will introduce new actors rather than bringing in existing developers. At least in Finland this has so far been the more prevalent trend.

Emergence by self-organizing space

The emergence by self-organizing space in the with-in mode refers to with-in developments that produce self-organizing spatial contexts in such a way that the inhabitants can take advantage of the self-organizing characters of space. The inhabitants can change the conditions of their dwelling through the flexible character inherent in the building. At its best, inhabitants can also affect the conditions of the perimeters of their dwellings, at least in owner occupancy. In the rental sector this could mean, for example, that the inhabitants could, following rules agreed with the owner in advance, give up part of their dwelling without losing the lease totally. Or a tenant's lease could take in part of a neighbour's apartment when the life situation changes in that apartment. Because of this opportunity, the tenant would not necessarily be obliged to move from the familiar dwelling, which is the case now when a dwelling becomes too big or too small for the tenant.

¹⁵⁹ Unfortunately this kind of development can already be detected in some co-housing developments; the contexts are defined by consultants even though the sites have been allocated for co-housing developments.



BOTTOM-UP DEVELOPMENT MODE

EMERGENCE OF SELF-ORGANIZING SPACE

This very rare case of production mode is one in which the people themselves produce self-organizing space in some form, in a bottom-up manner, without professional developers. See Fig. 33. In this research, bottom-up development is understood as developing the space and does not refer to self-building, which is where people also take concrete responsibility for the construction. Examples where people are themselves somewhat responsible for the construction are more common, but the professional builders usually take on a larger part of the responsibility.

Co-housing development projects can be divided broadly into two categories; those where participants want to get a reasonably-priced dwelling for themselves, and those where people want to affect the context of their own housing solutions in ways that are not available in the housing market. In the best scenario, both of these objectives are fulfilled. However, all people would benefit from a self-organizing strategy of the building, both in the lifespan of the building as well as in the design phase. Based on the experience of co-housing developments, the process of design and the definition of the social context of the project live continuously during the process (Korpela 2014, Interview 4). When many parties are involved in defining the context

WHY

Fig. 33. Kellokas Housing by Karin Krokfors Architects (2011) is an example of a bottom-up process resulting in self-organizing space using a self-organizing mode of production. It is still one of the few co-housing developments in Finland that has self-organizing characteristics and it was accomplished applying space unit logic. (See chapter IV). Initially the detached buildings consisted of two townhouses but its typologically flexible character allows the configuration of the buildings to change into dwellings and workspaces of various sizes during the building's life span.



for the housing and when aspirations for the project are great, the design phase is very complex. It means extra investment in design compared to ordinary developed projects because the designer has to accommodate many aspirations expressed by the inhabitants. At the same time these aspirations also evolve, sometimes even radically, during the course of design. In such cases, flexible design solutions that are more strategic in their character can also greatly benefit the social process connected to design phase.¹⁶⁰ This more tactical approach can then help distribute the financial and design resources in more beneficial manner for the inhabitants as well as for the developer in a with-in mode of production. At the same time it affects the whole life span of the building so that future inhabitants can also benefit from the self-organizing character of space. Generally, the self-organizing character BY space has not yet been the focus in co-housing projects.

EMERGENCE BY SELF-ORGANIZING SPACE

The bottom-up production mode that enables the emergence BY self-organizing space means that the building has a self-organizing potential that promotes the self-conditionality of its inhabitants. The emergence refers to the material and immaterial resources that are formed as a consequence of self-conditional use of space that occurs beyond the execution phase of the building. This is closely linked to emergence that occurs as a consequence of the way the space is configured and how it relates to its inhabitant's possibility to live creatively in and with the space. This also means changing the use of space to something other than housing, which is today largely understood as hybrid building.¹⁶¹ This way of producing buildings generally demands extra investment on the part of the inhabitants or professional investors that cover the costs of uses other than housing. However, it is often very difficult for the third sector or a group of people or just individuals who produce the smaller scale services and functions to locate their actions in these centralized hubs because the rents are usually high or the location unsuitable for spontaneous and temporary use. The contexts of small-scale services and business ventures usually are very local and also change very rapidly. Nevertheless, as mentioned before, the city structure and living urban contexts can benefit from this kind of local services with objectives other than profit-making or business expansion. In some cases, the businesses might be looking for growth, but as start-ups they are unable to invest in substantial space at the very

WHY

¹⁶⁰ Changes in technical systems, for example, are not so difficult to make if they are considered from the beginning in a flexible manner, simultaneously with the configuration of space.

¹⁶¹ In today's hybrid buildings the spaces are generally purpose built and it is not possible to change the function of the spaces. In a way, hybrid building is continuation of the idea of the functionalist city, simply interpreted as a building complex.

Fig. 34. Kellokas Housing by Karin Krokfors Architects (2011). Interior.



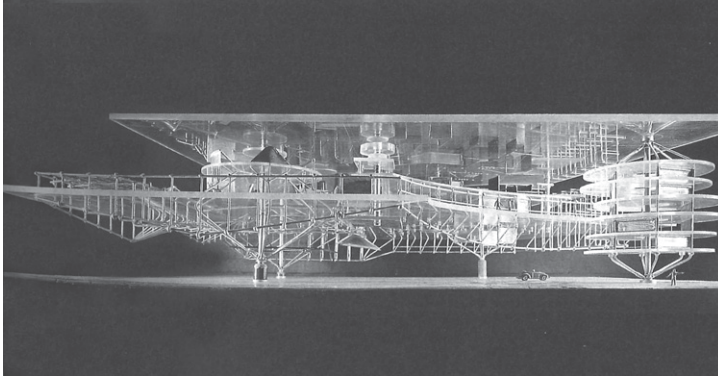
beginning of the venture. With self-organizing typology this kind of space can be spontaneously created within the existing building stock for different uses that are not known of beforehand and cannot really be predicted. Such space could be found in the existing city structure, even as parts of dwellings, if the buildings include self-organizing capabilities.

In the best case, self-organizing buildings can also locate bigger units of services and business that can be changed from housing use, and vice versa. This kind of spatial potential does not have to be custom produced with the help of professional investors who usually want to make a considerable profit. Instead the inhabitants can also benefit from their own investment, thus helping the risk management of ordinary people, by leasing a part of their personal space away, or, alternatively, attaching part of the building as leased space to their own dwellings. This can help to create new resources for people, or it can help to create new third sector services¹⁶² locally. Buildings can, for example, accommodate public and private services, such as kindergartens or small health services. The planning should then be such that it allows for change of use or some permissible fluctuation in uses – for example from housing to other uses – so that they can evolve easily in the city structure and promote its resilient development.

The different production modes and their contexts are combined in Fig. 35.

¹⁶² Third sector services should be understood here as a wide concept including joint ventures by all kinds of groups of people operating from their own starting points.

Fig. 35. Diagram of different building process modes.



3.3 THE EMERGENCE OF NEW CREATIVE AND INNOVATIVE SOLUTIONS

C

The emergence of creative and innovative solutions concerning the built environment is an evolutionary process, in which cognitive, material and social processes are entangled. It is a cycle of development that can be seen partly as artificial and engineered and partly as happening from self-organizing starting points. In natural organisms, self-organization is an intrinsic quality, but human-made systems are usually hierarchical, with fixed boundaries and engineered processes, although some self-organization happens here, too. However, if we take the analogy of self-organization and emergence from nature, the spatial premises can do much more than just adapt. It means that we should be able to engineer self-organization as a spatial character in a resilient manner in order to benefit people and societies. This in turn requires recognizing and understanding the creative dweller and the diversity and array of types of innovations related to space.

ENABLING THE CREATIVE IMPULSE

The Situationist thinker and artist Constant Nieuwehuys saw the action of creation as more important than the product itself. For Nieuwehuys, space was not only a tool for living but instead a plaything for adventure and discovery as well. Creative disorientation was at the core of his thinking. Nieuwehuys gave an example of the labyrinth as an urban planning principle and metaphor, which he presented in his New Babylon (1959–74) project. (McDonough 2009). See Fig. 36.

Fig. 36. The New Babylon model by Nieuwehuys.

In a labyrinth there is nevertheless only one right way to follow. He talked instead about dynamic labyrinths, which had not just one centre but an endless number of mobile centres. According to the Situationists, the human being should not be seen as a separate user of space but rather as an active creative party, one who can create new functions, ideas, programmes or anything unforeseeable out of or through space.¹⁶³ Situationist thinking combined the individual level of being able to affect with the change in societal level.

Typologically flexible spatial conditions promote self-organization both at the individual as well as at the societal level. They can help to foster, besides the individual's level, new economic and societal activity and also support the emergence of third sector activities, whilst balancing out the one-dimensional service contexts of certain areas. At the same time, typologically flexible building solutions can have a balancing influence in city areas that might otherwise be too inflexible to create social mixes. Areas would not stagnate into a particular condition, which would require considerable supplementary investments to fix. The resulting urban context would, as its natural feature, be able to repair itself to a certain degree.

New conquests in housing, however, are lengthy and intensive processes, and it takes a long time for them to become viable factors in the production of space. A system that reproduces itself, whose "wings" for development have been cut, requires an external impulse of some kind to make the entire system reorganize itself in a balanced way. New contextual innovations in housing have not emerged through market forces in the industrial era of housing production. To promote all kinds of innovations, there is a need for public sector involvement and new policies as well as novel holistic understanding of housing and spatial production in general. Markets by themselves possess no objectives for individual or societal creative impulses to emerge nor do they have conscious intelligence as their integral character in order to develop housing from more holistic starting points. Enabling the creative impulse in socio-spatial contexts requires development on a broad front, from regulation to practical implementation. Change, as discussed earlier, is also likely to require opening up processes for new actors beyond the existing institutional and private ones. But in order to realize the potential and promote social activity and prosperity in an in-depth manner, the processes of producing space should also go through radical changes, in which the objectives for the self-organizing characteristics are set out.

¹⁶³ Niewehuys saw the inhabitant as a producer of space and in relation to space (Bosma et al. 2000 : 51-52).

3.4

PARADIGMATIC CHANGE IN DESIGN CULTURE

D

TOWARDS SELF-ORGANIZING SPACE

This section will study the concepts of adaptability and flexibility from the point of view of their objectives, how they are linked to each other and to self-organization. Very often the flexibility of dwellings has not been thought of as benefiting anything outside its immediate realm. This is probably the reason why taking the step towards understanding a building as self-organizing entity has only happened in very marginal approaches.

The formation and idea of self-organization at the building level is, however, apparent in some contextual developments of flexibility in recent decades, although they have not been labelled as such. There are architects and people interested in architecture who have tackled the flexibility of a building in an insightful way, touching on the context of self-organizing space. The criteria for the self-organizing potential of space that I have developed using the concept of typological flexibility are built on these concepts and used as a sounding board for the development of the concept.

There is a long tradition of designing flexible space within modernism, and flexibility has been considered in various design strategies. As noted earlier, flexibility has been an integral part of the rhetoric of modernism, and it has been approached from very different angles. The intention here is to open up the most viable concepts of flexibility, and to show how they have been applied in design practice and in the theory of design, in order to gain a clearer perception of the concepts and their objectives. I will present several strategies and lines of thought that are relevant to the creation of self-organizing spatial configurations. I will also highlight the different background assumptions to these. This will help to specify how they serve self-organization and identify their possible shortcomings.

THE DEVELOPMENT OF FLEXIBILITY IN DESIGN

FLEXIBILITY OF USE AS PART OF THE MODERN PROJECT

Hilde Heynen (1999) considers that the interest in flexibility arises out of the attention paid to transiency and mobility in reforming the everyday inherent in modernism. It was characteristic of the early modernists to try to bring about fundamental social change, and thus in some way the social aspect of space has been part of understanding flexibility in design. In his article in *Neue Frankfurt*, written as early as 1928,

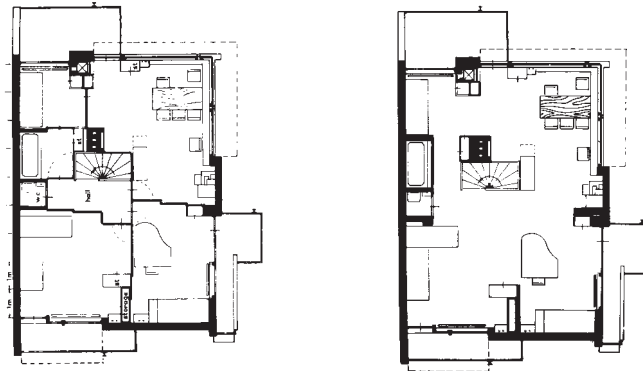
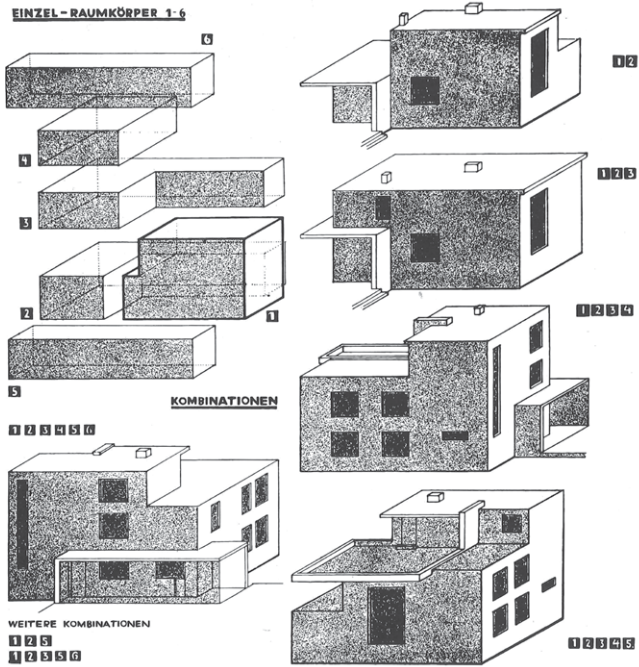


Fig. 37. Example of modular kit house by Gropius from 1920's.

Fig. 38. The Rietveld-Schröder House, Gerrit Rietveld 1924. The upper floor of the building is made flexible with sliding doors that accommodate the inhabitants' needs during the day. The big living room area becomes bedroom areas so the living room area is considerably reduced in the evening.

Marcel Breuer paid attention to the intense change in lifestyles, and considered it inevitable that the built environment would go through similar changes. He saw the answer in the flexibility of plans, spaces and buildings, in which all the parts could be changed or combined in different ways (Heynen 1999 : 47).¹⁶⁴ Nonetheless, the early modernist interpretation of flexibility was based on more patronizing tendencies. The project of creating the existence minimum started the development of the efficient use of space. It led modernist thinking to certain interpretation of flexibility, particularly as understood from the point of view of transformability for making the spaces more efficient. At that time, this was largely to be accomplished by movable partition walls and folding furniture.

The architects also wished to improve people's living conditions through reasonably priced housing, which also linked the concept of flexibility to the production methods. Attention was then drawn towards the building phase and construction techniques. Flexible housing production was seen as a technological project, one in which the new construction methods and mass production were developed alongside new housing solutions. Housing was expected to go through the same technological development process and be subject to similar production and economic changes as the means of communication, such as the telegraph and radio, had gone through (Heynen 1999 : 46–47).¹⁶⁵ Prefabricated element construction was seen as the answer and it was developed by several parties at the same time if from somewhat different starting points.

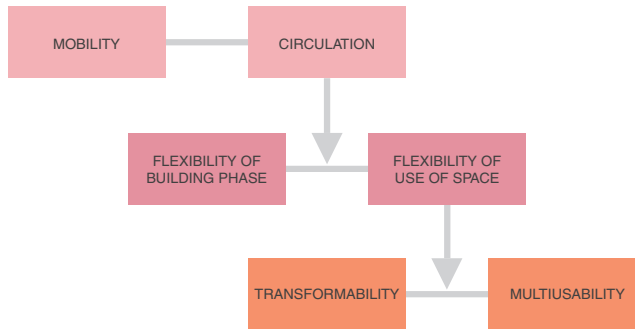
Nevertheless, the inhabitant was also in focus with the idea of enabling people to affect their own housing solutions. At the Bauhaus, Walter Gropius developed a do-it-yourself modular house kit, in which the future inhabitant could choose between different kinds of space modules according to preference and combine them into a house (See Fig. 37). The focus of the kit was, however, on the production phase and rather than on its further amendment.

The role model for flexibility in modernism was the traditional Japanese house, which brought the concept of transformability of use into western culture. Its iconic embodiment is the Rietveld-Schröder House in the Netherlands, of 1924. Here, as in traditional Japanese houses, the transformability of space was connected to flexibility following the needs of the daily rhythm (See Fig. 38). This kind of flexibility nevertheless required a common timetable and lifestyle from its habitants.

As noted, the many interpretations of flexibility had already appeared in the early period of modernism, largely concerning transformability, and were further developed particularly during the 1960s probably because of the questioning that society and architecture were going through in these periods. In the 1960s another understanding of flexibility was also introduced in a deliberate manner. A contrasting understanding

164 Original ideas presented in German in *Das Neue Frankfurt* 1/1928.

165 Original ideas presented in German in *Das Neue Frankfurt* 1/1926–27.



of flexibility of use was related to the use of space from the point of view of multi-usability without the need of transforming the space. This was introduced in the 1960s in the writings of the architect Herman Hertzberger, which I discuss more in-depth later on.

The thematic of flexibility in housing has raised its head at regular intervals for different reasons, but many of the ideas for flexible design introduced by the 1960s are still relevant today. There has been growing interest in these themes once again, now that we are facing environmental and societal change that suggests that the whole world is coming to a threshold.

THE OBJECTIVES AND CONTEXT IN THE DEVELOPMENT OF FLEXIBILITY

To be able to approach flexibility of design and production in its full range, I have mapped the concept of flexibility so that it also helps to define the objectives of different kinds of flexibility that guide their application. Based on a theoretical approach and historical examples I have divided the different forms of flexibility into categories of axes between sets of binary concepts. I considered it important for understanding the different objectives and presumptions entangled in flexibility because it would help to develop an understanding of flexible self-organizing solutions in building design as part of resilient development.

The binary pairs are (See Fig. 39.):

1. Mobility and circulation
2. Flexibility of the building phase and of the use of space
3. Transformability and multi-usability.

Fig. 39. The relationships between the concepts of binary pairs.

All the approaches of flexibility can be located in these categories of binary poles in one way or another. For this research, the two last categories are essential, although the first category is touched upon in relation to circulation. Each binary pair works on different levels of flexibility.

MOBILITY AND CIRCULATION

On a metaphoric level, mobility affects all the approaches to flexibility. As a binary pair it refers to the more general quality of flexibility. Change and motion have always been part of the thematic of flexibility because it is always a question of some kind of transition. Mobility usually refers to temporary forms of flexibility, but through an emphasis on circulation, it can also be linked to more permanent qualities of space, which are also apparent in understandings of resilience.

The transient character in the concept of mobility can already be linked to the time much before modernism in the spatial practices of nomadic lifestyles. It can also be seen in wagons of settlers moving west in the North American context, which developed, at least at the mental level, into the American mobile home. Industrial society has created new interpretations of mobility and circulation, and as a concept it is also firmly part of society today. Mobility has also been linked to temporality in the case of providing shelter for victims of catastrophes and this has developed into very meaningful if marginal approach to flexibility. Mobility can, however, also be linked to the flexibility that occurs in the construction process, as the mobility of the prefabricated elements or modules used for easy assembly on the construction site.

Mobility has also been used when questioning the stagnant practices of society and the building sector. An example of this are the provocative mental models of Archigram, which were developed in the 1960s. Their utopian scenarios were epitomized in the *plug in city* and the *walking city*. See Fig. 40.

They were influenced by Cedric Price's thinking and coincided with the ideas of the Japanese Metabolist group, who all tried to depart from the basic modernist understanding and from the familiar models used to create new ways of looking at buildings. However, the Metabolist group, also active in the 1960s, took their ideas further into more concrete projects. They approached flexibility from the perspective of Buddhist philosophy, in which change is evident and always present, but their interpretation was very technologically oriented and, as in early modernism, also concentrated on the building phase (Studio Vista 1977). The most famous example of a Metabolist project is perhaps Kisho Kurokawa's plug-in Capsule Tower hotel, in which the construction of the hotel rooms relies on the vertical load-bearing structure into which the hotel rooms, as prefabricated modular elements, were attached. See Fig. 41.

The cycle of substance and circulation of the use of building materials has also always been part of building with an efficient use of materials based on their availability

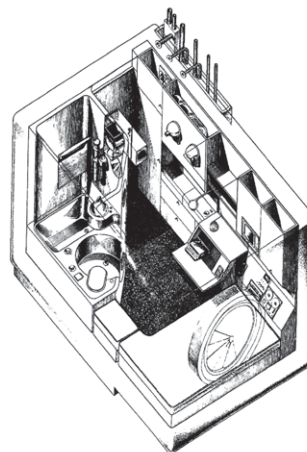
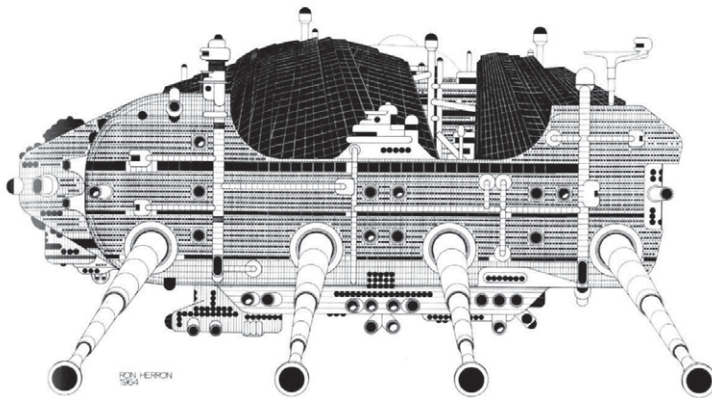
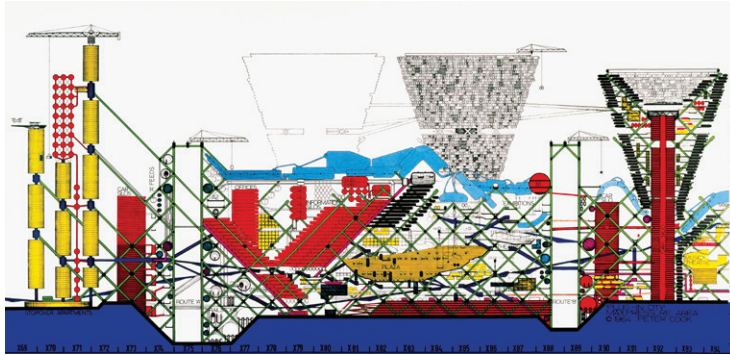


Fig. 40. Plug in city above and walking city in the middle by Archigram.

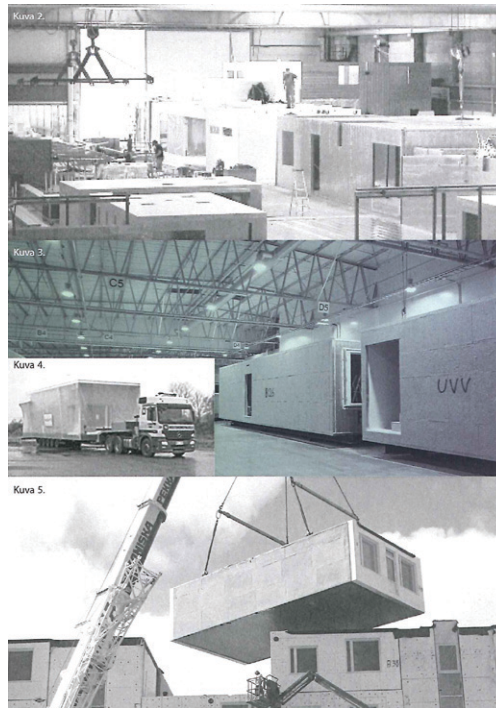
Fig. 41. Plug in Capsule Tower block by Kisho Kurokawa (1972). Prefabrication plays a crucial role in the thinking of Metabolists like Kurokawa, but the actual spaces themselves, the hotel rooms, cannot be considered flexible in use. They are fit for temporary uses like serving hotel guests, in situations where the multiplicity of uses is not an issue.

or scarcity. The concept of recycling can be seen to originate from these circumstances. Temporality is present in recycling and can be interpreted as the motion of circulation exhibited by the circulation of construction materials and substance in building processes. In this case, the focus is on the cycles of existence. However, flexibility of circulation of use can also be understood as resilient adaptability and as a static form of circulation, in which the space prevails but adapts to different uses. In this approach, the focus is on the circulation of people and the changing use of space. Because the viewpoint of flexibility in this research is on promoting the endurance of space, the resilient features manifested in mobility and circulation are clearly linked to adaptability and the self-organizing capability of the use of space. Even if the space comprises mobile components, its primary objective is to make the building and city structure withstand time. How this can be accomplished is the focus of the two other binary concepts.

THE FLEXIBILITY OF THE BUILDING PHASE AND THE PHASE OF USE

Regarding its objectives and driving forces, flexibility can be divided in two main categories, namely flexibility in the construction phase and flexibility of use during the lifespan of the building. They concern in which time frame and from which standpoint the flexibility occurs in the lifespan of the building. They differ from each other significantly. Flexibility in the building phase has mainly to do with the ease and speed of construction and the economic benefits it promotes. As regards the flexibility of use, the viewpoint is largely on understanding the buildings as processes that are as long as the lifespan of the buildings. This mostly benefits the inhabitants and the owners or managers of the building, but also has an impact on the development of the city structure in the long run. Flexibility in the different phases of construction and the use of the building can also be very contradictory in their effects, but at their best they can also benefit each other and be accomplished simultaneously. They can have a negative effect on each other, as epitomized in the example of the BES element construction method referred to earlier. It limits the flexibility of the use of the building significantly after construction. The process and methods of construction are essential in gaining adaptability. The construction method and the way the structure of the building is designed have essential relevance in the formation of flexibility of use.

The flexibility of the building phase has in most cases been linked to some degree to element construction, although its interpretation can also concern construction site logistics and other construction methods. The defining terms in prefabricated elements have usually been the transport of the elements to construction sites. The size of roads and vehicles has played a major role in defining the size of the elements, which have actually nothing to do with the use of buildings or contexts for housing. A few hours of transportation have dictated how the building can be used for several decades. This is even the case today with new modular construction developments. See Fig. 42.



Because flexibility of use has never been the primary objective of everyday housing production, the structure of the building and element construction has mainly been developed from the point of view of the construction phase, and this has greatly dictated the housing solutions.

TRANSFORMABILITY AND MULTI-USABILITY

Flexibility of use of space can be divided into two main categories, as stated earlier: multi-usability and transformability. The approach in this pair is already more focused on the character of the flexibility and on defining the parameters for flexibility of use in spatial terms. In them, flexibility is approached from a different angle and they also differ in their ways of application. Both obviously require an intentional attitude anticipated in the design. The word 'transform' portrays a type of flexibility in which space needs some kind of physical transformation to be applied in different ways. In multi-usability the space does not necessarily need any transformation to enable it to be used for different purposes. Multi-usability usually means that spaces are of an appropriate size and are connected to each other in a way that they can be utilized

Fig. 42. Building construction by modular building units.

in a diversity of ways. The configuration of space is a significant factor in creating multi-usability so that it allows the individual use of space that is not depending on the use of other spaces. This usually means giving up some efficiency demands, because the multi-usability of space means that room sizes are large enough to accommodate different uses. In the paradigm of efficiency promoted by industrial and profit-g geared housing production, this kind of approach has not generally been considered valid (Evans 1997).¹⁶⁶

In housing production, the set number of rooms has been generally a more important factor than the size of the space, which is related to high housing prices. In Finland, except in housing produced before the industrial period, multi-usability of space has been a non-existent dimension in the housing production that bases its paradigm on the efficiency of space, gearing it towards open plan design.¹⁶⁷

In general, the viewpoint of multi-usability is always long-term, although it does enable changes in the short term as well. In transformability, the frequency of change can be as short as one day or even a few hours. This concern with malleability was also based on the open building thinking that emerged in the 1960s with the work of the architect N. J Habraken. It was around the same time the architect Herman Hertzberger presented his concept of polyvalence, another way of approaching flexibility from multi-usable starting points for space. In general, all the forms and attributes of flexibility of use refer to one or other of these two approaches, even though the different viewpoints can be combined in the same solutions. Self-organizing space and the possibility and ease of change in buildings and urban structure arise from the point of view of multi-usability of space, which can be assisted by transformability. The different approaches of open building and polyvalence will be studied more thoroughly in the section on design strategies and ideas later in this chapter. I have considered them here as key concepts and approaches epitomizing multi-usability and transformability. However, there are also other valuable viewpoints that contribute to the understanding of typological flexibility that have had important roles in the design thinking about the various objectives of multi-usability and transformability of space and the understanding of the creative dweller.

¹⁶⁶ Since the arrival of modernism, a general efficiency demand has been embedded in housing production.

¹⁶⁷ This has been made possible by the combined open kitchen and dining-room concept, where these are attached to living room space. It has also affected the sizes of spaces generally reserved for sleeping. The combined living area, being based on efficiency demands imposed on housing, has also made the living areas into circulation space, which has limited their independent use (Krokfors 2016b).

UNDERSTANDING SELF-ORGANIZATION – EXISTING IDEAS AND STRATEGIES

IDEAS AND STRATEGIES FOR DESIGNING SELF-ORGANIZING FLEXIBILITY

The next step is to survey some of the most influential and interesting ideas and strategies that have, in some form, been tangential to the self-organizing approach to developing adaptability and flexibility. The ideas and strategies discussed below are chosen particularly because of their tactical or strategic qualities, ones premeditated in one form or another in the design phase to promote solutions that support the self-organization of space. The concept of time approached in these ideas and strategies refers to enabling the longevity for the space and as well as the self-conditional character of the space. In these design strategies, the starting points vary, but each tries to give some tangible attributes to the concept of strategic flexibility in some form.

THE OBJECTIVES OF CREATING FLEXIBILITY

As noted earlier, the background assumptions of flexibility can differ from each other considerably, some finding production playing a major role and others, in contrast, concentrating on the objectives of people's aspirations and relationship to space. The question of housing development has been a tug of war between visionary approaches and appeals to the "realities" of production. If the visionary aspect has surfaced, as it did in early modernism, as an engine for change, the reconstruction period after the Second World War saw the realities of production objectives becoming significant when quantitative criteria dominated. For this reason, it is important to understand how production serves self-conditionality rather than trying to solve the problems of sustainability only from the very exclusive premises that the production point of view represents. However, even though the development of flexibility for self-organization relates mostly to the use of space, it also depends on the tectonic character of buildings. This brings out the issue of how construction is executed. The structural hierarchical aspects are very apparent in many of the strategies and ideas concerning flexibility.

Some ideas are more philosophical in their approach and leave the manifestations of the structure and method of implementation for a particular design approach. I have also considered these approaches very noteworthy for the development of flexibility. They, nevertheless, offer some precept for design strategy in producing flexible solutions. Some of the following ideas and strategies have stimulated discussion beyond their own time or they have been targeted at a conscious change in housing paradigms in their own time. In some cases they have even had impact outside the realms of architecture and urban design.

As mentioned above, the most significant design strategies that explicitly considered the creation of flexibility can be traced originally to the 1960s. This is not

a coincidence. As in early modernism, the time period can be interpreted as consciously breaking away from the stagnated values and objectives of the past. The 1960s was a period when a new kind of energy and questioning stance entered the architectural profession as a reflection of societal change in general. Even though the reasons and development paths which caused this burst of energy in the 1960s will not be examined here, for generations of architects interested in flexibility since, it was a formative period. The very same objectives and ideas seem to be once again in focus in many architectural developments. As a consequence of the prominence of resilience, adaptability and flexibility have again gained more solid ground. The other interesting issue about the 1960s was that it saw the introduction of concepts linked to complexity and self-organizing such as *homeostasis* and *cybernetics*. They entered the discussions of architecture at that time and are particularly strong in Cedric Price's ideas to be considered later. At that time, reductionist thinking in science began to be questioned, a tendency which slowly started make its way into understandings of urban characteristics and its strategic spatial qualities.

The focus on the 1960s does not mean that nothing happened before or after. The more current approaches presented have generally either tried to analyze or rework the ideas of the past, or they have just concentrated on a very specific point or view from earlier ideas. Possibly amongst the most significant are the writings of Bernard Leupen (2005, 2006a) and Tatjana Schneider with Jeremy Till (2007). Leupen has also tried to create a coherent understanding that could help produce a generic kind of understanding of flexibility. The many new concepts, such as the *slack-space* introduced by the architect Peter Barber, have brought new viewpoints into the theoretical discourse on flexibility in the context of housing. The research on self-organization has concentrated mostly on the context of city formation. Even the gaming industry has had its effect, for example in the iconic Sim City game, which has influenced the development of different simulation programs like City Engine. Because in this research the focus is not only on the level of building but on urban context as well, I have also studied ideas about city creation. At the moment they represent the more frequently studied starting points for self-organization and are also linked to the study of the strategic attributes of space.

As mentioned before, Fritjof Capra refers to two main approaches to dealing with complexity. One approach is a mere "click together" understanding of complexity that is created by a variety of components; the other sees systems as living processes intelligent in themselves, learning and evolving, which means that diversity is created through self-organizing potential and emergence. This brings us again to the concepts of model and type. Their essence is very important for the understanding and creation of complexity in the context of architectural design. Model is more related to the "click together" thinking, in which the design copies certain preconceived models and joins them together. Type, on the other hand, is more concerned with a holistic

understanding of the whole and the emergence that the system, through its intelligence and strategic character, gives rise to. Type can have intellect, which can emerge as different and novel tokens, whereas model is just an accumulation of preconceived tokens. Both approaches can be found in some form in the ideas presented here.

THE CITY AS A PROCESS – SELF-ORGANIZATION IN THE CONTEXT OF THE CITY

According to Kauffman, as early as in the 18th century, Immanuel Kant brought attention to the self-organizing character of organisms in which components exist simultaneously as means and ends. Organisms are mechanisms in which it is possible for the whole to be maintained and at the same time for the whole to be an ordering that allows the components to be maintained; the whole exists for and by the means of the parts, and the parts exist for the whole (Kauffmann 2008 : 58). This line of thought is also apparent in the way cities develop. Cities also exist as means and ends.

Then the concept of evolution also surfaces, because in all organisms organization and reorganization happen continuously in the form of self-organization and emergence. In evolution, certain parts of the organism can persist and others vanish when the circumstances and systemic balance change. Evolution is a natural metaphor when perceiving the development of cities, particularly from the long-term perspective, because it does not go back to “normality” but continually evolves. Evolution in nature cannot however be directly applied to city structure, because a major part of cities are intentionally planned and executed by people (Marshall 2009, Steadman 2008). This is very similar line of thought to that of Capra (2002). Cities do not just evolve based on circumstances, because planning involves decision making that leads to certain kinds of action and outcomes that do not always follow the rules of natural selection. The creations of the human hand are always attached to some a priori perceived goal-orientation, which directs, in various ways, the creation of the new. Compared to Darwinian terms, natural selection can, however, be applicable in the sense that if something in the city structure does not serve the people and their needs, then that built environment is prone to vanish. But more important is how planning and design can be affected, and how buildings and city structure enable continuous evolutionary development through adaptability, and can do so without being the object of harsh natural selection.

CITIES AS SELF-ORGANIZING ENTITIES

The systemic character of cities, which resembles natural processes, has aroused a meaningful consciousness in planning that has been taken into consideration when promoting city development and people’s wellbeing. There are several prominent

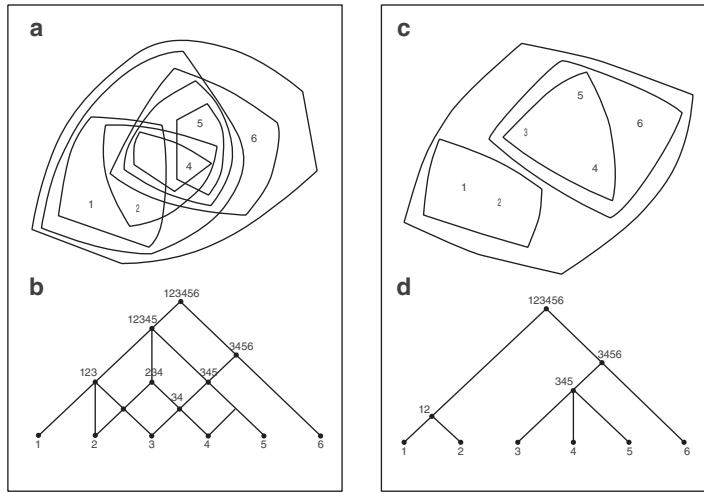
writers who paved the way for this understanding and saw the city as a self-organizing entity. Jane Jacobs (1961) was one of the first to raise the question of the city as a complex system. Jacobs understood how the interactions of people and practices enabled cities to create emergent systems, and she understood that the dynamics of cities were not created by centralized planning but by the lower level actions, for instance, of “strangers going about their business in public life” (Cit. Johnson 2002 : 92).

The city is a complex system with its inhabitants making constant decisions. It is a global order built out of local interactions in which a larger pattern can emerge out of uncoordinated actions. Even though cities are heavily shaped by top-down processes, it has been recognized that bottom-up processes play a critical role in city formation, creating distinct neighborhoods and other unplanned demographic clusters. Cities and “neighbourhoods are patterns in time” and they can be envisaged as the persistence of a whole over time that outlasts any of its components (Johnson 2002 : 82–91). Neighborhoods are like interfaces where people interact and so create new kinds of social patterns.¹⁶⁸

Vital cities have marvelous innate abilities for understanding, communicating, contriving, and inventing what is required to combat their difficulties [...] Lively, diverse, intense cities contain the seeds of their own regeneration, with energy enough to carry over for problems and needs outside themselves. (Jacobs 1961 : 461)

Now many scholars recognize that even though cities are ruled by top-down processes, bottom-up forces play a critical role in city formation. Juval Portugali (2000) and Béla Bánáthy (1999) have also raised the issue of self-organization as part of the development of cities and their planning. Their thinking is based on the notion that because of the underlying character of systems thinking, namely the unpredictability of the system, we need new kinds of tools to master its design and control it to some extent. According to Portugali and Bánáthy, self-organization is a morphological theory of systemic change. The changes in the city are not only caused by the external impulses, but rather the city emerges ‘from within’; it is the emergence of urbanism as a generative socio-spatial order through specific urban order parameters (Portugali 2000 : 330). The control parameters can trigger systemic change, but quite often cannot determine its fate (Portugali 2000 : 319). From this emerges a new type of city planning whose aim is not to control but participate. Certain theoretical approaches also give clues for designing engineered self-organization.

¹⁶⁸ According to Johnson, a good example of cities’ capability to learn are the likeminded business clusters (Johnson 2002 : 107).

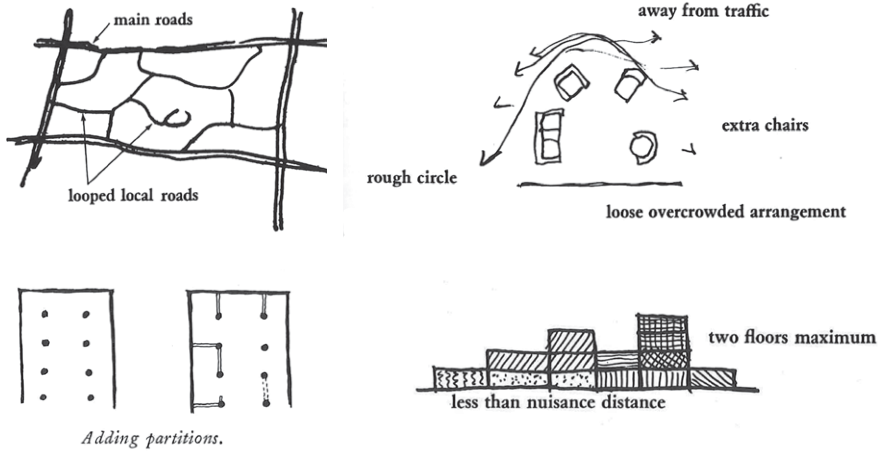


A city is not a tree

In his seminal article *A City is not a Tree* (1965), Christopher Alexander studied the organization of space at the level of city structure. He analyzed the formation of city structure with the help of diagrammatic analytical models as metaphors. He tried to answer the question of why the cities that had grown naturally as a result of long and spontaneous evolution compared to artificial cities emerging from the planner's pen on the drawing board seem not to create the same meanings in people. Alexander's answer was that the latter were lacking something essential. He used the metaphor of a tree to describe the artificial city and semilattice to describe the natural city. Alexander's symbol of a tree as a structure that grows into branches is motivated by the way that each branch ends at a dead end with no passage to anywhere else. In the semilattice every line leads to another line and there are no dead ends. See Fig. 43.

Here the city system is always a part of overlapping systems, whose spheres of influence are defined by users as part of the functioning of the system. The tree type gives only one way of passage and one way to perceive the structure. For Alexander, this was too simple a way of understanding such a complex entity as a city. For a living city, it should be the semilattice type. Alexander's approach is closely linked to the understanding of cities as meaning creators and learning systems that evolve continuously through the city's capability to promote different kinds of superimposed connections through the semilattice type.

Fig. 43. Alexander's *tree type* (c,d) and *semilattice type* (a,b) in diagrammatic representation.



Pattern language

Pattern language, a theory masterminded by Alexander, is both a theoretical and philosophical approach that tries to define the criteria of the good environment and give instructions and tools for how it could be accomplished. It does so by the use of different patterns. Pattern language was developed by Alexander and his colleagues in the book, *A Pattern Language*, in 1977. It could be considered a design strategy for the built environment in general, which is however geared to some extent towards the “click together” way of understanding the formation of city in all of its scales. It does however emphasize the notion of time and durability of the built environment. Pattern language is not developed as a way per se for creating diversity – that is more apparent in Alexander’s earlier book *Notes on the Synthesis of Form*, published in 1965. Pattern language does not directly refer to flexibility, but the notions in pattern language are consistent with the aim that people should be able to live from their own starting points. They can do so with the help of these timeless patterns that create durable high quality environment.¹⁶⁹

For Alexander, time and architecture are very significant starting points and he seeks to understand and define the parameters that make buildings withstand time and persist. For this reason, Alexander, with his colleagues, draws 253 patterns that could achieve this and persist in the city structure. See Fig. 44.

¹⁶⁹ The structure of the theory of *pattern language* is also interesting. The hierarchical approach for the formation of a time-withstanding high quality built environment, which the thinking is based on, is also a pioneering approach. In *Notes on the Synthesis of Form* (1964), and in *Pattern Language* parametric thinking is already present, which has also inspired the development of computer software and algorithmic planning procedures (Ics.uci.edu 1994).

Fig 44. Examples of different patterns from pattern language.

These patterns constitute the grammar of the built environment. The patterns can be divided into four different categories: *region*, *city*, *neighbourhood* and *dwelling*. (Alexander et al. 1977) Alexander defines the different levels at which the patterns function. All of the levels aim at the same notion that people can affect their environment. The levels are, however, nested inside each other and are not strictly hierarchical in their character, similarly to systems thinking.

For Alexander, the patterns represent timeless archetypes based on over-generational human experience. The patterns act as construction material for good living and assist the identification of one's own environment. Together the patterns create a manual from which the people can construct a city for themselves. Alexander wanted to give all people, not just professionals, the possibility to influence the formation of their own environment. So its motivation approaches the concept of lived space. On the other hand, the idea of the book is also close to the model books from the turn of the 19th and 20th centuries, which were produced to demonstrate high quality architecture, although it is true that the pattern language works on a more abstract and systemic level. Its objective is, however, to allow the city to be drawn by its inhabitants based on their ideas and culture, and in this way the city becomes the reflection of its citizens. Pattern language is interesting because it seeks to give an archetypal example of the patterns affecting our environment, but everybody can parametrically apply them to their situation and purpose. As in grammar, words can be used in very different contexts, but together they form syntax and grammar as Alexander and his colleagues propose – the grammar of architecture.

Alexander et al. also drew attention to the structure of buildings and to the building process and how this influences the timeless qualities of architecture. According to Alexander and his co-authors the answer to the flexibility of the building process is building on site, which makes changes during the construction process possible. He even suggests developing super-light concrete for beams, pillars and vaults, which would make building on site easier. (Alexander et al. 1977). For Alexander, the first inhabitant is the most important one, but it refers to the notion that the timeless archetypal qualities of architecture make it proper for the future inhabitants as well. The space persists and does not need adaptation. This approach is based on how Alexander sees the high quality environment as possessing eternal values that do not change, which is probably the reason why Alexander does not focus on flexible solutions. However, the focus in pattern language is on design and the production of space. Even though Alexander could have been a visionary before his time, his thinking about architecture draws from history; the development of totally new types and typologies is not much in the forefront of his thinking even though he uses modern examples epitomizing the same timeless values as historical models.

Rule-based planning and the flexible masterplan

The flexible master plan was studied already in some form in the 1960s in Non-Plan, which was a provocative idea that was introduced in the article *Non-Plan: An Experiment in Freedom* published in the magazine *New Society* in 1969 (Banham, Barker, Hall & Price, 1969).¹⁷⁰ The discourse dwelled on the same questions as Alexander proposed; does planning conducted by the professionals really lead to better environments? The article tackled the question of whether planners should be the ones who decide about the content of the environment. Non-Plan supported the idea that the general public could shape its own environment and that people should be involved in the design of their own environment. The article raised much controversy and the writers were attacked quite fiercely by the establishment (Barker 2003). Non-Plan was, however, probably written to provoke discussion rather than to propose a coherent theory. It introduced a speculative playful thought about what could happen if planning were more flexible. There was, for example, a proposal on free zones for development on the city fringes, which were seen to also anticipate the emergence of shopping mall districts.¹⁷¹ Non-Plan has also been criticized because of the car dependency created the free zones.¹⁷² The Non-Plan can also be understood from the point of view of a self-organizing tendency of the environment as a result of people's activity. In Non-Plan the idea of some sort of rule or principle-based planning is already germinating.

Rule-based planning has emerged in recent decades as a way of planning that can deal with the complexity of cities, based on the notion that the future cannot be predicted. It also takes into consideration the more and more complex nature of the planning as well, which has been studied by several scholars like Alexander (1987). In his book *A New Theory of Urban Design* he seized on the question of how organically cities develop.¹⁷³ He is in search of rules that embody this development and allow cities to grow into organic wholes. On the other hand, in his book *Cities and Complexity – Understanding Cities with Cellular Automata, Agent-based Models and Fractals*, Mike Batty (2005) searched for ways in which urban planning could move from a centralized, top-down approach to allow more bottom-up ways of planning to emerge. He studies the various ways urban change and its dynamics can be perceived and modelled by spatial models like cellular automata, agent-based models and fractals. A more design-based approach applied to planning is presented by Kees Christiaanse (2007), who studied how rules could be drawn and executed as part of city planning, for instance in the Wijnhaven development in Rotterdam. This is achieved by definition

¹⁷⁰ The idea for the article was based on conversations between the authors.

¹⁷¹ The idea the article proposed, of control-free zones, has also materialized in the development of the London Docklands (Barker 2003).

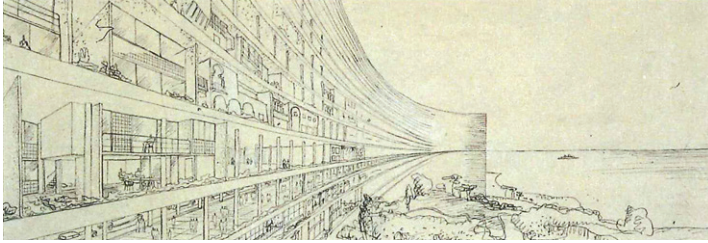
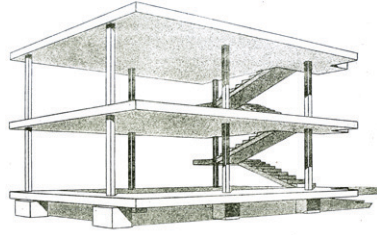
¹⁷² Among others (Varnelis.net 2017).

¹⁷³ Alexander already noticed in his seminal book *Notes on the Synthesis of Form* (1964) that the city systems have originally developed from bottom-up processes but since the Industrial Revolution this connection has been broken.

of parameters by certain rules of play, which in turn guide the implementation phase from more self-organizing starting points.

Rule-based planning can allow different kinds of scenarios to emerge based on flexible strategic parameters given for city development. The scenarios can be tested to some extent with the help of fast simulation models. Through simulation, for example, different parameters of the built environment can be tested in relation to each other. This can help us to study the variation of choices and also show the potential unwanted results when certain kinds of rules and parameters are applied to simulation models. There is also the potential for a vast amount of information to be linked to computer models and simulations (Staffans et al. 2015). The focus so far has been, however, very much on modeling. The rules of play, and their role in planning initiatives, have been emphasized more in the various approaches of flexible planning by means of strategic planning documents that do not tie the solutions but give some kind of guidance for the execution of the cityscape. In the actual planning process the planning solutions are usually expected to guarantee a certain level of quality, rather than see them as the best possible solutions for the implementation phase (Portugali 2000). A very important factor in the new ways of planning and drawing up strategic planning documentation is that it should allow the emergence of totally new solutions and possibly even better solutions that are not known about the planning phase and which would not emerge so easily through traditional planning processes.

In rule based planning much depends on how the rules of play are drawn up: are they promoting just strategic planning or also the self-organization potential of the buildings. The rules can be both qualitative and quantitative as long as they do not tie the execution too much, but instead give options for different scenarios for building design. The more strategic approach of rule-based planning and its applications can, at its best, benefit the execution phase and create a better quality and character of building compared to the traditional approach, which tries to define very precisely the form and quality of the buildings in the planning documents. At its worst, rule-based plans can just become a set of rules that gives rise to the same problems as traditional planning and guidance, that is, if the background assumptions to the rules indicate, for example, a certain understanding of building typology that affects implementation. As discussed before, it is important to notice that the flexibility of the plan does not necessarily mean the same thing as the flexibility of the built environment. That is, the flexibility of the plan can also lead to a very fixed and rigid built environment unless it had some strategic objectives exactly not to do so. The focus should not only be on flexible implementation but on how cities can evolve after the implementation of the plan. Then the focus shifts to the strategic dimension of buildings.

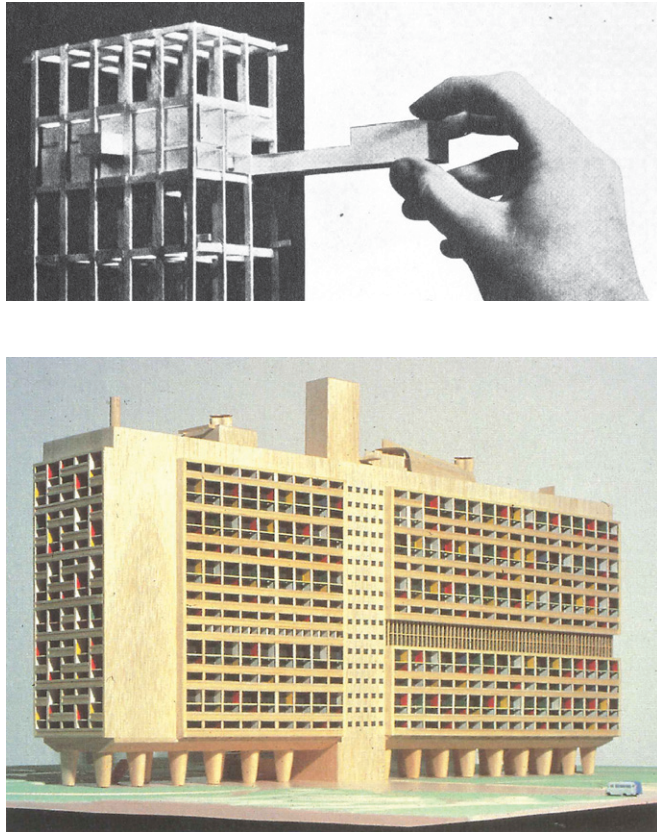


BUILDING AS A PROCESS – SELF-ORGANIZATION IN THE CONTEXT OF BUILDING

A long lasting resilient built environment also requires new ways of understanding buildings. In present day production, buildings are considered as end products and are seen as a closure for certain kinds of uses. Buildings, however, like cities, exist simultaneously as means and ends. They continue their life for decades, if not centuries, after their execution, satisfying different people's needs, inhabiting dreams and new ways of being, as well as giving shelter and being homes. Buildings that are in a continual state of becoming can then themselves be seen as processes that need some kind of self-organizational qualities in order to persist. What the understanding of self-organization at city level can give to the analysis of self-organization at building level is connected to the notion that functions and actions need not be predicted so precisely, as long as the buildings comprise strategic spatial qualities that promote self-organization and emergence.

When examining the strategic qualities that give rise to the self-organizing qualities of buildings, two different, but organically interlinked notions regarding buildings come into focus, namely the structure and the spatial configuration of the building (Krokkors 2010). The structure and spatial configuration affect the morphology of dividable entities and how they are connected to each other. The areas of circulation within the spatial configuration of the building define how it can be used in multiple ways without locking its spatial configuration into an inoperative fixed pattern in time.

Fig. 45. Domino above and Algiers project below by Le Corbusier.



THE STRUCTURE OF SPACE

The structure of a building plays a crucial role in achieving strategic flexibility of space in buildings. It has to be defined in a manner that enables certain spatial configurations that constitute a flexible typology for the whole building. Several approaches have been developed, particularly regarding the structure of the building, that have to do with the separation of load-bearing structures and lightweight as more modifiable components of the building. Understanding what can be modified easily, and how the structure plays a role in flexibility, are the main issues that define the adaptability of the building.

Domino and plan libre

A leap into a new kind of structural thinking in design was introduced by Le Corbusier in his Domino House concept, which promoted the free design approach. Le Corbusier developed his architectural principles in his manifesto, *The Five Points of*

Fig. 46. *L'Unité d'habitation de Marseille* by Le Corbusier 1947.

a New Architecture (Le Corbusier 1986),¹⁷⁴ and the free plan (*plan libre*) was one of the points. Although the idea of Domino was based on classical architecture it was a very modern idea concerning housing in 1914–15 when Le Corbusier first introduced it. Domino and the free plan created by the pilotis enabled the freedom for design. See Fig. 45. Even though its objective was mass production and the development of reinforced concrete solutions, its real power lay in its more contextual way of thinking. Here the structure based on load-bearing walls was abandoned, and the floors, the concrete slabs, were supported by pillars (*pilotis*). Compared to earlier construction methods, this freed up the design of dwelling space and was a mental step towards flexibility in housing design as well as the flexible use of space. In the Domino House Le Corbusier focused mainly on the freedom of design so that the carrying structure would not dictate where you need walls and windows. It was also a hierarchical approach to understanding the structure. In the Algiers project, on which Le Corbusier worked from 1931 onwards, he applied the Domino idea of free space in a long mega-structure in the cityscape that allowed the dwellings to be located freely in it (Thecityasaproject.org 2010).

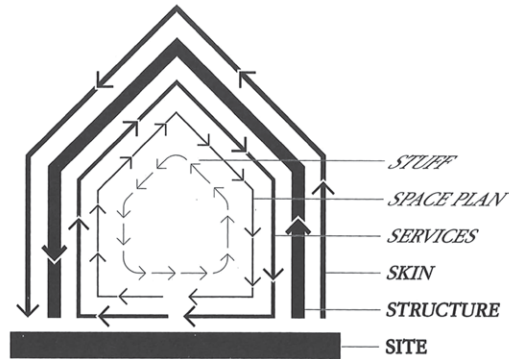
In Algiers project A, the pillar-slab load-bearing structure made it possible to sell space of different sizes, from 15, 20, to 30 metres wide so that the inhabitants could implement the dwelling they wished (Bosma et al. 2000 : 29). See Fig. 45. The application of this idea was also developed in the Unité d'habitation Marseilles project in 1947. See Fig. 46.

The structural approach of the Algiers project has been criticized many times over for its megalomaniac and simplistic understanding of the city, but it nevertheless had a pioneering impact on the understanding of the urban context, architecture and people's self-conditionality regarding their own living conditions. The project already shows a budding version of a flexible interface between architecture and people's own definitions of space, one enabled by a strategic understanding of structure and of how it could be designed to promote the differentiating use of space.

How buildings learn

Another way of approaching the structure of a building is a more temporal approach which understands a building as a continual process. These ideas were introduced by Steward Brand in his book *How Buildings Learn* (1994). Trained as biologist and designer, he drew attention to the fact that buildings continue their life and evolution long after their execution. Brand understood building as a process, and noted that different parts of the building had very different rates of change. A building can be divided into layers, in which each one has a different cycle of change. Brand argues that it is impossible to predict the functions of the building in the long run and

174 It was introduced in *Vers une architecture* by Le Corbusier in 1924 (Le Corbusier 1986).



believes that architects have been misled to think that they can predict the functions of the buildings based on the functionalist idea, “form follows function”. According to Brand, all buildings grow in one way or another during their lifecycle (Brand 1994 : 3).

Brand based his thinking on the ideas of architect Frank Duffy. Frank Duffy is an architect whose architectural office DEGW has developed office design. Duffy paid attention to the asynchronous pace at which different parts of a building need changing. According to him, a building is composed of several layers of longevity of its built components, and he recognizes four levels of components: *Shell, Services, Scenery and Set*. Shell is a structure that lasts through the whole life cycle of the building. Services are the technical systems, like pipes, ducts and lifts, which are replaced every 15 years. Scenery refers to the partition walls and lowered ceilings, and these change at approximately 5–7 year intervals. Set is the furniture, which can be changed at a frequency of a month or even a week. (Brand 1994 : 12). This approach is quite close to understanding a building as a set of different processes. Brand developed Duffy’s theory further and expanded it to comprise housing as well as public buildings. He divided buildings into different levels that change at different rates, as follows. See Fig. 47.

SITE, *geographical location, urban location, site, which lasts forever.*

STRUCTURE, *in which he separates load-bearing structures from other structures, and in which change occurs over very long spans of 30–300 years.*

SKIN, *outer shell, which changes every 20 years.*

SERVICES, *temporal span is 7–15 years. Many buildings are demolished if their technical systems are hard to change and too embedded in the fixed parts of the buildings.*

SPACEPLAN, *the internal organization lasts between 3–30 years depending on whether it is office space or housing.*

STUFF, *furniture and so on, which can change location and content very quickly.*

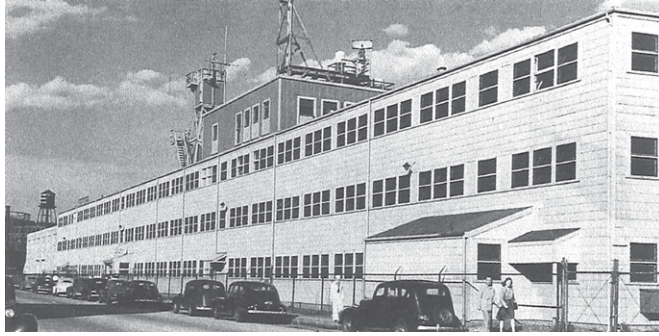
Fig. 47. Brand's Shearing Layers of change in buildings.



The definitions of time for different layers are very culturally bound, and the time spans can be debated, but the approach of considering time and the temporal relationship between the different layers is a very significant idea and discovery for the resilient design context.

Brand also sees that there is a certain dynamic at work in the different temporal layers. He refers to the ecosystem researcher Robert V. O'Neill and his colleagues who argue that in ecosystems the slow control the fast, which is to say the system dynamics are controlled by the slowest components while the faster components follow them as the birds follow the trees (O'Neill, Deangelis, Waide & Allen, 1986 : 98). Brand applies this analysis to buildings. The slower part of the building, like the load-bearing structure, controls the action of the faster ones. The *site* dominates the *structure*, the *structure* dominates the *shell*, and the *shell* dominates the *services*, which dominate the *space plan*, which then again dominate the *stuff*. But this kind of dynamism also works in the other direction according to Holling, whose work Brand refers to (Brand 1994 : 17). The fast components propose and slow components dispose. In big changes the fast components have a large effect on the slow ones. Brand sees that fast components act as a challenge whereas the slow ones represent stability and generate constraints. Bernard Leupen (2006a), for his part, uses Brand's ideas to discuss how, at its best, the stable structure liberates the temporary. For Brand, one determining factor in longevity is how well the building can absorb new service technology. He argues that the design imperative of adaptive building is how well it can enable the change between the different levels and systems, which represent different pace of change, and the slow ones will prevent the change of the fast ones. The interior organization changes rapidly whereas the shell usually maintains the continuity.

Fig. 48. Chatsworth House and its owners.



Meaning creation through space

Brand also points out that people prefer living in buildings that are still in the middle of the process, because then buildings can still engage us and maintain our interest (Brand 1994 : 11). Brand also recognizes the impact of the place and the character of a building on its age and pace of change. He divides buildings into three different categories, which are tied to place: *high road*, *low road* and *no road* buildings. According to Brand (1994 : 35), high road buildings are durable, independent and express confidence, and they impose their personality on the inhabitants as well. Low road buildings Brand sees as shabby, spacious and empowering people (Brand 1994 : 24–31). Their character is based on quick responsiveness to the demands of their inhabitants. The biggest difference between these two is the pace of change. All other buildings fall into the no road building category.

High road

According to Brand, the characteristics of high road buildings include character, tenacity of purpose, constant management, time and a continuous flow of managers with good self-esteem. The building itself expresses self-confidence. Brand gives the example of Chatsworth House, the home of the Duke and Duchess of Devonshire (Brand 1994 : 35). See Fig. 48.

The Duchess herself talks about the personality of the building that sticks to its inhabitants. “The way space is disciplined affects you when you are surrounded by it for so long,” says the Duchess. Longevity is partly affected by love for the building; otherwise one would not be able to maintain it. (Brand 1994 : 35).

Low road

Brand states that in low road buildings all changes are usually for the better. They are run down, but usually these buildings are also spacious. One important factor is the

Fig. 49. The MIT Building 20.

freedom of use. Brand gives an example of an MIT building from the World War II period that was originally meant to be temporary.¹⁷⁵ It did not even have a name but was known as Building 20 (Brand 1994 : 24). See fig. 49.

According to Brand it was the only building on campus where you were able to do whatever you wanted, and because of that the building was loved by its users. It was generic in character and suitable for laboratory use as well as experimental space. Because it was built to carry heavy loads and was of wooden construction, changes in the horizontal as well as the vertical direction were easy. Because none of the MIT colleges owned it, it worked as a playground for fledgling students as well as researchers, and it became a spontaneous interdisciplinary research centre for half a decade (Brand 1994 : 24–27). In summer the building was hot and in winter it was cold. Its amenities were spartan and it was dirty as well as ugly, Brand (1994 : 27) stated. He therefore asks why it was able to survive for so long and be so loved. An inquiry among alumni in 1978 gave the answer.

The most important reason was the liberty to do almost anything to it without asking permission. If you wanted to make a hole in the floor to get higher vertical space you just did it. You did not have to be afraid that you are harming or injuring the architecture. (Brand 1994 : 28)

This dimension of freedom is the most important characteristic of low road buildings. Brand quotes the ex-president of MIT Jerome Wiesner when referring to the character of the building:

[...] it puts the personality of the people in. The highly educated people are ready to give up services in return for space, freedom, interesting neighbors and ribbon windows. (Brand 1994 : 25–28).

The same tendency is seen in other rundown industrial buildings that artists have put into service. Similar comparisons could be made with container buildings and other temporary spaces Brand (1994) states.

No road

According to Brand, unfortunately many buildings belong to the no road category. They do not possess the virtues of high or low road buildings. They lack any relationship to time. They are purposely built and do not in any form reflect their inhabitants. They are not adaptive in their character. The no road buildings are sterile and inhuman environments (Brand 1994 : 52–53).

¹⁷⁵ It was built in 1943 and was under threat of demolition all of its life until 1998 when it finally was demolished.

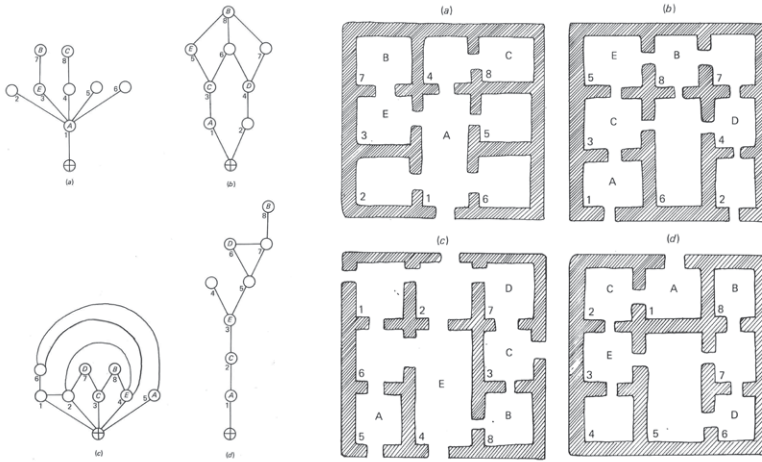
Scenario design

As an answer for design, based on his analysis of the time-based qualities of buildings, Brand introduces his idea of scenario design. However, it remains on a very abstract level in his book, and is not in any case its main focus. It is proposed as an answer to designing for the unpredictable. The idea is to think in advance of how a building could adapt.¹⁷⁶ What is very interesting in scenario design, however, is the idea of creating adaptability and timelessness through design in advance, as a strategic practice incorporated in design. In the design process the different uses can be anticipated, even though there is no trajectory yet for how the uses might develop or what they will be in the future. According to Brand, based on idea adapted from Duffy, design should plant the seeds for all future uses (Brand 1994 : 181). He believes that all buildings are predictions and usually all predictions go wrong. But the building can be designed in such way that it does not matter if the predictions go wrong. The old buildings that have withstood time usually have this property as well as some sort of overcapacity that can make it possible. Maybe the most insightful observation is Brand's comparison of chess with scenario design. In chess, people usually make moves that keep different options open. The idea is very close to that of self-organization and emergence as well, something which Brand, as a biologist, is likely to be familiar with. In self-organizing organisms, the organisms are resilient, which means that they have very different ways of proceeding when one way of coping collapses. Brand also highlights the significance of individuals in the development of the new. Individuals learn faster than organizations, which is why Brand sees the bottom-up way of creation extremely important in the production of space (Brand 1994 : 188).

CONFIGURATION OF SPACE

The concept of self-organizing space that springs from the configuration of space is connected to abstract modularity as well as people's behaviour and their aspirations regarding what they can do in relation to space. It can be about which part of the space and building a person can control and how a person can affect spaces and their use. However, from the point of lived space, the space can comprise much more in-depth connotations than just its use and possession. These are linked to the cultural dimensions of space that Brand (1994) also talks about, as well as the more individual meanings the space can create from more self-conditional starting points. Meanings are also interlinked with the configuration of space that give rise to its social, cultural and self-conditional aspects. This will be studied through two different understanding of space in its social and cultural analysis and from the point of view of the creative process.

¹⁷⁶ Brand, however, equates the programme of the building to the design. From the viewpoint of the design, the programme does not yet say very much about the actual design. On the contrary, very precise programmes have the tendency to restrict the design processes, that is, unless they operate on a very strategic level. This is probably what Brand is after.



Space syntax

Space syntax is a theory and an analytical tool developed by Bill Hillier and Julienne Hanson that portrays the connection between space and social life. It was first published in the book *The Social Logic of Space* in 1984. Space syntax can be applied at several scales, from city structure to the spatial configurations of buildings. In the context of the architectural debate in the 1980s that in practice focused on architectural styles, their view of seeing space as a social and cultural construction, and perceiving and portraying social relationships through diagrams was groundbreaking. Space syntax has been since widely used, particularly in urban research. The idea is very close to that presented by Alexander in his *A City is not a Tree* analysis, where spatial context is seen in relationship to the connections of passages. However, while Alexander was quite normative in his approach and interested in the creation of the built environment, Hillier and Hanson took the idea much further and developed space syntax as an analytical tool for studying buildings. Hillier and Hanson’s starting point was scientific research and the idea was based on an empirical study of how spatial configurations and their cultural and social connotations can be made perceivable (Hillier & Hanson 1984).

Space syntax is the analysis of spatial configuration, and studies its inner logic. It can help planners and architects evaluate the social impacts of their plans and design. Simple diagrams can be used to indicate how spaces are connected to each other in relation to social interacting. These diagrams can also be used as a tool to represent

Fig. 50. Example of analysis of a plan. The lines portray connections, and the circles portray space. If the dot does not lead to any new line it means “bag poop” (cul de sac), that is, that there is no connection to other rooms. The circles or rings portray how the rooms have more connections to each other and that there are more options for using the spaces.

MOH

types of spatial configuration as they appear in the relationships of different rooms. Hillier and Hanson talk about the genotypes of spaces, which means how the spaces are connected and how they reflect the social relationships. According to them, the ordering of space is the localization and ordering of the relationships of people. They state that spatial ordering is one of the most important and striking ways we can recognize cultural and social differences. Hillier and Hanson studied a great number of settlement patterns and analyzed their social connections through space. They believed that, in emphasizing the visual character of the space so much, architectural research has neglected this viewpoint. One general idea in space syntax is that space can be divided into components and analyzed as a network of choices. These can then be portrayed as maps, in which the relational connectivity appears. With the help of these diagrams it is possible to study, for example, how navigable any space is. (Hillier & Hanson 1984).

Although space syntax is very much an analytical tool and has been developed since into a diversity of simulation devices, it raises important questions about how space should be produced and how design research could study the mutual relationships of spaces from the viewpoint of people's living habits as well as cultural and social habits. See Fig. 50.

The concept of type

The concept of type¹⁷⁷ is not really a design strategy, although closely connected to it. Type is essentially connected to design thinking and the understanding of the main concept of this research – typological flexibility. Type has been a tool used for understanding the essence of architecture since the 1800s. Type is a holistic understanding of the different dimensions of architecture. The typology of building, closely connected to the concept of type, usually refers to a building's spatial configuration and, as Hanson and Hillier pointed out, it is also closely connected to the social and cultural understanding of space. Typology is the essence of genotypes. Typology refers to how the spaces are configured in connection to each other, defines how the building can be used and how it can adapt to changes. Based on their spatial configurations and structure, certain typologies allow adaptability better than others. However, its meaning is much wider than just the spatial configuration.

Space and type can have cultural as well as more personal meanings, which are very difficult to pin-point or measure. For the formation of positive meanings the architecture needs to encompass the potential to create continuously new meanings

¹⁷⁷ The concept of type is essential to various sciences. As a concept, it is broad and associated with the way human beings exist in the world. Regardless of culture and place, the human being attempts to organize and understand the world around her/him using classification and typologies. It is by observation, classification and comparison of different types that people gain information which they can then use further by developing different views on the world in order to again affect it.

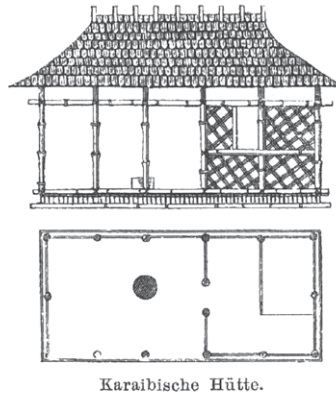
through new uses. This is also connected to the overall architectural quality of space and building, which can inspire people to produce their own creative solutions in relation to space. People usually want to preserve built environments and space, if it inspires them and they can interact with it. This is the case even where habits and interpretations of the same space differ between individuals and eras. Thus, the concept of type is a holistic concept that comprises both the physical and mental aspects of buildings. According to Nordberg-Schulz (1963), type, in its varying forms, has, at regular intervals, offered architects the means to renew and reform their field. The concept of type has regained new meanings as attitudes in architecture have evolved in parallel with changes in society.

The interpretation of type in relation to earlier interpretations of the concept

The understanding of type in architecture has consisted of a search for the essence of architecture, and it cannot be directly associated with any 'isms' or particular ways of thinking. Because type as a concept can also be laden with a number of values, it has often been harnessed to bringing forward new points of view and to justify new design solutions (Forty 2000). Type and model are often confused with one another, but as was pointed out earlier, in fact the concept of model largely contradicts the concept of type, or it can be understood as a marginal aspect of type.

The scientist, art historian and critic, Antoine Quatremère de Quincy, was one of the earliest developers of the concept of type. As early as in the 18th century, he distinguished between the concepts of type and model (Forty 2000). He developed a theory of imitation at a time when the relationship between nature and architecture had become a prominent question in architectural theory. The concept of type played an important part in his theory. According to Quincy, architecture did not copy nature as a model, but imitated it, i.e., the processes of nature. In other words, a model was a clearly concrete exemplar, whereas a type was an architectural idea – the process of architecture (Forty 2000 : 304).

The word "type" presents less the image of a thing to copy or imitate completely than the idea of an element which ought itself to serve as a rule for the model [...]. The model, as understood in the practical execution of the art, is an object that should be repeated as it is; the type, on the contrary, is an object after which one may conceive works of art with no resemblance one to another at all. All is precise and given in the model; all is more or less vague in the type. (Quatremère de Quincy 1825 : 148, cit. Forty 2000 : 305).

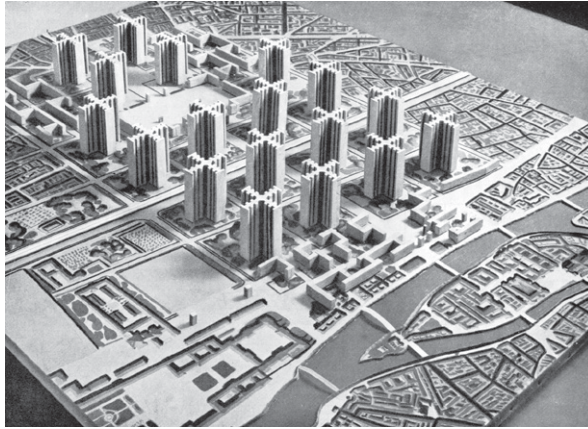


Quincy's thoughts on abstraction were further developed into a more concrete direction by Gottfried Semper at the beginning of the 19th century.¹⁷⁸ Semper's project was to find and classify the prototypical forms of architecture, which would then be adapted to stylistic changes yet retain their characteristics in one way or another. He took the concept of type towards the concept of *archetype* in architecture. The example of the *Caribbean Hut* built on the idea first presented by the French architecture critic, Laugier (1977 (1753)) (Leupen 2006a : 28). The Caribbean Hut concept proposed the general archetypal character of building in general, which consists of the different processes of building that give the buildings their shape. In the 19th century, architectural discourse was very concentrated on style, but in Semper's analysis the question of type arose from very tectonic starting points, and in such a way that conceptual thinking was also very much in focus. According to Semper, the architecture of the building could be understood through four different processes: *earthwork*, *framework*, *membrane* and *hearth* (Semper 1863). This is actually very near Brand's (1994) understanding of layers. According to Semper, these were the initial motives, independent of style, and they are present both in a Caribbean hut as well as in a temple. Semper could be said to be one of the first to conceptualize the building as a process, in which the objective was to understand the primary character of a building without attachment to any particular period or style. See Fig. 51.

There is also always a danger of understanding the concept of type as permanent and unchanging – a model. When a type, or an idea of the building, has been developed and introduced it often has a tendency to become a norm according to which regulations may then be formulated. Therefore, type starts to resemble model and its

¹⁷⁸ Forty (2000 : 305) argues that Semper was critical of Quatremère's idealist take on type as generic idea and wanted to expand it by giving it more substance.

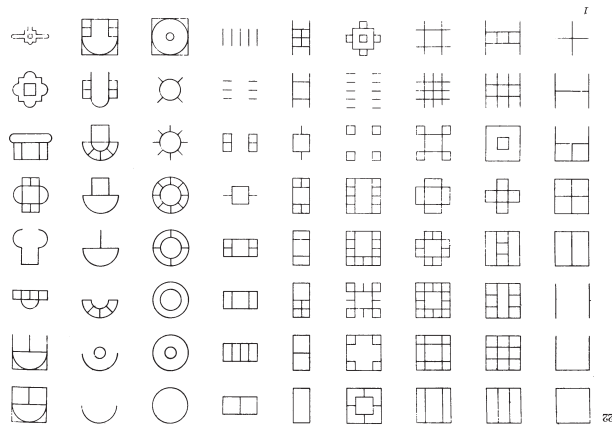
Fig. 51. The Caribbean Hut by Semper.



renewal becomes difficult. The architect Rafael Moneo (1978) considers it important that a designing architect not use the concept of type only as a classification tool but instead use it in order to produce new architecture. According to him, the concept of type also includes the process of change. The concept of type is a changing frame, within which modification can also take place. Even though typological examination comprises a certain level of replication, the idea of the uniqueness of an architectural object can never be abandoned in architecture. A design process consists of bringing together typological elements – formal ideas – under certain circumstances in order to create a unique, individual work. For the pioneers of modern architecture, such as Mies van der Rohe, space was not meant for a particular function, but space itself had a meaning. A space could act both as a school or a church. (Moneo 1978 : 32).

Concepts that are harder to explain, such as imagery, ideals, and conceptual and archetypal characteristics, are also an inherent part of the concept of type. According to Franck and Schneekloth (1994), type can be examined from material, imaginal and conceptual points of view. However, these points of view are intermixed to the extent that none is directly independent from another. They say that material characteristics are often called functional types. They are either shaped by nature or by humans, such as a forest, a park, a road or a house. Nowadays, many material types consist of multifaceted social, economic and physical structures. Each era and society creates material types on the basis of its own order and values. Imaginal types are interwoven with material types, and with their social structures. They are not physical structures, but products of our imagination and senses. This type includes utopias, ideal models about dwelling, childhood memories of an environment, etc. As such, these do not exist anywhere, but they contribute to the formation of our environment. Franck and Schneekloth give examples of this, such as the designs for *Plan Voisin* and

Fig. 52. Plan Voisin in Paris by LeCorbusier 1925.



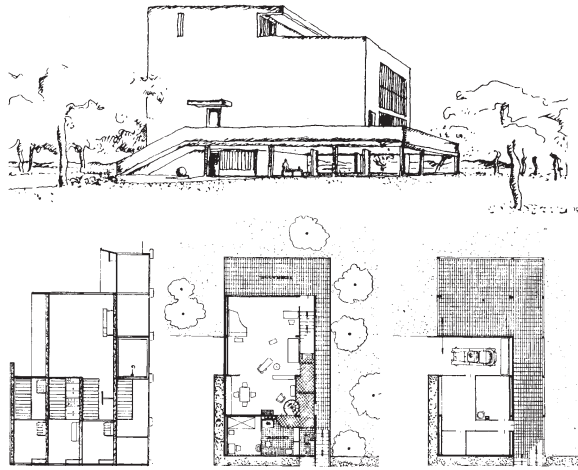
Ville Contemporaine by Le Corbusier, which became models for ideal types in many grandiose suburban plans, both in Europe and the United States in the 1960s and 1970s (Franck & Schneekloth 1994 :20). See Fig. 52.

Imaginal types can be used to control and steer the formation of both imagery and the environment against other imaginary types, or they can be used to prevent other such types from being created. As an example of such use, Franck and Schneekloth (1994) offer the “American dream”, a way of living in a detached house that stands on its own large plot. This imaginary type has been influential in creating the vast suburban sprawl of individual detached houses which, from the point of view of sustainable environmental development, are very problematic. The conceptuality in type, according to Franck and Schneekloth (1994 : 21), manifests itself in the intellectual structures, such as typological systems that we use in order to perceive and affect the world. Type is not limited to description, but aims at analysis. Analysis itself is a fundamental tool for defining the objective that building aims to achieve.

The concept of type as a means for the analysis and development of a viewpoint

The concept of type has often been used as a means to introduce new aspects into architecture, or to justify design solutions, or to function on a more conceptual level as a herald of a changing stance in architecture (Forty 2000). As early as in the beginning of the 19th century, J.N.L. Durand (1805) introduced the possibility for type to act as a means of analysis and change in architecture. Durand criticized the tyranny of classical systems and considered them decoration. According to him, such elements as columns, plinths and arches should get their form in accordance with the material used

Fig. 53. Building forms by Durand (1809).



and function required. He developed different types (he used the term *genre* instead of type) which derived from different needs and followed an architectural brief for a particular typology, such as a hospital, a prison, a library and a theatre. He regarded style as something that could always be applied from the outside. He developed an architectural system and a method which could be applied and used to respond to the needs and requirements of a changing society and new building types. Durand's principles and elements acted as compositional aids. (Franck & Schneekloth 1994 : 22). His approach, however, can be seen to platinize type to a collection of different formal design features close to the “click together” model. See Fig. 53.

The stride of modern architecture, in parallel with the industrialization of society at the beginning of the 20th century, attacked the formalistic concept of type. The idea of type was perceived as a collection of historic and formalistic rules and limitations of which modern architecture should be free. A good example of this can be seen in the debate around the Deutsche Werkbund on types and categorization by type. Type was used to oppose mass culture and to bring order into the otherwise chaotic world as universal models. Le Corbusier's architectural types, *Maison Citrohan* and *L'Esprit Nouveau*, were based on a similar premise and their intention was to bring rational order into bourgeois inappropriateness and to preserve cultural values in design (Forty 2000 : 307). See Fig. w54.

The early 20th century idealistic architectural stance of modernism saw the concept of type more like a model or a *prototype*. Functionalism, in particular, took a stand against the typological, compositional concept of type, which defines type as traditional forms. (Moreo 1978 : 32) For functionalists, space derived from its

Fig. 54. Maison Citrohan by Le Corbusier (1922).

function only. They saw mass production as one of the potentials that new modern architecture encompassed.

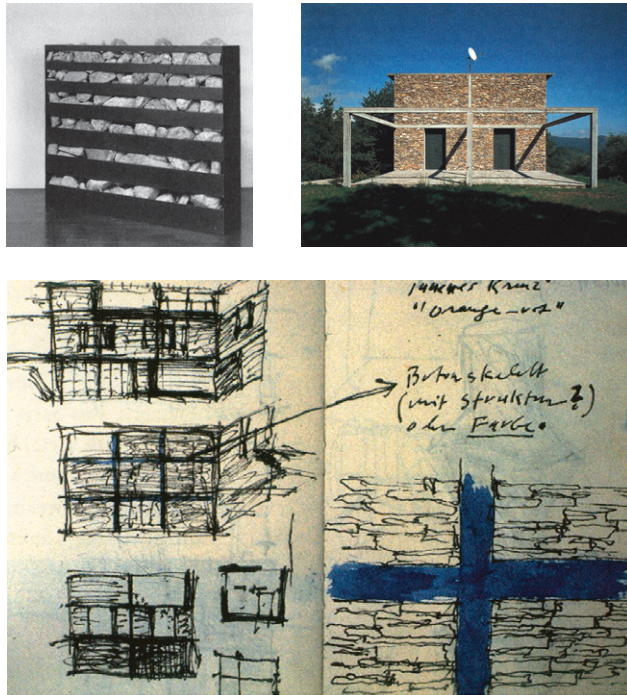
From the 1950s onwards, when modernist, functionalist architecture came under criticism for having lost meaning, it had an effect on the concept of type as well.¹⁷⁹ But it was not until the 1960s that the concept of type was reintroduced into architectural discourse. In Italy, in particular, the debate was fervent and concerned itself with the conventions in urban design. Some of the central names in this debate were Saverio Muratori, Carlo Aymonimo, Vittorio Gregotti and Aldo Rossi (Forty 2000 : 308). Typology was used as a tool for urban analysis. It acted as a tool to describe the relationship between buildings and the city. Architecture was not just a matter of defining space, but a spatial, social and historical urban phenomenon. Aldo Rossi took this thinking furthest by using type as a device to examine architecture separately from the functions that it served. According to Rossi, certain historic forms of buildings and streets were manifestations of type, and they were unchanging and permanent, a view which resembles the understanding Alexander and his colleagues of the pattern language. Architecture derived from something other than functions, which could change over time. Only architecture was permanent (Rossi 1982). Yet Rossi regarded the typology of architecture as an immutable historic phenomenon. Development had little place in his theory. The interpretation in a post-modern architectural style in general narrowed the understanding of urban space to a series of aesthetic and morphological loans.

Type and design process

Regardless of the design method, type as an architectural idea and as the formal core of architecture, is always, in one way or another, present in the design process. The typological approach has provided a way in which architecture has been passed on from one generation to the next, in the form of theories or significant works of architecture. Typology and typological analysis have also served architectural education and deepened architectural thought. But the question is not only about transmitting models, it is also about renewal. If it is only a matter of copying something, the architect will no longer be needed. The kit house industry is a good example of this (Davies 2005).

Both Argan (1963) and Colquhoun (1967) highlighted the importance of typology in architects' creative design processes. Argan (1963) saw typology as being simultaneously about the historical process of architecture and about an individual architect's thinking and working processes. According to him, typology is often understood merely as the transferal of symbolic elements whereby both ideological and symbolic characteristics can consciously (or subconsciously) be transferred and presented as

¹⁷⁹ The most vocal critics were the Structuralists and Team X who denounced the CIAM ideology and its biased interpretation of architecture.



formal references to existing architecture. This way, typology, as a concept, starts to resemble iconography, which is always part of the concept anyway (Argan 1963). According to Argan, to understand type purely formally, excludes the artistic creative process, which is a fundamental element in the concept of architectural type. The perception of type as a reductive process, within which previous architectural works of art are reduced to mere types, and thus their stylistic and historical references are gradually lost or neutralized, assists the architect in making new creative choices regarding type, and it also enables her/him to develop them into new types. The concept of type both comprises the critique against types that no longer function, and overcomes those types by creating new ones (Argan 1963 : 242-246).

Similarly to Argan, Colquhoun (1967) regards the typological method as both a symbolic and creative process. Symbols and semantic contents vary in time as society and its needs change, which is why he also questions the perception of typology as a return to traditional morphology. On the other hand, he also criticizes the rational and synchronously intuitive way in which modernism separates architecture from its cultural context. By intuitive, he means the denouncement in modernism of all rules and inherited forms. He also considers the purely technocratic and functionalist approach to architecture an impossibility. To illustrate his point, Colquhoun mentions descriptions

Fig. 55. Above left, Robert Smithson's installation 1968; on the right, Herzog & de Meuron, Stone House Tavole 1982-88; below, a sketch of Stone House Tavole.

by architects of design processes, within which the practical and technocratic, or other – such as mathematical – methods, can steer the design up to a point. At some point somewhere, though, the architect has to make aesthetic, formative and tectonic choices. Colquhoun thinks that these choices and the factors that inform the design processes are a significant cultural frame that should be made visible. (Colquhoun 1967 : 253 - 254).

How do cultural dimensions manifest themselves in the design processes that are directed by the architect's individual design methods for renewing the context of type? Where is the line between the morphological loan and the reformative creative process? Very few architects have either written or described their creative processes in that context, most probably because it is a multifaceted and complex process that is difficult to conceive, let alone to verbalize. The architects Jacques Herzog and Pierre de Meuron have, nevertheless, attempted to illuminate this aspect of their design process (El Croquis 60, 1992). Their starting point is that of the artist, so they approach architecture via observation and interpretation. Herzog and de Meuron are like tracers of existing "tracks". They bring the tracks forward and enhance them, question them and possibly give them new meanings in their design thinking. They see that the relationship to existing architecture cannot be avoided and it is important, but there is no intermediary tradition or homogeneous culture anymore – that is a utopia (El Croquis 84, 1997). Their way to perceive the world is part of the design process. Each design project or plot gives them its own architecture and it is not a question of style or forms that repeat in their work.¹⁸⁰ See Fig. 55.

As a matter of fact, the architectural plan and the architectural work interest us as tool for the perception of reality and confrontation of it. Here too, we would view the moral and political content of our work from a more questioning stance. Not only as a stance during the drafting process, but also as the self-reflecting quality that we try to bring into the finished buildings themselves. (Herzog & de Meuron 1997 : 207–211)

According to Ursprung (2002), studying Herzog's and deMeuron's stone house Tavole (1983), it is possible to find connections in the building to both the history of architecture – as in the tectonic thinking of Semper – and to modern art – as in Robert Smithson's installations. The stones from Tavole have been used in the walls by laying them inside the concrete beam frame. The building itself does not directly refer to the forms or structures of the local stone architecture, instead the building creates its own connection to the landscape and the context. Therefore, new architecture has avoided becoming pastiche even though it is very much linked to the existing context of Tavole, both materially and in scale.

¹⁸⁰ Herzog and de Meuron's design approach epitomizes well Schön's idea of the reflective practitioner who has to define the problem while designing through a questioning stance in design.

In architecture, as in other forms of art, the avant-garde is a movement that questions the whole field. With time, art and also architecture verges on institutionalization. New ideas are adopted eventually as matters of course, and form part of the institution and there is some resemblance to the conservation phase incorporated in resilience thinking. The avant-garde characteristics of 20th century modernism have gradually become the norm in housing production. In a way, the architectural trend that derived from the avant-garde stance has become a new design tradition. The culture of expertise and specialization is part of modern society, as Schön also points out. The Finnish art critic and theorist Irmeli Hautamäki describes the gap between specialized expertise and the majority of people as follows:

*The expertise that develops further and further creates also, in art, the same problem as in the modern society in general – art becomes alienated from the life we lead. Expert cultures do not meet the everyday life of people or the so-called live-life. A group of experts replaces traditional social structures, family and friends.*¹⁸¹ (Hautamäki 2003: 97–99)

Jean-François Lyotard, whose work Hautamäki also refers to, highlights the reformative position of the avant-garde in art. According to him, without reform, art becomes a commercial application of predestined and pre-calculated rules. Lyotard (1984) examines the concept of the avant-garde via the concept of the post-modern. The post-modern is not the historical period or era that began after the modern. Lyotard sees modern time as a cyclical period, within which there is always a post-modern era about to take place. The following present is already being born inside the current present. The post-modern is the future modern time, where the difference between the post-modern and the modern exists in the fact that the post-modern is connected to the cultural verge for further complexity and differentiation. This resonates with the concept of type.

The strength of understanding the meaning of type as part of the creative process and architecture is based on the notion that the aesthetic and spatial characters of architecture are no longer seen as separate from its functional or social aspects. In artistic processes, like in systems thinking, an entity is always more than the sum of its parts. By isolating and emphasizing certain viewpoints, many aspects can easily be overlooked, but in a creative process they are usually taken into consideration through adopting more holistic starting points. In art, the formation of the new precedes its final comprehension, which is only dawning before it achieves its final form. The condition was also emphasized by Polanyi in the concept of tacit knowledge. If housing design is seen merely from the point of view of production and the practical, it will very quickly exclude development. That way, only production-related and pragmatic

¹⁸¹ Translation by Karin Krokfors.

aspects are allowed to evolve in housing design, and the process will not necessarily respond to the real experiences of people.

CREATIVE DWELLER THROUGH RESPONSIVE AND EMERGENT SPACE

There are different design approaches that tackle the challenge of building with a self-organizing potential and that includes an understanding of the way people can affect their space based on their aspirations. These approaches give very different roles to people and execute their influence in various ways. They are based on diverse understandings of the objectives of design. I have called these viewpoints *co-creation* and *co-evolution*. I see the main distinction between co-creation and co-evolution in the impact levels the self-organizing capacity of buildings and space offer, and also on a range of scales they affect. They can have an effect on limited conditions of space, such as inside the dwelling, or they can have an impact on the whole building or urban contexts and even society as a whole. Co-creation and co-evolution are usually intertwined and do not always appear as purely one or the other.

Co-creation

Co-creation as a concept has usually been linked to economic strategies or business philosophies. It also refers to introducing new ways of production that involve customer participation, which is connected in turn to the value creation of products, as in Victor & Boyton's concept of co-configuration. The emphasis of co-configuration is on the production phase but it also considers services later on (Victor & Boyton 1998). Given the context of flexibility of use here, I have interpreted the concept of co-creation to mean that it can take place as a continual process even after execution. So, co-creation can be linked to both production and use and it can be connected to the evolution of a building based on the attributes premeditated in design, although its focus is on how people can act upon space. The attributes of design can be either responsive or proactive in character. They can propose ways of using the space based on preconceived ideas, or give freedom for people to use the space and cultivate it for their own purposes. In my interpretation co-creation usually works in a closed entity that the person manages, but as a concept it can refer also to the scale of the whole building while it is being produced.

Co-evolution

Co-evolution as a term has been used today, for example, in technology, sociology and more recently in relation to sustainability. In technological terms, it can also refer to hardware and software, which are separate components but closely connected to each other by co-evolution (Evolution.berkeley.edu 2017). I have used a similar parallel when referring to the relationship between people and space. Space can have flexible

parameters, “the hardware” that allows people to use the space according to their aspirations, while the ways of using the space can be seen as “software” that can also evolve into totally new societal contexts. The co-evolution of buildings and people can also effect changes outside the realms of a particular space and the ways people behave and act. I recognize that co-evolution, linked to self-organizing flexibility of space, has effects on its instant realms i.e. in building and city as well as society.

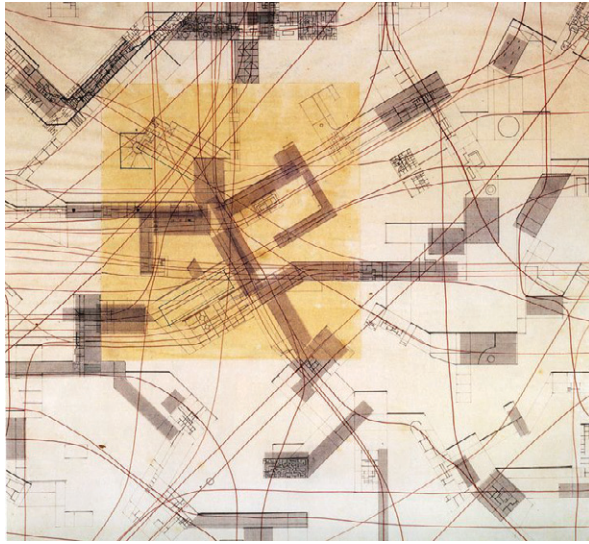
I have proposed three ideas and strategies that all reflect, in one form or another, the aspects related to co-creation or co-evolution. The categorization has been slightly rough because both qualities can be observed in all of them. However, I consider it important to separate them as concepts, because they both seem to indicate slightly different trajectories of conduct. Co-creation can be seen more as a tactical approach while co-evolution is more strategic as well as holistic in character.

CO-CREATION – THE CREATIVE DWELLER

Fun palace and free space

A very interesting approach that tried to pave the way to understanding the dweller as creative was developed by Cedric Price in the Fun Palace project in the 1960s.¹⁸² The whole project was based on the pioneering idea of taking into consideration the co-creation between people and architecture. It was all about interaction between people and space through certain flexible characteristics of the building. It was a project based on the concept of free reactive and proactive architecture, in which the architecture was seen as a space which can be modified according to the aspirations of people. It was meant to enable new spaces, actions and social contexts to emerge. Even though Fun Palace was not linked to housing, the project opens up viewpoints that have something to offer in the context of designing the self-conditionality of space and understanding the creative dweller. Fun Palace was a question of anticipatory design, making it possible for people to use and create space according to their own needs and desires. Even though Fun Palace was never realized, it sowed the seeds for other projects like the Pompidou Centre in Paris, even if these did not reach the same level of ambition as Fun Palace had as a project (Matthews 2007 : 190). The design concept of Fun Palace is still inspiring new generations of architects (Mathews 2007 : 254).

¹⁸² The idea of Fun Palace came from the influential theatre figure Joan Littlewood who, in 1962, met Price and introduced her idea of a “people’s theatre” to him. They were both innovators in their own fields and were very interested in living conditions and in the development of people’s potential. Littlewood’s idea was not so much about entertainment or conventional theatre as about a space in which people could play, learn and redefine themselves in an interactive manner (Mathews 2007 : 63). People’s free time had increased substantially in the 1960s when working hours had been shortened. Free time needed new definitions. People had to be continuously entertained instead of developing their own creative potential. (Mathews 2007 : 113).

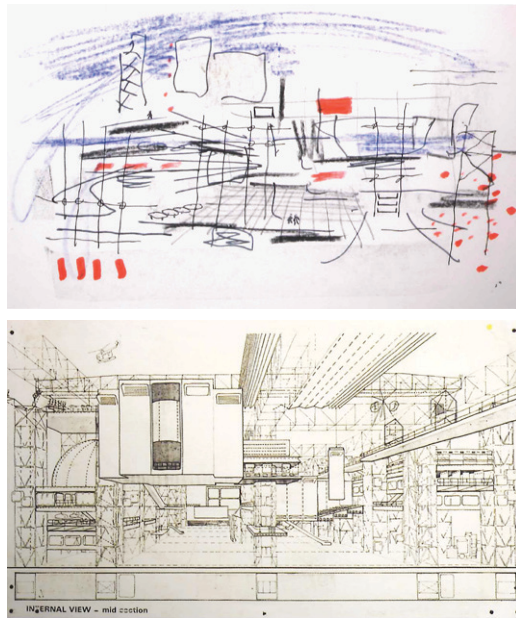


Fun Palace did not have any direct role model or predecessor, but Price was inspired by Nieuwenhuys' idea of New Babylon. According to Nieuwenhuys, the understanding of human creativity has been a built-in thematic of different avant-garde movements. Price quoted Johan Huizinga – “Homo ludens” – man at play, referring to humans' escape from reality by replacing it with a dream reality. This would make the human forget unwanted conditions. New Babylon was a purely theoretical and utopian idea of an ad hoc place, in which everything would be accomplished without planning in advance. It would be flexible, modifiable for the purposes of different actions, the changes of atmosphere and state of minds as well as behaviour. Every component would be undecided, mobile and flexible. (Mathews 2007 : 96). Price's approach was, however, more concrete than Nieuwenhuys's New Babylon. See Fig. 56.

Price was very interested in cybernetics as well as systems thinking, which particularly in the 1960s were rising to the consciousness of people who challenged the mechanistic world view. The theme of diversity and variation had been part of architectural discourse from the 1950s onwards in England.¹⁸³ For Price, architecture should be anticipatory, designed for what is uncertain and unknowable. He called it calculated

¹⁸³ Price was among the first architects who wanted to utilize information technology to create architecture that is responsive to changing forms and use. Archigram was also fascinated by Fun Palace and particularly its aesthetics. The influence of Fun Palace can be seen in Plug-in City as well as in Walking City (see page 226). Archigram's Mike Webb has stated that they were never as in-depth as Price's. Whereas Archigram understood that technology worked on a more aesthetic and symbolic level, computers and technology were integral to Price's plans. He never used technology as the goal but as a tool (Mathews 2007 : 242).

Fig. 56. New Babylon plan by Nieuwenhuys (1959–1974).



uncertainty. This idea was close to cybernetics and *game theory*, which he encouraged architects to get acquainted with. Instead of designing conventional buildings, which would contain a fluid and transformational programme, Price started to conceive of a skeletal framework in which and around activities could grow and develop. The structure would be organized in such a manner that all the non-load-bearing parts could be transformed or changed. Everything in the building such as tv, communication, acoustics, sound control and electricity should use information technology. The space would contain information pillars, which would remember the user's questions and requests, and could even make suggestions about the action and use in the space themselves. Price did not exclude any developmental direction (Matthews 2007). According to Matthews, Fun Palace was under-defined, full of potential and open to many interpretations. (Matthews 2007).

Any positive and negative associations could easily be attached to it. The character of the building complex was that it would never be totally finished, and Price was hoping that the users could design it as and when they used the building. The Fun Palace was self-regulating and its physical configuration and operations should, as an integral part of the architecture, anticipate and respond to possible modes of use (Mathews 2007 : 173). See Fig. 57.

For Price, architecture was generally an instrument for social improvement (Mathews 2007 : 242–257). This can be still seen to follow the modernist notion that technology can solve spatial problems, but the intensity of the co-creation involving people and architect – Price's key idea for Fun Palace – was unprecedented at the time.

Fig. 57. *Fun palace* drawings by Cedric Price (1963–1964).

Even though it was the social aspects that were the focus of Fun Palace, its legacy has usually been seen in terms of its technology and high-tech aesthetics. Although the project was born during a time of great technological optimism and even romanticism in the 1960s, according to Matthews (2007) Price sought to transcend to architecture this prevalent trend of the cultural life that time.

The ideas presented in the Fun Palace are particularly interesting from the point of view of understanding people's creative potential and appreciating that co-creation between the people and the architect can happen during the use of the building, after its execution. The other significant aspect in Price's ideas is that the building is never ready but rather evolves continuously so that all its manifestations cannot be predicted in advance. There is no need even for that because the flexibility of the building offers the set for unpredictable development and emphasizes the understanding of the creative dweller.

CO-CREATION AND CO-EVOLUTION AS STRATEGIC AND TACTICAL APPROACHES

The two key concepts of flexibility, that is, multi-usability and transformability, will now be explored more thoroughly. This will be done from the point of view of two main strategies introduced in the 1960s, as mentioned before, which are the two different approaches that have affected the discourse and development of flexibility to this day, namely open building and polyvalence. Both these approaches have very strategic starting points even though their interpretations are very different and serve different objectives. The thinking has emerged from very different background assumptions about how people affect space, architecture and society. Open building that is geared more towards transformability and structure has its roots in mass production, and it has been very methodical in character. In polyvalence the emphasis is on the multi-usability and self-organization of space in such a way that there is no need to make considerable alterations to the space. As a concept, it could not have been further away from the idea of open building when the two emerged in the 1960s.

Polyvalence does not relate to the methods of production in any way as in open building but rather focuses on creating a spatial configuration that also allows multi-usability for people for generations to come, and it is closely linked to the concept of type in its all implications. Even though in both strategies the focus is on how people can affect their own living solutions, they approach self-conditionality from very different angles. If open building starts from a more limited set of manoeuvring within an individual dwelling, polyvalence examines the multi-usability also within the whole building. However, open building has been developing since the 1960s and its principles have slightly shifted over time, whereas polyvalence has been referred to mostly as a theoretical standing for flexibility. It is not a movement concerning flex-

ibility like open building. The background assumptions about efficiency demands and technological application have, however, played a major role in open building. The architect N. John Habraken, the master-mind behind open building, has also developed and softened slightly his views particularly concerning the built environment and its operations (Habraken 1998). The concept of polyvalence in building, the child of the architect Herman Herzberger, has also been redefined and developed further by the architect and researcher Berndhard Leupen (Leupen 2005, 2006a). To understand the concepts of transformability and multi-usability, it is however essential to be able to grasp the different background assumptions in open building and polyvalence as to what they mean for the self-organizing quality of buildings in general.

Open building – Co-creation (tactical approach)

Compared to the work of Nieuwenhuis and even Price, the open building design concept developed in the context of standardized housing production in the 1960s in the Netherlands, and was very concrete and practical in its approach. Habraken had the groundbreaking idea of defining the hierarchical levels of influence of space and apply it in everyday housing production. His book, *De Draggers en de Mensen: het einde van de massawoningbouw* (1961), was translated in 1972 as *Supports: An Alternative for Mass Housing*. As a concept, the open building (*open bouwen*) was established in the 1980s when the a research group (OBOM) was formed at TU Delft (Kendall & Teicher 2000 : 16). Open building was, and still is, an approach to design and production that aims at responsive dwelling according to inhabitants' needs. It can, however, be applied to office and other buildings as well (Kendall & Teicher 2000 : 4). I have dwelt on open building at length because its development encapsulates the many issues of flexibility of space, that aims at inhabitants' influence in the context of production demands. The open building ideology is also particularly connected to the understanding of the concept of transformability of space.

Residents' influence

The system building developed to solve the housing problem after the war was under criticism because of its neutralizing effect on housing solutions in the Netherlands. Habraken paid attention particularly to the fact that the age-old natural connection between human beings and the built environment was starting to be disrupted. The new production method had stopped the old way of producing one's own dwelling which had brought individual character to buildings. Habraken saw, however, an opportunity in mass production to achieve this lost connection again. In *Supports: An Alternative for Mass Housing*¹⁸⁴, he analyzed the effects of mass production. The buildings were monotonous and showed no influence of the inhabitants. The ease of

¹⁸⁴ I will refer to the book simply as *Supports* henceforth.

mass production had also failed to produce any benefits for people (Habraken 1972). Habraken's interest lay primarily in how, within mass production, the inhabitant could have more influence. He believed that the inhabitant's influence would also enliven the monotonous built environment created by mass production (Habraken 1972; Bosma et al. 2000).

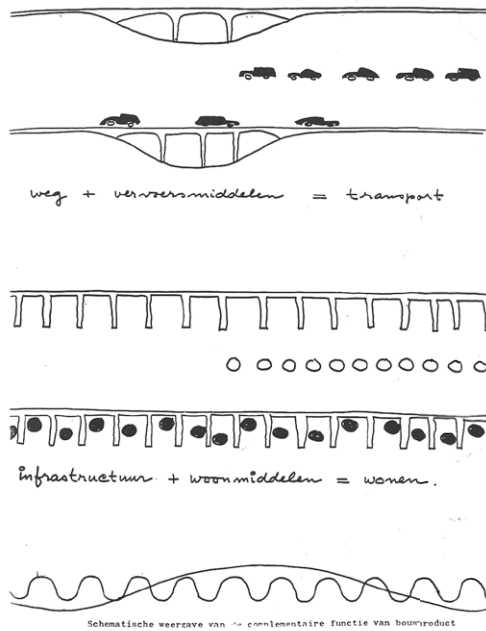
With rational system building, stiffness and repetition were being strengthened and at the same time it was decreasing the architects' freedom and influence. For designers, this was a difficult position. There was a possibility to create flexibility in the system, but developers wanted more unity because it was cheaper, simpler and faster to build. Nevertheless, system building based on mass production did not turn out to be any cheaper than traditional building (Bosma et al. 2000 : 91). Habraken's idea was that if the building construction could be applied more effectively the results could also be different. According to him, industrial building construction could be utilized to give the inhabitant bigger freedom of choice. Habraken concluded that mass production had impoverished and weakened society. With the help of his open *support system* he saw that there might be a possibility to encourage the emergence of a new society. In mass production generally the inhabitant does not assimilate to the dwelling and cannot influence it. According to Habraken, the inhabitant had three options; to use, break or deplete it. After that the inhabitant can move into a better dwelling. Habraken believed that the modern city dweller had become a nomad, moving from place to place without taking part in the change of the environment. He saw that the inhabitants then feel that the city is something outside themselves and their self-expression. (Bosma et al. 2000 : 91-97).

The hierarchical levels of influence

According to Habraken, housing production was not only a question of form but a process where power is divided according to "who decides when about what". The problems are not about architecture but stem from the conditions that lead to architecture (Habraken 1972), which was insightful thinking at its time. Habraken also understood housing in its wider social context and he divided the hierarchical levels from the point of view of influence. He developed a theory of supports and infill, which would be clearly distinguished from each other. The load bearing structure, the supports, was something permanent and the infill was flexible so it could change according to different needs (Habraken 1972). See Fig. 58. The idea is close to Le Corbusier's Domino House idea as well as his Algiers project. It can be considered the role model for the idea, although Habraken himself does not mention them. Habraken saw Le Corbusier's idea more as a technical one, while his own supports system is more of a societal approach than a technical solution (Bosma et al 2000 : 105).

Habraken's considered the support structure to be an independent durable structure that can be compared to a bridge or a road. It can be seen as a land structure, in

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which all the connections, including electricity, water and technical systems are located. From this structure, the community is born. Its structure is long-lasting compared to the dwellings situated in it. In that way, the structure also takes into consideration the changes happening in time. And the decision-making process operates on different levels depending on the hierarchical level of operation (Bosma et al. 2000 : 113). One of his basic assumptions was that decisions concerning the lower level do not affect the decisions made at the higher level. The levels are *city structure*, *city tissue*, *support structure* and *infill* (Habraken 1972). The city tissue and support structure define the building and the block. The infill defines the dwelling. Architects are responsible for the support system and planners are responsible for how it is situated in the city structure. The responsibility for the support structure is the state's, whereas the responsibility for the dwellings is on private stakeholders/actors/entrepreneurs. According to Habraken, the support structure should be seen as architecture, not just as a skeletal frame. The support system could provide a stimulating infill package for the inhabitants (Habraken 1972). However, this view caused confusion in various parties, because they were not able to understand it, and practical examples were called for to be able to outline the theoretical approach. Developers and contractors wanted to see if it differed from the structural systems already in use. This need for concrete examples led to the creation of SAR (*Stichting Architecten Research*) (Bosma et al. 2000 : 104).

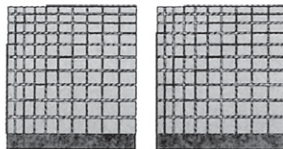
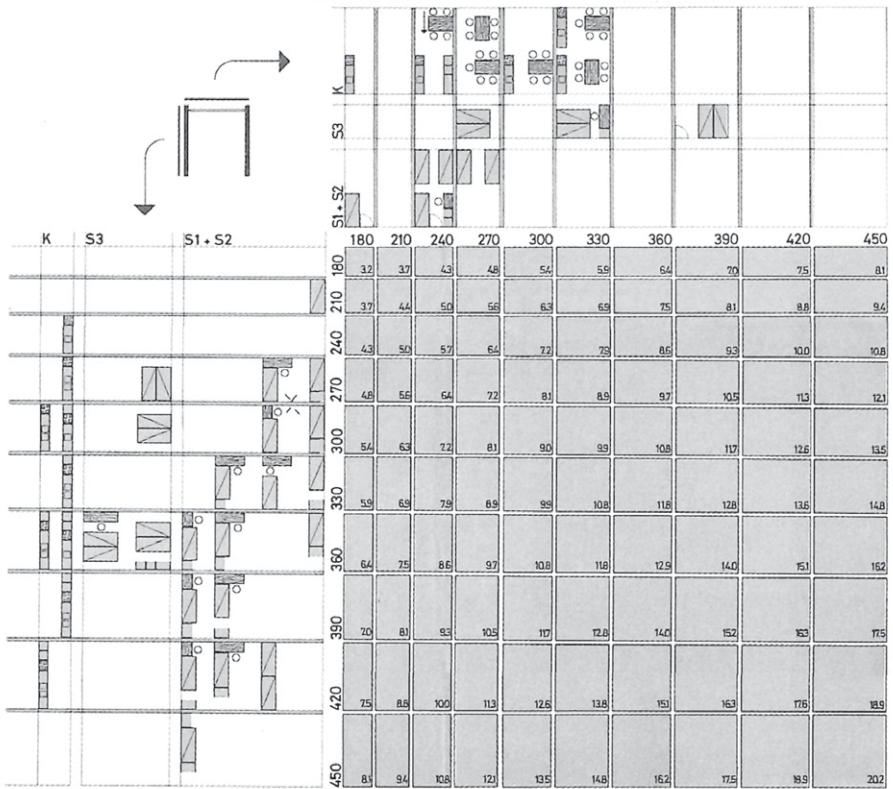
Fig. 58. Habraken's diagrams showing the comparison between support structure and infill packages, including car traffic on the highway. (1965).



overzicht specifieke verblijfsruimten

blijfsruimten hebben de nominale maat van $n \times 30$; de werkelijke afmeting kan zijn $n \times 30 \pm 10$ cm.

op basis van gebruiksnormen (v en w functionele grondslagen) en gebruiksanalyses van de breedte en de diepte van verblijfsruimtes kan in het 10-20 rooster een overzicht van specifieke verblijfsruimten worden samengesteld. deze specifieke verblijfsruimten zijn bij het ontwerpen te hanteren als zelfstandige eenheden. de specifieke ver-



op basis van het overzicht van specifieke verblijfsruimten kan men komen tot een eenvoudige normstelling.



Fig. 59. Poster of the SAR 65 model.

SAR

SAR was founded in 1965 and acted as a key promoter of open building. SAR consisted of several architectural firms with Habraken as its leader. The official objective of SAR was to stimulate the industrialization of housing production and to find connections between the architectural profession and industry, as well as setting concrete objectives for housing design (Kendall & Teicher 2000). According to SAR, total freedom would create chaos so it should be directed and monitored by introducing some limits. In defining the rules, SAR called them “rules of play”. Habraken’s objective was not, however, to improve society as a whole, nor to advocate revolution. He wanted to change reality with his new method rather than identify himself as a utopian thinker. (Bosma et al. 2000 : 106). His critique was targeted at the way mass production was conducted and how it was not based on wide political or social viewpoints. According to Habraken, housing solutions could not be made based on aesthetic viewpoints. He did not so much concentrate on improving architectural design as on creating the circumstances needed to foster good housing design (Bosma et al. 2000 : 296–297).

SAR’s methodic design

SAR’s vision of housing production was also very methodological and started to live a life of its own. SAR even developed a new design method, which aimed at rebuilding the whole decision-making process of housing design (Bosma et al 2000 : 216). It was a new methodized tool that would bring clarity to decision making in the design process, a “manual” for architects doing housing design. For example, SAR 65 and SAR 67 were design concepts that sought to create a general method of housing design by defining the zones of operations.¹⁸⁵ See Fig. 59. The objective of the method was a coordinated building process using the means of mass production. It aimed at a high level of quality without financial risk. The different actors should also operate more closely together. Not all developers agreed with this because for them the main objective of housing production was profit, and the new method created extra work and made the selling process more complex (Bosma et al 2000 : 214–215). The contractors understood that the support system could be profitable, but making the infill was not because of the extra work it included, particularly if the decisions were made by somebody other than the builder (Bosma et al 2000 : 234). SAR had difficulties in convincing the contractors

¹⁸⁵ In SAR’s method the designs were divided into *margins* and *zones*, which were developed to help the design process. According to SAR, they would be made possible by variation in the support system. The *alpha zone* was situated behind the outer wall of a building. It was located inside the building but maintained the connection between interior and exterior via windows and doors. The *beta zone* was located inside the building but did not have direct contact with outdoor space. The *gamma zone* comprised all public spaces like corridors, stairwells and galleries. For them certain functions were imposed. The inhabitants did have the possibility to organize living rooms and bedrooms, for example in the *alpha zone*, and kitchens in the *beta zone*. The *delta zone* was reserved for private outdoor spaces like balconies, patios, terraces and gardens. Added to these was also a sector that made different uses possible in those spaces that did not form part of the zone and support system. (Bosma et al. 2000 : 224–225).

and developers of the importance of differentiating between the support and the infill (Bosma et al 2000 : 238).

The predetermined method developed by SAR and architectural design were seen almost as synonyms. According to SAR, the zone system helped the inhabitants to perceive the variation within certain limit values, so that they could compare the different solutions with each other. For the designer, it was meant as an analytical tool for locating rooms and the components they demanded (Bosma et al. 2000 : 56–81). SAR's method was also applied to planning (Bosma et al. 2000 : 254–255).¹⁸⁶

However, in practice the housing solutions turned out to be as specific as in any housing design solutions. The solutions offered represented known housing conventions and there was no typological development. The system also turned out to be expensive, even though the expected outcome was to get cost savings by executing the massive support system with mass customized methods (Bosma et al. 2000 : 222–228). There was a flavour of Taylorism in the meticulous structuring and measuring involved in the zone system. The method did not start from the character of the space but from the notion of what was made in the space, resembling the functionalist thinking.

Roles

According to Habraken, the role of the state and the construction firms was too big in deciding what gets built as well as how it looked. In mass production, the role of design was more like a designing a prototype which was repeated. In this situation, the architect's role was quite small (Bosma et al. 2000 : 94). Habraken noticed quite soon that to be able to accomplish a change he needed to collaborate with different actors, such as the designers, inhabitants, authorities, investors and big construction companies. He also propagated the idea of a new division of roles between the different parties. The inhabitant had a big role in Habraken's thinking while the architect's role diminished and went through radical change (Bosma et al. 2000 : 144). Habraken believed then that a dwelling was not a piece of art but a functional object. In housing design, the architect loses her/his individual personality. For Habraken, the architect was the servant of the inhabitant and the manager of the project (Bosma et al. 2000 : 306). He considered the architect to be partly an engineer and partly a consultant, a kind of a mediator between the inhabitant and the industry. According to Habraken, the architect's role as an artist was over (Bosma et al. 2000 : 96). He considered CIAM

¹⁸⁶ Planning was understood to have morphological starting points even though functional factors had a significant role to play as well. The support system resulted from the morphology of the urban structure and buildings were seen as the spatial building blocks of the city. Outdoor spaces were defined as space types such as streets, alleys, squares, parks, gardens, courtyards, boulevards and canals (Bosma et al. 2000 : 257–258). The idea came close to pattern language thinking although its approach began from very different starting points to do with mass production. There was clear division between the urban design and building design.

and Team X as community clubs, entangled in utopian ideas, and unsuitable for dealing with societal issues (Bosma et al. 2000 : 98).

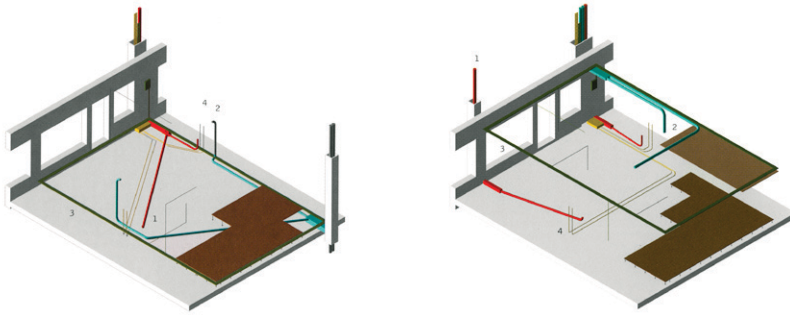
Critique

In the end, SAR's methodical design approach did not turn out to be very flexible. The support system was neither totally neutral nor open, and it also faced resistance within SAR. Critique was targeted particularly at the support system idea and how it was seen as an architectural element. SAR also faced much criticism outside its realm. The designs were seen as inhuman and SAR was accused of techno-commercialism (Bosma et al. 2000 : 233).

SAR's objective was to strengthen the connection between the state and the construction industry as well as between the other parties interested in housing. SAR collaborated with construction companies, which had had a tremendous impact on housing production after the war in the Netherlands. Many architects had difficulties with that. Habraken was considered a slave to big capital. There was a fear that commercial life would engulf SAR and poison the whole project. (Bosma et al. 2000 : 300). The younger generation criticized the Eindhoven technocrats [SAR], who had handed over architecture to big business (Bosma et al. 2000 : 302).¹⁸⁷

However, the primary critique was about the character of the inhabitants' influence, which was considered very constrained. In the hierarchical system the inhabitants only had a very small window in which they could make choices. This contracted the influence of inhabitants to "tinkering with products that already possessed built in preconditions prescribed by others" (Bosma et al. 2000 : 303). The group called De4 Afbraak (The 4 and Demolition) wrote: "The thing that Habraken calls 'rules based on predictable' confines the control in areas that have been decided by somebody else than the users" (Cit. Bosma et al. 2000 : 303). Critique was also aimed at the authority concept, which the critics thought was too narrow. They thought that Habraken was not interested in who used power and how. According to them, Habraken should place his theory in the context of social criticism, because it was apparent to them that he considered the individual execution of power better than centralized power. The same issue was also criticized within SAR. Among others, the architect John Carp pointed out that power was targeted at the morphological structures and it did not pay attention to who actually used the power. SAR approached the division of support and infill from a solely materialistic point of view and saw no connection between it and architecture. The architect Joost Meuvissen criticized SAR's very narrow outlook on space: "It is something that is left over. It is the location and size of the air". (Bosma et al. 2000 : 305-311).

¹⁸⁷ They particularly criticized how big business took over technology and science to serve their own purposes, and kept monopolistic connections to the building sector.



The influence of open building

Although Habraken had very humane ideas about housing architecture and wrote extensively after publishing *Supports*, his original idea of uniting the inhabitants' influence and standardized housing production was not very fruitful in the end. This was because it sprang from the logic of mass production, and its understanding of the role of architecture in general was geared towards standardized and methodical ways of designing. The tones of open building were somewhat totalitarian, at least in SAR's period. From the point of view of development and sustainability, the very strong tendency to seek universal solutions to suit a certain production method, and the business logic underlying that production, was also a very narrow one. In its understanding, the typology and its potential development were not really considered an essential issue.

However, despite the fierce criticism it faced at the beginning, open building has been applied and developed into a viable way of promoting flexibility and making dwellings more open to changes through transformability. The open building system has been expanding to other countries since the 1960s with a diversity of interpretations in different countries (Kendall & Teicher 2000). Nevertheless, in general, the interpretations of open building have been very technologically oriented. This has also been the case in Finland where open building has been tied to existing conventions, which in turn reflect customary planning and implementation procedures. This is not so much the consequence of the open building concept itself. Rather it is the case that the open building concept seems to have suited Finnish production processes very well and reflected a similar kind of rationale. However, Finnish open building has given the only viable concrete solutions concerning the transformability of dwelling. This is partly because of its prominent promoters, such as Esko Kahri (1993, 2011), Ulpu Tiuri (1997) and Jyrki Tarpio & Ulpu Tiuri (2001). They have also written and studied open building and its possibilities extensively in the context of Finnish housing production. What is very important in open building developments in Finland is that they recognize the modern way of building that takes into consideration the different

Fig. 60. Technical flexible solutions by open building (Tarpio & Tiuri 2001).

technical systems and tries to develop systematic approaches through transformability in dealing with the technical systems. See Fig. 60.

Polyvalence – Co-evolution (strategic approach)

Herzberger's concept of polyvalence comes close to the idea of co-evolution, which in turn is closely linked to the multi-usability of space. Polyvalent space is a concept relating to the character of the typology of the building. Hertzberger did not seek to develop a method for designing architecture but rather developed a more design philosophical approach. It is tied to the spatial qualities of architecture and emphasizes a holistic perspective without separating the use, architecture and typology from each other.

Hertzberger was looking for flexibility in the design itself. He understood that polyvalence is a feature and integral aspect of space and space does not necessarily demand any changes to be flexible (Hertzberger 1962 : 117). For Hertzberger, space itself and its character was meaningful for the flexibility. He also believed that the space should comprise characteristics that would inspire inhabitants to creative solutions in relation to space and in their own lives. Hertzberger's ideas are not far away from the thinking of the Situationists, Lefevbre and Price, let alone Brand, who saw space in relation to human beings and their active mental dimension.

[...] neither neutrality, which is the inevitable result of flexibility (tolerable to all, just right for no-one), nor specific, which is the consequence of too much expression (just right but for whom?). It is not somewhere between these two extremes [;] the lack of commitment and too much self-assurance, that the possibility of a flexible solution lies, [...] namely in the standpoint that everyone can relate to in his or her way, the standpoint that can take on a different – and hence divergent – meaning for each individual. [...] And it can only take those different roles if the divergent meanings are contained in the essence of the form, so that they are implicit provocation rather than explicit suggestion. (Hertzberger 1991 : 149).

Hertzberger also brought the time dimension into flexibility. He examined flexibility from its long-term objectives by thinking about what makes the buildings withstand time and be adaptable. According to Hertzberger, in functionalism it was a question of the expression of effectiveness of space, in which differences were manifested by separating the functions from each other, both in urban structure and in buildings. According to him, this led to extreme specialization and resulted in segregation instead of integration, which has turned out to be very unsustainable and inefficient (Hertzberger 1991 : 146–147).

One of the understandings of modernism is that as long as buildings are neutral they can easily bend to different uses. But Hertzberger thought that neutrality holds in it a lack of identity, a lack of individual and original character. His idea of flex-

ibility arises from the notion that no function is better than any other for any given space. All situations are temporary and changing. The flexible plan should, according to him, start from the assumption that no situation is the right one (Hertzberger 1991 : 146). This notion is also very close to systems thinking. According to Hertzberger, flexibility has only to do with uncertainty (Hertzberger 1991). He thinks that neutral flexibility will never produce the best or most appropriate solution. Because of that, Hertzberger thinks the only constructive approach to these situations is to produce a form or space that it is, in itself, lasting and polyvalent in character. It should be able to cater to very different functions without going through modifications.

Hertzberger believes that the uniformity of cities originates from thinking and searching for universal solutions, where functions like living and working are separated. This does not mean that separating functions has made any specific demands on space. Instead, people make the demands, and they can be very different depending on their personal preferences. According to Hertzberger, the functionalist approach contains one standardized concept, which does not allow changes. This collective imposition decides where people place their tables and beds. From generation to generation we create uniformity (Hertzberger 1991 : 147).

The coagulation of freedom and collective human action in home and in city have happened by predetermining the purposes of space. According to Hertzberger, this has happened in an uninspired manner, in which all the variations that form the identity have been radically weeded out. He takes Amsterdam's old merchant houses as an example, showing how every room can be used for sleeping, eating, relaxing and working, and each room lights up the inhabitant's imagination as to how s/he would like to use the space. According to him, the diversity in the centre of Amsterdam is not so much to do with complex principles as with the serialization of spaces that are polyvalent even when they are not so different from each other (Hertzberger 1991).

Hertzberger thinks that we should also give up collective interpretations of individual living patterns. Individual interpretations of collective living patterns can be made possible by the ability to absorb and accommodate as well as induce all the wanted functions and changes in them (Hertzberger 1991 : 146–147). Hertzberger has a plea for design in which a building can adapt and change and at the same time preserve its identity. This kind of thinking is actually very close to resilience thinking. Above all, architecture should offer incentives for users to influence and use a building in many different ways, not so much because they strengthen the identity of the building but to strengthen their own identity. Hertzberger, however, also believes in efficiency in creating space, but he calls for a new understanding as to how that concept is defined (Hertzberger 1991 : 148). He questions whether it is efficient if it can produce only one way to use the space.

Hertzberger supports the objective of self-conditionality but sees that there is a need to set some boundaries to people's choices. He thinks that architects are not



there only to be in the background to offer an empty shell for inhabitants and their unlimited wishes. According to him, this kind of thinking could be reduced to a menu that offers an unlimited selection, but instead of making you hungry makes you lose your appetite (Hertzberger 1974).

Change in general is a permanent situation and that is why the possibility for change should be taken as an existing starting point to be considered in all circumstances. To be able to persist, architecture should, according to Hertzberger, make different meanings possible. He thinks that architecture should exude and absorb many interpretations without losing its identity in the process. Meanings change and everybody gives their own meanings to things. Because of this, Hertzberger thinks that the architect should be able to take different roles, but this can happen only if the architecture can provoke implicitly rather than make explicit suggestions. Hertzberger sees that we should liberate architecture from its hardened chains. He

Fig. 61. Hertzberger's Diagoon Housing (1971) is based on polyvalent thinking and potential variations of a plan that the inhabitant can make.



challenges architects for searching for archetypal forms, because they can be associated with multiple meanings (Hertzberger 1991 : 149). According to Hertzberger, changes can be facilitated without the need to reorganize the structural and architectural presence. See Fig. 61.

Flexibility therefore represents the set of all unsuitable solutions to a problem. On these grounds a system which is kept flexible for the sake of changing objects that are to be accommodated within that system, would indeed yield the most neutral solution to specific problems, but never the best, the most appropriate solution. The only constructive approach to situation that is subject to change is a form that starts out from this changefulness as a permanent – that is, essentially static – given factor: a form which is polyvalent. In other words, a form can be put to different uses without having to undergo changes itself, so that minimal flexibility can still produce an optimal solution. (Hertzberger 1991 : 146–147)

This, however, usually needs very spacious solutions for rooms and passage spaces.

Hertzberger does not give any more attributes to the concept of polyvalence than that the space can be used in various ways and can inspire people's own self-expression. Hertzberger is thus relying very strongly on the architect's competence to produce typologically polyvalent buildings and spaces from very different starting points. In his approach, Hertzberger mostly ignores the conventions of housing production and talks more about the ideal situation for how a sustainable built environment should be created. According to Koos Bosma, Dorinevan Hoogstraaten and Martijn Vos (2000) who have studied open building extensively, Hertzberger's understanding of flexibility is rather limited because it does not consider transformability in any form (Bosma et al. 2000 : 78). The reason why Hertzberger has been criticized is probably because many of his concepts remain ambiguous and open to various interpretations. However, Hertzberger's point of departure is also valid today and timeless in its character. Polyvalent thinking is very much a question of resiliency in action.

Frame as generic space

One theoretical approach in which both points of departure are apparent can be found in Leupen's idea of frame as generic space (Leupen 2006a). Leupen, also a Dutchman and very familiar with the thinking of Habraken and Hertzberger, has made an interesting theoretical synthesis of their approaches. Leupen has developed Hertzberger's concept of flexibility and polyvalence further by interpreting it in a manner that also takes transformability into consideration. Leupen sees the concept of polyvalence as a feature of flexibility where minimal possible changes accomplish the biggest possible change (Leupen 2006a : 24–25). Leupen speaks about changeability,

Fig. 62. Interior photograph of Diagoon Housing (Hertzberger 1971).

which is the flexibility that the permanent frame offers. According to Leupen, the frame enables the creation of generic space, which in turn gives the opportunity for flexibility. He divides generic space into three different categories: *alterable space*, which is comprised of changeable elements; *extendable space*, which can grow; and *polyvalent space*, which means flexible space that needs no modifications (Leupen 2006a). For Leupen, polyvalence is nevertheless just one characteristic of flexibility and his focus is less on the quality and identity of architecture with reference to polyvalence, which is however an important issue in Hertzberger's understanding. The typology per se is not emphasized in Leupen's perspective even though he recognizes the importance of the circulation properties of the building and role that divisibility plays in flexibility, which the generic frame promotes.

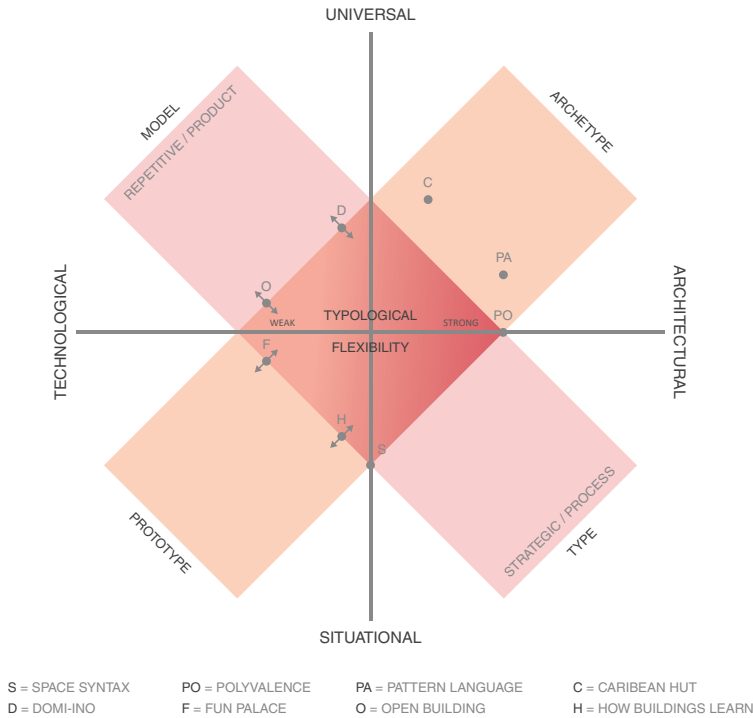
ANALYSIS OF TOOLS FOR SELF-ORGANIZATION – MULTI-USABILITY AND TRANSFORMABILITY

SPACE

The ideas of the architects Habraken and Hertzberger clearly demonstrate the two aspects, multi-usability and transformability, that are inherent in developing self-organizing of space. When we compare these approaches towards flexibility, the context in which they both operate emerges. Obviously, the concepts are tied to the 1960s when they were created and also to the Dutch context, but at their core there is also an almost archetypal understanding – the two polar points – in which different developments of flexibility seem to be entangled even today. These see flexibility either as part of a technological or an architectural agenda. Self-conditionality in open building emphasizes production and the dwelling whereas in polyvalence the point of departure for self-conditionality is architecture and the overall typology of the building.

Habraken took as a given mass production and the prevalent method of construction, and tried to work from there. He was not really questioning its premises but also tried to apply the rational thinking of mass production to design. Even though his starting points in *Supports* were very much focused on architectural expression, as vague as this was, he saw the design of housing itself very much as a technical operation, in which the architect's role and design development from the point of view of architecture did not play a significant role for him. This is probably one reason why it was so easy for him to produce this hierarchical division of levels of influence in such a linear and clear-cut manner. It almost denied the fact that architecture could give more than a structural dimension to housing and people. It also did not recognize the systemic understanding how everything affects everything across the hierarchical levels. Hertzberger's point of departure is more in line with systems thinking even though it did not offer any concrete trajectories for the development of housing production. He

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took architecture itself as a starting point for creating the potential for a lasting built environment but without separating structure and architecture as concepts. The only objective he stated was that architecture should be polyvalent in order to persist over time and serve unpredictable needs. In these two approaches of open building and polyvalence, the art of architecture and the technology of the design took different positions although in both approaches the objective was to help the inhabitant to live from their own starting points. If Hertzberger searched for the ideal way of building, Habraken had something much more practical as well as rational at stake, working in the realms of the existing condition of housing production.

In the background of the both approaches there are also the two poles of flexibility; the transforming of space so that it fulfills the present needs imposed, and, on the other hand, the time-transcending quality of space that is as such adaptable and closely linked to the typology of the building. These two viewpoints come closer to each other if they are approached from the perspective of means and ends – as the transformational tools for achieving the objective of multi-usability of space. Habraken looked at transformability as something that generally serves the personal needs people impose on space, not just something that strives from efficiency. The idea behind polyvalence is

Fig. 63. Analyses and relationships of the portrayed design strategies.

similar, but here flexibility is approached from a different angle, through a typological means that enables the differentiated use of space without needing to transform the spatial premises. However, even multi-usability as understood in polyvalence usually requires some transformability when space is limited and, particularly in present-day buildings, when there is a need for lot of technical systems and applications. Multi-usability and transformability are therefore very often connected. Transformability can then be considered a sub-level of flexibility or a device that helps create multi-usability to cater to people's more transient needs. Multi-usability and transformability could be understood as the "yin and yang" of flexibility. Even though in some form they can be considered opposites, they also complement each other and make possible different ways of considering the flexibility and adaptability of space. When we reflect in resilience thinking on the concept of efficiency, the most efficient space is not always the most resilient but rather the space that offers most options for diversity and emergence.

Structural levels and self-organization potential

From whatever direction we approach flexibility, the structure of the building comes into focus very soon. Almost all relevant ideas and strategies since Semper and Le Corbusier have recognized the importance of structure in the realization of flexibility. A very important viewpoint then is the carrying structure's relationship to other structures and technical systems, and how the spatial and organizational conditions are defined. Maybe the most important contribution of Habraken is his insightful division into carrying structure, supports, and infill. Even if one can see here the influence of Le Corbusier's Domino House concept and the Algiers project, Habraken took the thinking further as a conceptual approach by a clear division of influence.¹⁸⁸ The load bearing structure is also, to some extent, modifiable depending on its character, but this usually requires such heavy-duty operations that from the point of view of spontaneous flexibility it is questionable. Open building also identifies the role of technical systems and their significance in creating flexibility. Brand has also observed that if the technical systems are too fixed to the carrying structure and so not modifiable, they might even lead to the demolition of the building due to laborious and costly alterations. The challenge of integrating the structure and technical systems is very important in achieving self-organization of space, and one which open building applications particularly have tried to solve.

A very important notion in the work of Brand is also the overcapacity of space. This is usually linked to the structure of space. The concept emphasizes the characteristics of the loadbearing structure, which has overcapacity for the first purpose intended but which enables a variety of unpredicted uses in the future. Over-sizing can also be

¹⁸⁸ Others like Duffy, Brand and Leupen have developed this notion further and emphasized the structure, which is always the most permanent compared to the temporality of the infill.

a concern for technical systems by providing more strategic approaches for technical systems. This kind of over-potential of technical systems can be found in some applications of open building. However, oversizing can help to go beyond the designed purpose of the building in the executions phase so that it can allow the development of new social and structural practices within the space.

Hertzberger does not emphasize structure at all but talks mainly about different architects' approaches, referring to the diversity of tectonic ways to produce polyvalent space. Hertzberger's approach starts from the point that the structure is always an integral part of the architectural concept. The multi-usability of space, at the core of the concept of polyvalence, can be created through a variety of structural solutions, be it carrying walls, pilotis, modules or something else. Hertzberger is not trying to find a universal concept for structure that would solve the housing problems, as Habraken's supports to a certain extent attempt to, but instead Hertzberger is in search of new typological ways of producing polyvalent space. This is largely due to the fact that universal structural construction can bind the development of the housing typology. The concept of polyvalence is very linked to the bottom-up spontaneous emergence that space can give rise to when its adaptable typology is premeditated in design. For Hertzberger, the configuration of space takes precedence.

Configuration of space and self-organization potential

What really makes buildings self-organizing in the long run is the configuration of space and the divisibility properties of spatial units this creates. Making a flexible load-bearing structure is just the first step in gaining self-organizing space. How spaces are linked to different carrying structures and circulation properties is another key to the self-organization of space. The configuration of spaces and their relation to each other should be designed in a manner that enables circulation within the building and the independent use of firmly or more loosely defined space units. This is also what Hertzberger is referring to when he is talking about the typology of Amsterdam's merchant houses. This social notion of space, made transparent by Hillier and Hanson in space syntax, epitomizes the importance of the spatial configuration of city, buildings and dwellings. The relationship of space to social interaction and the emergence of new operations in space are also present in Price's thinking. The social relationships produce culture, but as Price, Hillier and Hanson noticed, the spatial configurations produce social and cultural contexts. This is a significant observation for design. In fact, from the point of view of sociocultural sustainability and resilient development, it questions the vast majority of the industrial housing and urban space being produced today.

ANALYSIS OF OBJECTIVES FOR SELF-ORGANIZING CRITERIA FOR SPACE

TIME

Longevity and temporal levels

In one way or another time has been one of the most significant factors in the study of design ideas and strategies. In more transformational starting points, the time periods under examination and the rhythms of change can, at their shortest, be just a day, but from the viewpoint of multi-usability, where the focus is on the urban level, the scope can even be hundreds of years. In most of the strategies and ideas presented here, the time dimension is approached as a factor of self-conditionality with an effect on space, which means it has also an effect on the duration of architecture. At the core of the time-withstanding criteria for buildings there are also the meanings linked to the space and the built environment as a whole; the aesthetic quality as well as the character of space.

Semper, Alexander and Hertzberger examine longevity primarily from the point of view of architecture. They are searching for some sort of archetypal understanding and spatial configurations of architecture that withstand time. They use the history of architecture as a springboard for studying buildings and built environments that stand over time. Semper is the first to break free of stylistic starting points in understanding the buildings as different processes. For Alexander and Hertzberger, a century later, the approach is primarily a conscious breakaway from the numbing uniformity of industrial mass production and its problems. Alexander attaches his thinking to history both architecturally and in relation to the urban context, whereas Hertzberger is a pure modernist in search of new typologies, even though his approach stems from the recognition of the adaptive character and time-withstanding qualities of historical architecture.

Habraken also tries to solve the problems of uniformity, but his focus is very constrained. The production-based approaches have, in general, been very different in the time spans they consider, mainly looking at the first inhabitants and their choices. In open building the overall city structure and its longevity, as based on inhabitants' needs, are less emphasized because the starting point is more the production and the ability to transform the dwelling per se. City and buildings generally have no dynamic interface in open building approaches. However, the more recent applications of open building do take into consideration the future inhabitants, even though the focus has usually been within the boundaries of a dwelling and limited to the preferences of the inhabitants in the conditions of the existing typology. As such, this has little effect on city structure and its temporal development.

The division of the building into different temporal levels has been the basis of several approaches, as in Duffy's and Brand's thinking. But Brand's approach is

much wider and very clearly concretized in relation both to sustainable building and to understanding a building as a process. His ideas about temporal levels also help understand the development of self-organization in buildings. According to Duffy and Brand, there are several processes going on simultaneously in buildings that should be taken into consideration in the design of self-organizing space. For creating self-organizing space, it is particularly important to recognize the different technical systems and their quick rate of aging. This requires that it should be easy to replace them. The focus of the examination of temporality in design is in the terms that the different temporal parts impose on each other.

The character and identity of space

A very interesting observation about the various ideas and strategies presented is how the character and the identity of the space is related to sustainability and flexibility. The modernist tradition has usually linked flexibility to the neutral and generic character of space and its transformational potential as their background assumptions. Alexander, in particular, recognizes the character and the identity of the built environment. Habraken, at least in his SAR period, is a rationalist for whom the character of the architecture is not so meaningful. According to him, the architect should not be an artist. Rather, the inhabitant creates, with the help of the infill system, the content of space, understood largely as situating functions. Hertzberger's remark that buildings are not just shells, aims the critique largely at the thinking and worldview that Habraken and SAR represented. Hertzberger raises the issue of the specific character of the space as a criterion for resilience and highlights the architect's relevance in producing it.

In addition, Hertzberger's conscious break from the modernist understanding of efficiency of space, emphasizes the identity of space and sees it as a meaningful criterion for how persistence and meanings in people's minds can be created. He withdraws from universal meanings and calls for the individual meanings and inspiration that space can bring to its inhabitants and, in doing so, is also in search of the creative dweller. For SAR and Habraken, universality was in the production method whereas for Hertzberger, as for Alexander, universality can only be traced in archetypes, which can however create a variety of meanings on the spatial level.

How identity is linked to transformability is seen in the Price's Fun Palace and Brand's example of MIT Building 20. They are both seen as examples of an inspiring "neutral" space, which can be modified and used freely as one wishes. The inspiring features in them are their potential for play. As part of housing or as housing that can itself be transformed into in various uses, this kind of space would probably widen the spectrum of living as well as give different dimensions to meaning creation. If identity is linked to the timeless qualities of space through multi-usability, it is also connected to the playful qualities of space by the transformational potential of space in time.

Emergence through self-organization of space

As a character and consequence of space, the creation of social contexts and the potential of a variety of uses in time is something that is particularly present in Herzberger's and Price's approaches towards design. The self-conditional use of space is also in focus in pattern language, even though his temporal view does not emphasize adaptability and flexibility. Price's design concept, compared to Alexander's pattern language or Habraken's open building, is particularly focused on people's possibility to create new spaces, practices, operations and events, as he calls them, and thus meanings that are not based in preconceived ways of seeing the world. Where Alexander tries to define what is good architecture and the good city, Price bases his thinking on what is meaningful for people and how their potential can be charged in the interaction with architecture in time, which also partially resonates with Habraken's thinking. For Price, however, people are co-creators with the architect, and the building is seen more as a process than a finished product or a shell for different uses. This thinking comes close to the concept of emergence, where interaction creates something totally novel and unpredictable that could not have been predicted from original premises. Herzberger's objectives are very near Price's, even though his approach is very different. For Herzberger, architectural quality and spatial configuration is a significant part of emergence and he also thinks there are limits to what inhabitants can influence within the context of architecture. Herzberger approaches emergence from the typological premises premeditated in design, while for Price emergence happens through the transformability of architecture that springs from the structure. Both, however, recognize that the potential for emergence requires conscious implementation in design, which also Brand emphasizes through the idea of scenario design.

THE ROLE OF THE ARCHITECT AND THE CREATIVE DWELLER

SELF-CONDITIONALITY

It is especially Habraken, Herzberger and Price who touch on the role of the architect. Habraken saw that the architect's role would change significantly with open building. Quite radically, he saw that the architect's role should have been given to the inhabitant if only within a limited frame – the infill. The architect would then be some kind of organizer who tries, methodically, to fulfil inhabitants' wishes. Habraken criticized the system but at the same time took it as his starting point. Herzberger meanwhile emphasizes the inhabitants' freedom to produce meanings themselves. His thinking is not hierarchical, and for him the city and the typology of the buildings are intertwined. The buildings should be able to absorb all the changes that cannot be predicted, things which Cedric Price's Fun Palace also takes as its starting point. Herzberger believes strongly in the architects' capability to produce this freedom for the inhabitants,



whereas Habraken was very skeptical about the architects' agendas. Hertzberger also points at the architect's capability to create inspiring spaces, which in turn helps the creativity of people to blossom and so develop their own identity. However, the main focus in all the ideas and strategies presented is seeing and understanding people's creative role in relation to space.

Hierarchy and the inhabitants' influence

In one way or another many of the ideas and strategies presented here have some kind of hierarchical model in the background, through which they try to structure and understand the influence over space.

In open building the hierarchy of influence represents the basis of the whole approach. People's ability to influence comes, however, from hierarchical levels of decision making, which are precisely defined and preconceived. In open building the inhabitant can exert influence and operate hidden in the dwelling and inside the building according to the rules of play by tackling the content of their own dwelling. Open building as Habraken portrayed it lacks the questioning stance of the design itself, which is so inherent for creative design and typological development as well as in resilience thinking. Open building ignores the interlinked evolving hierarchical systems, springing from the concept of panarchy, which is seen as an antithesis of the strict hierarchical models.

Similarly to Habraken, Alexander divides pattern language into hierarchical levels but his objective is closer to the concept of panarchy. An inhabitant's possibility to influence urban structure springs from the building level and is cumulated and resonated in the city structure. Alexander sees that the inhabitants make the city alive. His approach does not easily fit in the existing developer-led production but rather attaches itself to the hypothesis that the built environment is in quite a concrete manner produced by people with the help of a pattern language manual. It could be considered an almost utopian model compared to existing ways of producing the

Fig. 64. Rusc co-housing development in Berlin (2005–2007).

built environment, and it does not really identify any territorial boundaries for who can decide on what. However, recent developments in co-housing are not so far away from Alexander's thinking, even when the space itself is not built or produced by the people themselves. Alexander's thinking can be seen to be flourishing today in some co-housing developments, where the inhabitants have also been actively involved in the formation of public space. An example of this is the Swan's Market urban renewal project in the U.S., which also offers public spaces for everybody within the realms of the co-housing development (Fromm 2012) as well as the Rusc co-housing development in Berlin (Ring 2013). See Fig. 64.

In purely hierarchical ideas and strategies, the inhabitants' influence is predefined rather precisely. It then has the tendency to comprise the background assumptions as to what the flexibility can or should tackle. Therefore, the contextual definition is not made by the inhabitant but s/he operates based on the predefined rules of play. In less hierarchical types of flexibility, the influence over space is seen to happen through multi-usability of space assisted by transformability, so the context is not limited by predefined solutions or ways of being, but instead allows for the emergence of new ways of being and contexts not limited mainly to housing use either.

Responsive architecture and architect

When comparing Habraken's open building and Herzberger's polyvalence, including their background assumptions, you can detect similar tendencies in the architect's role as a designer, which today also roams between functionality and art. Habraken is very good at portraying the one end, where the architect is seen mainly as a marginal actor and the architect's role as rather reactive. At the other end, Herzberger particularly emphasizes the architect's role as the creative proactive practitioner. Because the concept of polyvalence, as compared to open building, is much more ambiguous and has no ties to any method, it can have endless artistic as well as typological manifestations and interpretations. Strict methodological design fixes a rather narrow spectrum of end results and predetermines the scope of the design. The strategic dimension in design, on the other hand, can promote the emergence of a variety of possible worlds and contexts without delimiting the outcomes. The crucial difference in method and strategic dimension is that the means used – the tools – in design do not affect the ends by using certain criteria that delimit the outcome.

Especially in housing design, the positions taken have been guided by a certain understanding of art and have been strongly mutually exclusive. Understanding art – architecture – as artistic creation has focused on the aesthetic quality of the final product, and less on its other dimensions, such as its proactive role in producing new contexts, which is actually also a very viable interpretation of art today. In housing design, the idea of functionalism as locating functions has emphasized the

notion of seeing architecture from the practicalities of living rather than the living as a whole. In public building, the art of architecture has been much easier to accept as a starting point. The industrial conventions of producing housing have entailed thinking of the mundane, which has created very technocratic tendencies in housing design at the expense of qualities that are very difficult to measure but vital for the durance of the built environment. The inhabitant can also act as a co-creator with the architect without undermining the capability of either architects or inhabitants even though they might act in a very different time.

The kind of thinking echoed by Habraken in the 1960s may have come from the worry about the architect's main interest in artistic considerations, but surprisingly, it even bypassed concern over the producer's objectives to exploit the situation, which meant that the creative process in housing design was undermined. Mass housing production has reduced the architect's possibilities of influencing a high quality environment within the so-called normal housing production, which in turn has affected the development of new housing typologies, including those that spring from the desires of the inhabitants. This is connected to the internal paradox in creating responsive architecture, in which the architect needs to have a more autonomous role within the process to be able to be less autocratic over the design solutions by promoting a strategic design dimension in them.

This confrontation between Habraken's and Hertzberger's points of departure, I have portrayed as binary poles that bring to the surface some lines of thought still existing in housing production.¹⁸⁹ This dialogue brings us to the source of architects' skills and professional ethics as they relate to the development of housing design. Habraken's understanding of the architect's role in the 1960s was almost pessimistic. In his thinking, the architect's capability, ethics and interest in creativity were largely denied. This is partly the reason why Habraken saw a need to replace creative potential with a methodical system for producing inhabitant-oriented housing. It is almost as if he saw the architect as a danger to inhabitants and production. This is rather in contrast to Hertzberger's optimistic belief in the architect's competence to produce polyvalent, inspiring and meaningful space that serves the inhabitants. These lines of thought still prevail in some form as background assumptions in housing production and can be detected in the way different stakeholders approach design, a feature that also to some extent surfaced in my interview material (Interview 1 and 4). The introduction of a strategic dimension into design does not mean giving up architectural qualities; on the contrary, it releases the potential of architects, if we follow Hertzberger's line of thought on using the potential of skillful architects to the full. From the point of view of a resilient built environment, Hertzberger's point does not seem to be at all that farfetched.

¹⁸⁹ Hertzberger was at the time a member of Team X that Habraken criticized heavily.

CONCLUSIONS CHAPTERS I-III

The first three chapters have been a guided tour through the points of interest connected to design context and design strategies. The emphasis has been on how the context affects spatial design and limits its viewpoints and outcomes, thereby also affecting the general development of housing. The chapters have moved through the whole production process from planning to implementation portraying its systemic character to build up an understanding how significant the developmental tendency and the adaptable and flexible building stock and its self-organizing potential is for the resilient development of the built environment as well as for the wellbeing of people.

The focus of the thesis has been on the long-term viewpoint embedded in resilience thinking. The way we understand housing and the production of built environment today cannot be seen as resilient in the end. The chapters have discussed, based on research and practical experience, those issues and objectives that are crucial for time-withstanding building stock and responsive and flexible design that reflects social change and diminishing natural resources as its prerequisite for resilient design.

BACKGROUND ASSUMPTIONS – MENTAL MODELS

To be able to guide the overall production system to promote resilient spatial production there is a need to go much deeper right to the mental models and background assumptions that the production holds inside rather than dealing with events and symptoms. The spatial context has been based on existing models in the design and spatial production, partly because space itself and its development has not been seen in production processes as a criterion for sustainability. The emphasis has been largely on energy consumption and other measurable qualities in housing production. The design and production of housing has, for the most part, developed following production logic.

The efficiency thinking connected to use and production of space has guided the design that has also been connected to energy consumption on dwelling level. As resilience thinking points out, understanding efficiency and optimization in a different way than before has a key role to play if we are going to end up with sustainable solutions that are resilient and can adapt to unpredictable changes. The thesis points out that, concerning efficiency in building, the understanding of efficiency should actually take as its point of departure a much wider consideration of spatial understanding, namely, building, area and city levels. Understanding those levels and their connections to dwelling space has a lot to do with how we should develop design and spatial production in general. The current objectives imposed on design are following understanding that sees the dwelling as fixed boundaries and the object of optimization. The price of housing has skyrocketed because there is no real need to promote

in-depth development of housing and its production by professional developers within closed markets that continually neglect development as well as competition. Instead of rethinking the processes of production and investing in development the producers have opted for making the dwellings smaller and more “effective”. Rather than opting for making the dwelling unit continuously more efficient we should opt for the possibility to have the resources that we need at hand in different times in city, area and building level through the adaptable character of buildings and possibility to be able to continuously affect the dwelling sizes and the varying use of space.

UNIVERSAL MODELS OF UNDERSTANDING OF HOUSING

Even though the quality of building construction has developed to some degree since precast element building was introduced in Finland, the main mode of production today in Finland, the initial assumptions about dwelling and construction have not really changed that much. The narrow understanding and haphazard systemic connections embedded in processes producing space for living have become a straightjacket for development. The universal thinking in design as well as production and the dominance of production aspects in the building sector has led to very uniform housing design solutions in Finland, which is and will be most likely incapable of adapting to future changes and will need much resourcing later on.

THE ROLES OF THE STAKEHOLDERS IN PRODUCTION

The objectives for design have been set by certain stakeholders as public and private guidance balancing each other, which has been aimed to guard private and public interests in the production of the built environment. Public guidance has been seen responsible for the societal viewpoints and to ensure and protect what is understood as the common good, whereas the production sector has been seen as the executor of planning solutions as well as a vital driver for the national economy and its development. This bond has been seen as the basis for the development of housing over decades. Following this fundamental link between public and private interests, they have emphasized logic in which both the public and private guidance have been based on a very universal understanding of housing and a generally accepted way of conducting housing design and production, and where the private guidance has been following the production logic and its economic drivers. Because of the sectorized character of production culture it has been difficult to affect the system from within. The stakeholders have not been able to affect or recognized their own importance as creators of a resilient built environment. In hierarchical and sectorized systems the systemic learning has been minimal.

THE HIERARCHIES OF INFLUENCE – PEOPLE AND SPACE

However, even though social sustainability is recognized as part of overall sustainability, its context has been vague and nor policies or the stakeholders have not been responsible of its attainment. The emphasis has mainly been on overall social interaction and how it can promote sustainable solutions in people's lives, but it has had no prominent effect on production. The linkage between people's changing behaviour and space has not been in focus in production so far, except in marginal cases. The possibility to affect one's own living solutions, let alone solutions in urban contexts, has been near non-existent.

SYSTEMIC CONTEXTS AND UNDERSTANDING INNOVATION

The gamut of issues to consider in producing a sustainable built environment is extensive and closely connected. The diffuse and linear processes have emphasized operations timely not in relevant positions. For example, the building design in Finland is guided too closely in planning phase affecting the typological development. The existing systemic context has often unintentionally acted against innovation through meticulous and detailed regulating and guidance affecting the building design. However, this does not mean giving up regulating and guidance, but rather rethinking its contexts, which spring from the new object settings. Nonetheless the systemic connections exists, but the processes have not, however, been guided from that understanding. The systemic effects have been arbitrary or unduly binding in their character rather than promoting spatial resilient development. All guidance and regulation have had impact both in a direct or indirect manner on the general building culture, which have resulted in housing production that has not been able to follow social development and development in general from more comprehensive standpoints. The current very technology and product oriented understanding of innovation in housing production is no longer fully relevant concerning the spectrum of developmental issues. The focus on who generates innovation and in which phase of the project as well as what are innovations, is very limited. These issues concerning the meaning of creative potential in housing design, which would enable the emergence of balanced community structure and even new economic drivers, has been undermined. The production of the built environment has become a repetitive action that is continually reproducing its mirror image in housing solutions that have not changed much in past decades.

FROM SHORT TERM TO LONG TERM FOCUS

Professional developers have based their production on short-term commercial profit making and been able to set profit expectations high in closed market situation, which has made the formation of new housing concepts rather sporadic. The short-term

view has been so dominating and pervasive that it has been extremely difficult to exit.

Because the emphasis in housing production has been limited to the actual production phase and seeing the buildings mainly as products, the life span of the building and its social aspects and processual qualities has been largely bypassed. The present system has become, to some extent, a cash machine for those that do not benefit from resilient development in general. It is true that building is very expensive in Finland, but without really digging into the roots of this, current efficiency thinking and the lack of skills in building culture is reinforcing the existing situation rather than curing it. The prevailing short-term view and just tinkering the processes is also preventing us from seeing things differently and working towards more developed scenarios for the spatial production.

To achieve sustainability, the built environment as well as the buildings need to be approached as a complex human habitat that is affected by how people want to live and interact with each other also in the future. In the long-term view the prerequisite of sustainable environment is highly linked to spatiality and to the understanding of design's potential as a mediator between societal and individual wellbeing. Space, its quality and its dynamic relation to city structure has been the most significant factor in the longevity of the built environment for centuries, which can be perceived in existing old built environments and buildings.

REDEFINING SPACE AS A RESOURCE AND THE EMERGENCE OF CREATIVE DWELLER

The built environment is very often trivialized as a compromise between public and private interests, which also comprises a systemic lockage between its parts. In the end, the actions take place in a very scattered manner related to both duration and resources embedded in the building stock. The visions that might have been there, the skills and creativity that would have been available and the knowledge that might have been gathered, do not necessarily pass further. The creative interaction and mutual learning connected to space is more of a high ideal but not really reflected in processes. The present condition does not make systems that are connected to the production of built environment to grow more intelligent over time, which is the character of self-organizing and emergent systems and a basis for resilient development. The present system does not necessarily even recognize the formation of creative impulses in society.

The understanding of space as a resource becomes diversified if we also see it as mental capital and not simply as financial capital. As a mental resource, space springs from the social contexts and interaction and it can also be the basis for innovation. Instead of disconnecting people, as our housing solutions in apartment buildings often do, spatial reality could be much more multifaceted than it is today and promote all kinds of innovations from social to financial.

It is already perceivable in the old industrial and aging societies that the material resources will be diminishing in the short term and do not necessarily extend in the long-term focus either. On the contrary, it is most likely that to prevent climate change and its cumulating consequences, will demand even greater resources and changes in systems guiding the spatial production, not the mention the limits of the carrying capacity of planet, which all have to be dealt with. Rather than having one universal way of producing and developing things, an ecosystem of different kind of development modes that could emerge also from different kinds of contexts of production; top-down, with-in and a bottom-up manner is needed to challenge each other and locate the differentiating needs and aspirations and potentials of people. Prospective mistakes made in production would then be tolerable compared to what they would be in universal systems and through narrow understandings of space. As a basis of this development is the understanding of creative dweller that can spring from adaptive and flexible strategic design dimension.

FROM SPACE AS PRODUCT TO SPACE AS A PROCESS

The mechanistic world-view, now already a passing world view, usually sees no other value than the product value, which is still strong in the development of the built environment. The sooner we move towards an in-depth systemic understanding of world and societies, which is already happening in many other areas of society, it can help us to create resilient built environments and buildings. We should move towards systems thinking and see the buildings' potential as promoting self-organizing that can continually create new meanings and promote the emergence of new spatial manifestations within these buildings. Certain strategic characters as well as architectural qualities would also enable the proactivity of the inhabitant as a co-creator of space even though the architect who designed it is already long gone. This would also promote the more long-term dynamic of co-evolution of space and overall built environment. This kind of potential springs from the multi-usability of buildings and space which is assisted by the transformability of space.

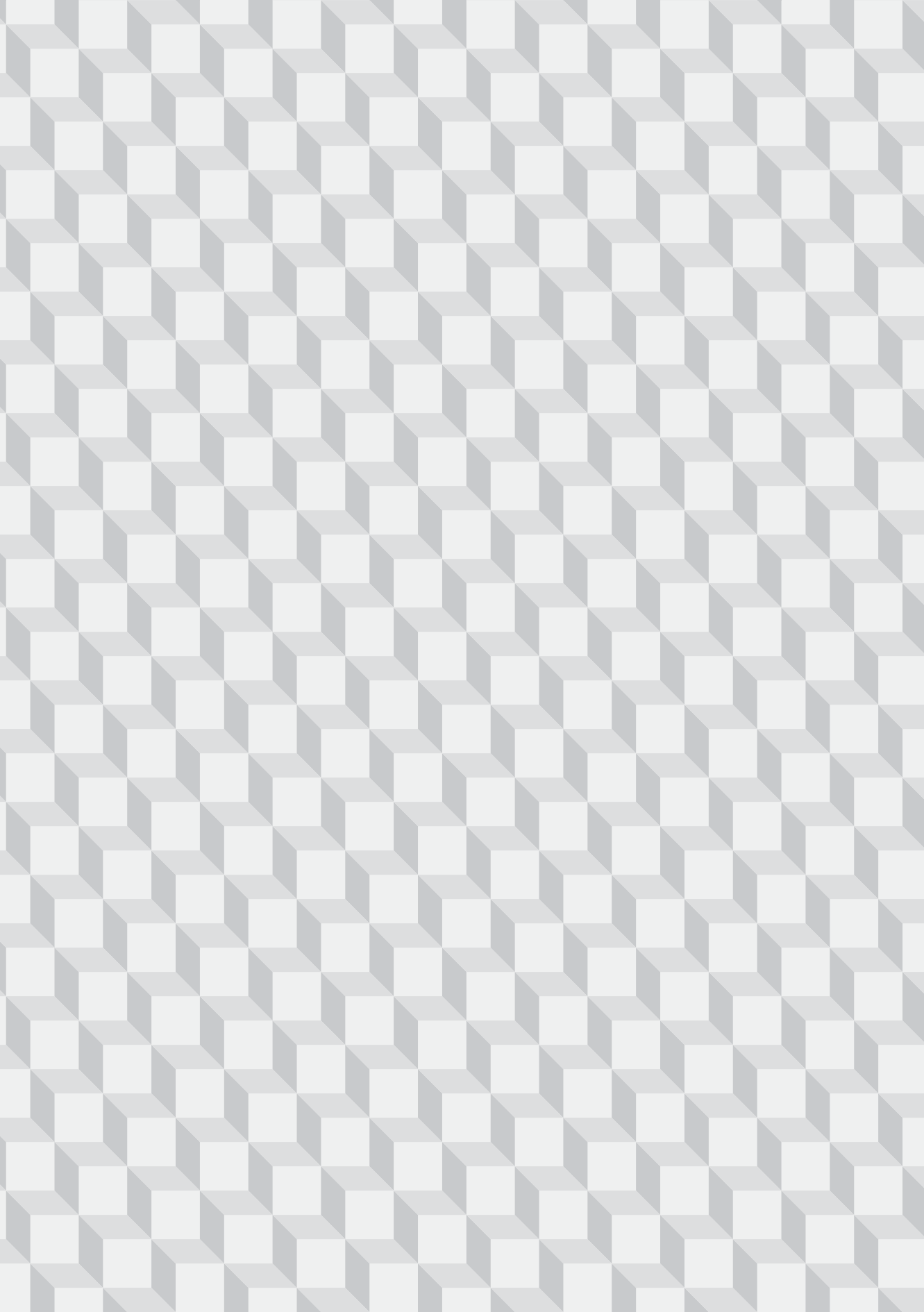
IT IS TIME FOR SPACE

The built environment produced by the industrial era of housing production has been proven to be embarrassingly short lived. It is a problem with which people and societies will struggle for a long time to come. It is not solely a question of bad building per se, but of a systemic bond that works against the development towards lived space and resilient building. The technical quality that has been achieved by regulating and standard, as a reaction against low quality construction conducted, can even hide the need for other kinds of development and developmental tendency in general. The

character of suburban building disconnected from the urban living, and the fixed way of understanding housing and dwelling, is creating a time bomb which, despite the apparent refinement of its quality in the past decades can turn out in a long run to be as unsustainable as the early mass produced suburbs, because the typology and structure of buildings do not support change. The systems perspective and strategic view, however, invites us to see buildings and space as processes and beyond the potentials that exist today in everyday housing production. The proactive way of using and dealing with space can also make us give up the rather fixed division between the housing space and other uses.

To achieve the potential of space, the paradigm of how we design and produce space needs to be rethought. The strategic and tactical dimensions of housing design are linked to the typology of a building and its potential to accommodate change in an easy manner that does not require considerable efforts and resources during the life span of the building. For architects this means a new outlook in housing design as paradigm shift, which has so far been very much focused on conventional design methods and preconceived ideas of design procedures. At the core of long-term adaptability lay the objectives of multi-usability and meaningful architecture both embedded in the concept of typological flexibility. The different aspects of typological flexibility can be divided into objectives and mental tools to promote the understanding of buildings as processes. How this can be approached through the concept of typological flexibility is dwelt on more closely in the next chapter.

CHAPTER IV



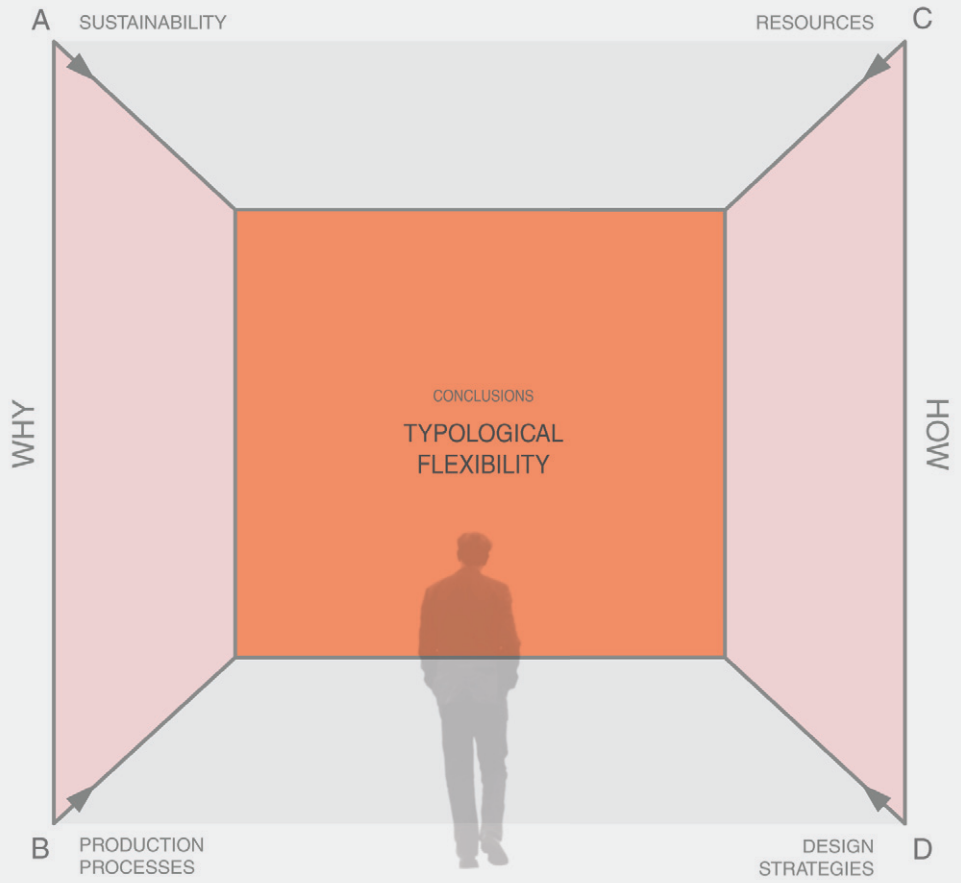


Fig. 65.

IV TYPOLOGICAL FLEXIBILITY

4.0

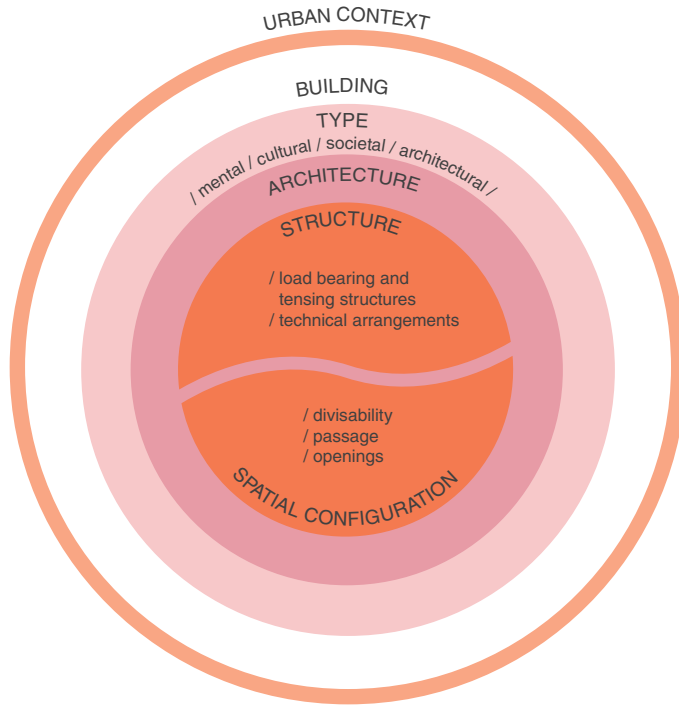
ENABLING THE SELF-ORGANIZATION OF SPACE BY DESIGN

The third chapter dwelt on the potential of existing design thinking for understanding a strategic dimension in design. This chapter, and the level of typological flexibility, will define more closely the characteristics of typological flexibility that promotes the potential for self-organization through space and how it could be implemented in design thinking. To be able to make self-organization an objective of the resilient and strategic design dimension, there is a need to define parameters for typological flexibility and how it is achieved. Both the concepts of typological flexibility and self-organization act as means and ends for resilient space. Typological flexibility refers also to the dynamic character of flexibility that is accomplished by a certain type and a spatial configuration that can lead to self-organization of the built environment. The concept could have been defined as typological self-organizing flexibility. However, I have taken the view that inherent in the flexibility that springs from a flexible building typology are embedded the objectives of organized flexibility that can be seen to promote self-organization.

In architecture, typology usually refers to the spatial concepts and configurations of which a dwelling, building, building complex or city structure is formed. The typological approach in design refers simultaneously to the spatial logic of the buildings, the configuration of passage spaces¹⁹⁰ to other spaces, and to the whole context of spaces within the architecture of building, as studied earlier in the context of type. In type and typology of building, everything affects everything simultaneously, as in systems in general. Besides being an architectural entity, a building can also be considered to be a system or several nested systems. The interface with urban context gives type depth and affects its social and cultural context.

The typological approach in typological flexibility is considered a very holistic term and connected to the creative context of type discussed earlier. And, based on that interpretation of the concept, it comprises the architectural as well as cultural aspects of design. For that reason, the mental meanings the architecture can create in people become a powerful part of the concept. See Fig. 66.

190 Passages spaces are usually understood as entrances, stairs, corridors and hallways.



TYP AND DESIGN PROCESS

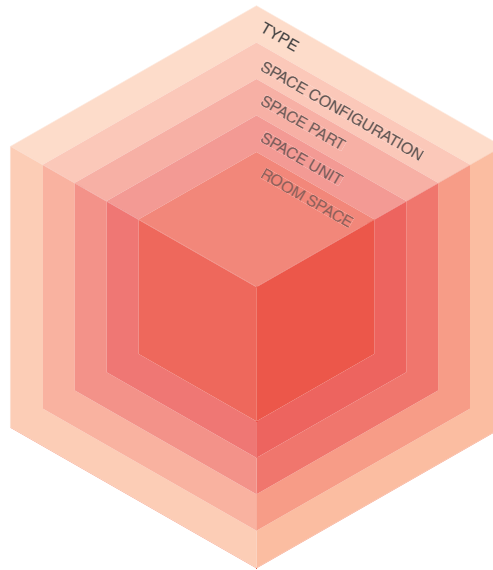
As discussed earlier, typology and type are significant concepts for the theoretical understanding of architecture, and, since the dawn of the Enlightenment, have affected architectural thought in one way or another. Even though type has been interpreted in very different ways and from various starting points in different times, it has always played an important part in the creative process of design (Moneo 1978). In this research, I apply the concept of type in a manner that has been less common in theoretical approaches, namely connecting it to the concept of flexibility and to systems thinking. On the other hand, earlier interpretations of type and typology are very much present in my own interpretation as well. In this thesis, I emphasize particularly the creative potential and character of design, and the comprehensive examination of design through type. For my interpretation, it is significant that I approach the concept from the point of view of a practicing architect emphasizing the creative process and continual renewal embedded in the concept.

The concepts of typological flexibility and polyvalence discussed earlier are cognate concepts, because both are based on the same understanding of the need for multi-usability of space on a building level.

Fig. 66. The connection between different aspects of space from an urban context to the room division potential of buildings.

Like in the concept of polyvalence, typological flexibility can be designed in various ways and approached from very different viewpoints of design. It does not therefore resemble a design method that sets out how one is supposed to end up with design solutions. Neither does it refer to a specific outcome where the design is supposed to lead to. Each designer approaches the design assignment from their own starting points, as set by the objectives and other imperatives of that particular design assignment. The designer can develop a totally new approach to typological flexibility from the specific starting points of the project, or apply already conceived types to produce typological flexibility. In the background of the concept, the strategic dimension of design means a clear cut from a function-based design paradigm towards the self-organizing understanding of space. This should always be enabled as part of building design as its socio-spatial resilient condition.

Typology and type are present in all design, particularly at the very beginning when the designer is looking for and defining the various ideas for the building and its overall context of a particular environment. As mentioned before, through type the designer can approach the design assignment and the vast amount of possible ways to go forward more consciously or intuitively, with the help of tacit knowledge. Creative work is not just about cognitive knowledge or making an architectural object in a linear or rational process, but rather is a proactive and interactive process occurring between the designer and the project. The architect creates a new interpretation, which is part of her/his memory, knowledge, and ways of thinking, as well as skills. So, in that way, architecture is not just a problem-solving practice, even though a certain design solution does result from the process and forms an operative entity. Nevertheless, its components cannot be separated and analyzed individually to understand the whole. This research aims to go beyond the mystical aspects of the design process with the aim of creating tools for developing a strategic design dimension through typological flexibility. To be able to make the concept of typological flexibility more transparent and tangible, I have developed sub-concepts to clarify it, objectives it should fulfil, and tools for assessing whether the objectives are really being achieved.



THE “BOX WITHIN A BOX” APPROACH

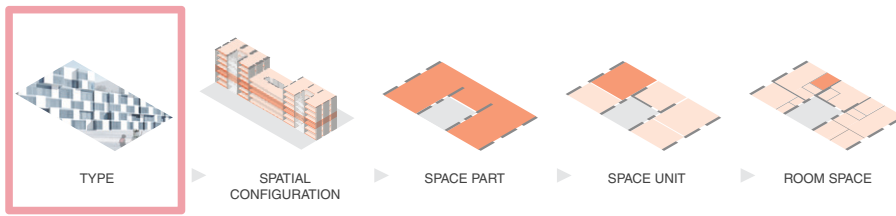
Even though systems thinking is a holistic approach that views the whole as inter-linked parts and systems, it also involves some kind of hierarchical understanding of the system (Meadows 2008). Understanding this particular hierarchical character makes it possible to exploit the system for more manufactured goals even though the nature of their content is not known beforehand. The sub-concepts within typological flexibility demonstrate more precisely the aspects concurrently at work within it. They have a loose hierarchical relationship to each other in line with the understanding of panarchy introduced by systems thinking. The higher hierarchy is connected to the lower hierarchy but the lower hierarchies are the key asset that gives motivation to the higher hierarchies. They are interlinked, and they work towards the same goals even though the focus in each can be slightly different. As Meadows points out, the purpose of the upper levels of the hierarchy is to serve the purposes of the lower levels (Meadows 2008 : 85). For example, in Habraken’s thinking on supports and infill, which still epitomizes linear thinking, each hierarchical level serves different purposes.¹⁹¹

¹⁹¹ The lower hierarchy concentrates on the manoeuvres inhabitants are allowed to take within the realms of their dwelling. It has no real effect on other layers. Even though the supports level is drawn to make the changes easy, the changes on the dwelling level do not affect the use of the building in general or the urban context.

Fig. 67. The hierarchy of nested concepts within typological flexibility of building.

Then, optimizing spatial solutions is based on different purposes on each level. Systems thinking understands that the purpose of the hierarchy is to help the sub-system to do their job better. However, the systems usually do not meet their goals because of malfunctioning hierarchies (Meadows 2008 : 84). Either the purpose of the system is unclear, or it is optimized for different outcomes than those that make it sustainable, say, for example, for production objectives, or because the different sub-levels follow their own purposes. This is well epitomized, for example, in solutions where the structural and technical systems are based solely on technological points of view, but do not have a clear relationship to the whole spatial system and how it serves resilient building more generally. To be able to promote resilient development, the “box within the box” thinking rooted in systems thinking, is also significant in spatial terms, in understanding the hierarchies working within the concept of typological flexibility. In the concept the different focuses serve the same purpose even though they might manifest themselves differently and deal partly with different issues. They, however, relate to each other in a box within a box manner in the fashion of a “Russian doll”. The biggest “doll” refers to the more general understanding of typological flexibility, the type of the building, and more precise definitions can be found when the overlaying dolls are dismantled as *spatial configuration*, *space part*, *space unit* and *room*. To understand the typological definitions, all these attributes of space are important and they are all connected to each other in a way that reflects the concept of panarchy. The designer is able to reach the qualitative objectives and characteristics by comprehensively and consciously working towards typological flexibility on each panarchical level of system. See Fig. 67.





4.1

THE SPATIAL “PANARCHIAL” LEVELS OF TYPOLOGICAL FLEXIBILITY

TYPE

The concept of type conjoins spatial configuration and architecture as a meaningful whole, including the meanings and cultural contexts that are generated in people by the architecture. Type is a concept concerning the relationships within the whole as well as being the engine for the emergence of new design approaches. At best, architecture based on a certain type can create new meanings and interpretations of space and new ways of approaching design. To be able to understand what is understood by type in the context of typological flexibility we must distinguish *type*, *house type* and *building type* from each other. Building type can be understood in a much narrower sense, and historically it has largely been understood through the function of the building, such as residential buildings or commercial buildings, etc.¹⁹² House type already involves a wider contextual understanding of space; type here is often understood as referring to style or spatial arrangements. Nowadays house type is understood as a mixture of form and character of a building, such as *single-family house*, *apartment building*, *town house*, etc. It gives some kind of spatial clue to its size or the kind of housing we are talking about, but not really much else. Because people might already have very defined understandings of what the architecture will be like in certain house types, it can already be quite a leading term. However, type, as discussed earlier, has to do with a much wider understanding of the spatial configuration of the building, and this means that it usually comes with no background assumptions about form or certain function. As a term it is stripped of stylistic imperatives. It is not tied to any formal manifestation of the concept. In a way it is a pure term categorizing generic features of the typology – the core essence or idea of the building – that can be applied in various ways as different manifestations of architecture.

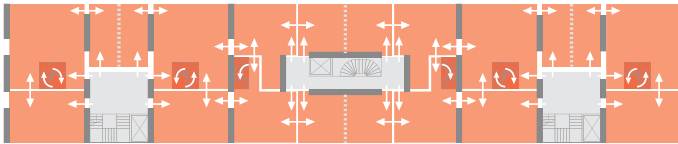
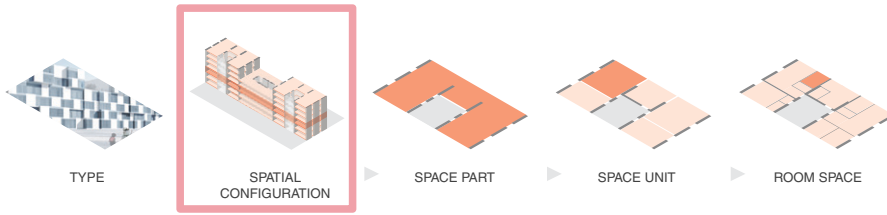
¹⁹² Building type is already an established term and differs from my use of type of the building. The type of building here refers to the spatial configuration that is not necessarily at all linked to building type but instead refers to the particular spatial arrangements and architectural solution that holds all the connotations of type.

Type is always composed of architecture, a way of building, a site and urban structure. Due to the flexibility of the type of the building, the influence of type on the urban context depends how integrally the spatial arrangements are linked to the interface between the building and the city structure. But they always have some kind of linkage, whether loose or more strict. To take advantage of type, planning should always allow for the possibility of developing new types at the design phase, which could foster resilient development by enabling the building to react to social change. This is why a specific understanding of house types taken for granted as starting points for planning, such as apartment building, traditional lamella, gallery access or tower house types, can also considerably delimit the typological development. When buildings are understood through the concept of type and typological flexibility, and not through building type or house type, this also changes how we understand urban structure.

Hybrid building design development that has emerged more consciously in recent decades has already blurred the definitions of building types, even though they have long lines of ancestors, such as ground floor shops as part of the building or as in Le Corbusier's 1947 L'Unité d'Habitation in Marseille. In flexible typology, I want to go even further beyond the understanding of hybrid building. In typological flexibility I see the buildings as spatial entities that can house any kind of functions in a flexible manner. This means that the functions for the premises of a building complex are not too precisely defined beforehand, as is the case in most hybrid building designs in existence. Buildings are understood as architectural creations with cyclical tendencies that are not only limited to the purpose they were built for; rather the architecture they epitomize has the capacity to accommodate various socio-spatial tendencies. This does not, however, necessarily mean that the design of buildings has to be overly universal or generic in character. Instead they can have identity and potential for change based on their "box within a box" character. The significance of architectural character in itself increases when the building does not give exact clues of a functional presence, when buildings become more adaptable to very different purposes.

As discussed earlier, in the design of self-organizing space there are two significant factors to consider: first, how do the processes guiding the design enable the emergence of new typologies, and second, how can typological flexibility be created within the design of the building to take into consideration its whole life span and its resilience to unpredictable changes in societies. A significant part of this kind of endurance of a building is connected to architectural quality. When we review old and preserved buildings that are still inhabited, as Hertzberger did, we notice certain features that have been relevant to their survival, that have even transcended societal and technological changes, such as the Old Dutch merchant house and Victorian townhouse referred to earlier.

Its spatial configuration enables multi-usability and at the same time has a very characteristic architecture, which is easy to relate to, but moreover has an integral and interactive relationship to the city structure. In Dutch merchant houses, for example,



particularly the ground floor, let alone other floors, are very easy to change from housing to other functions because of the entrance organization, stairwell configuration connected to spaces, their sizes, abundance of entrances and big windows. The biggest problem in these metamorphoses, however, has been accommodating the technical systems that have developed radically over the decades. Nevertheless, it is quite amazing that town houses have persisted through these technological changes. It suggests that the character of built environments and the meanings they have created have potentially affected their survival. All in all, type can be considered an engine of a kind of relationship with the city, one based on spatial configuration and architecture and the way it allows people to participate in societal life as well as be innovative in their spatial premises.

SPATIAL CONFIGURATION

For the self-organizing quality of space to be realized through typological flexibility, it is essential to address the spatial configuration of the building. This refers to how spaces are organized in relation to each other and which kind of living concept can be developed through spatial configuration. A very important and relevant issue is how the circulation within the building and into the building is organized so that the emerging spaces are multi-usable, with the capacity for uses other than housing as well. Also

Fig. 70. Example of “box within a box” thinking. The spatial configuration of a typical floor in the building. Living House © Karin Krokfors Architects.

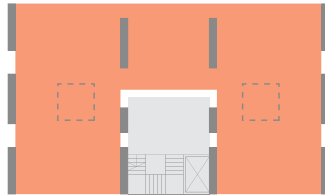
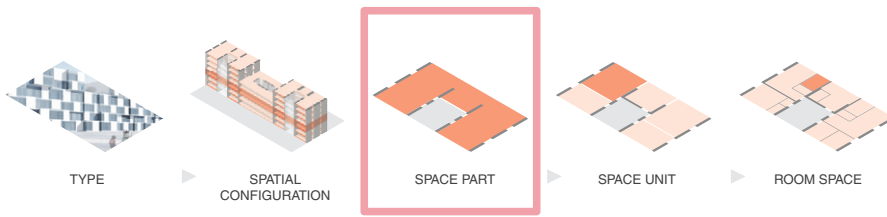
crucial is how the spatial entities can be divided and defined as spatial units so that each prominent unit can function independently of the others.

Spatial configuration and definitions of modularity should not just be a feature of singular dwellings but should be understood much more broadly as a feature of the whole building and urban structure. A good example of why this viewpoint is relevant is offered by the problems caused by hybrid buildings in urban structures where the spatial configuration and modularity of a complex have been too loosely connected to each other, where they have not really been configured from flexible starting points. This can be seen for example in a hybrid building solution that has been constituted by creating big commercial premises as some sort of pedestal for housing situated in upper floors. With the downturn in the economy, the large undividable commercial premises have become empty and created a scary “ghost town” underneath the dwellings (Interview 1). The possibility to divide the large premises into different-sized smaller units could have helped the situation. This is, however, very much linked to the spatial configuration of the whole building complex and to its technical systems that have to allow easy divisibility. The spatial configuration is a significant part of the design by which unpredictable use can be accommodated during the life span of the building, affecting the urban context as well. It defines the divisibility parameters of different spatial units – the modularity – and circulation within the building. See Fig. 70.

SPACE PART

As recognized in various strategies of flexibility, structure plays a crucial part in typology. What I understand by a space part is the space as its greatest, surrounded by supporting and tensing durable structures that create the overall loadbearing structure of the building. The space part is the maximum free space bounded by the fixed structures that are not supposed to change. The building is usually comprised of several space parts. The idea behind this use of space part is to define the largest functional areas available within a building. This is however, not the same thing as the dividable unit within the building, which is again a much more abstract term than space part and will be considered later.

Space part is connected to the understanding of generic space and it does not refer to any real understanding of the architectural quality or identity. It is merely characterizing the biggest possible free space within the typological concept of the building. Each situation, structural solution and architecture as type creates its own space parts. Space part refers to the spatial entity that, in some form, is fixed through the loadbearing and tensing structures in the building. Even though a building is usually constituted of several space parts a space part can comprise the whole building, as is the case in the Domino House where the carrying structures – pillars – do not separate the spaces within the building into more outlined and defined space



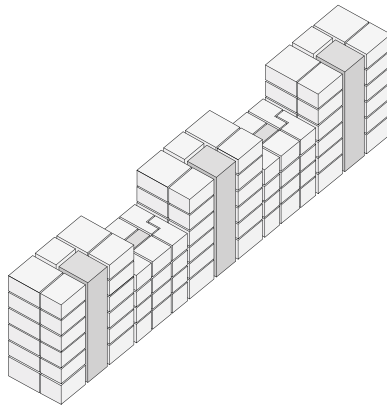
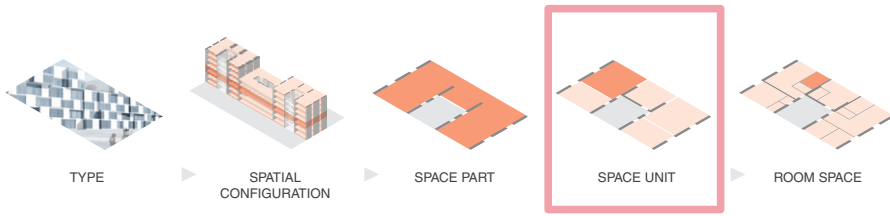
parts. But if the Domino House concept has several floors, there are already several space parts. It depends on the solution and character of a space whether it should be considered one space part or several separate ones. Space is always relational and understood from the point of view of the person or other living creature using it. The space part constitutes the realm of space that is not altered without changing the loadbearing capacity of the building. Space parts can also be divided into different spatial entities – space units and/or rooms. See Fig. 71.

SPACE UNIT

Operating within the space part is the concept of space unit. It epitomizes the way a building can be divided into independent spatial entities reflecting the abstract modularity of the building. Space unit thinking, discussed in more depth later, is the key for creating spatial realms that allow for multi-usability, and for resilience in building and city. It is the same feature of modularity that fosters the resilience of organisms, here applied in human-made socio-spatial configurations. The definition of space unit takes its power from the understanding of systems thinking and it can be defined in various ways in different typologies. Self-organizing organisms usually display some sort of modularity as part panarchical modular systems that are able to alter their context when the need arises. To continue using the metaphor of living

Fig. 71. Example of “box within a box” thinking. The space part is defined as the largest functional areas surrounded by carrying and tensing structures within the building in Living House © Karin Krokfors Architects.

TYOPOLOGICAL FLEXIBILITY



organisms, a space unit can be compared to a cell that can operate as an independent cell or be part of a conglomeration of cells that form a living entity, like an organ, that in this case parallels, for example, a dwelling, building, area or city. Bigger dwellings are usually a composition of several space units. Another important issue is how space units relate to each other. Capra (2002 : 8) emphasizes a clear distinction between a cell wall and a cell membrane, and this is also a useful metaphor for understanding how space units should relate to each other. Cell walls are rigid structures whereas membranes are permeable in order to keep certain substances out and allow other substances in. This is the character of the metabolism of a living organism. As Capra puts it “living systems are organizationally closed [...] but materially and energetically open” (Capra 2002 : 13), which also describes how life constantly seeks novelty. This comparison can also be made between space units and rooms, which will be handled further later. The walls of space units and rooms can be paralleled with cell membranes. In order for them to be “alive” and interact with neighbouring space units and rooms they should not be fixed like cell walls. In this way they can create a constant novelty of use as well as different configurations of combining space units, but at the same time they can also act individually.

Fig. 72. The building can be divided into interlinked space units that are premeditated in the design. They are independent units that can interact with each other. The dwellings, comprised of space units, their sizes and functions can continually live during the lifespan of the building. No division into dwellings or other functions is final.

Living House © Karin Krokfors Architects.

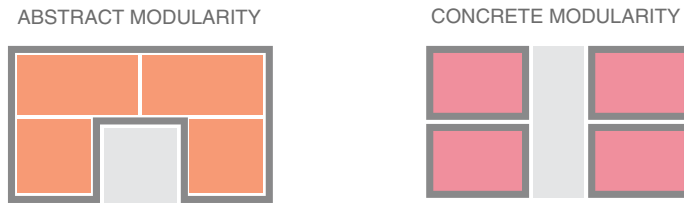
The concept of adjacent possible

Another relevant notion in the self-organization of systems is the rule and theory of the adjacent possible (AAATP) (Kauffman, 2008), that can also be related to space unit thinking. This refers to the way the potential for creativity and emergence exists even though the content of the potential “new” is not yet known. Kauffman defines living creatures as autonomous agents, which can act on their own behalf in an environment. To survive they must evolve towards higher complexity. These autonomous agents can interact and emerge into an adjacent possible. In systems thinking, the possibility for interaction between the agents releases the potential for emergence and creativity. In human-made creations the adjacent possible can be interpreted as the easiest change that can occur. According to Kauffman, the creativity in the universe is tied to explosions into the adjacent possible. The adjacent possible is then the becoming of things. Bacteria cannot emerge to become human beings, except through an evolutionary process in which the bacterium always develops through chemical reactions into the adjacent possible. Finally, after several development stages, a human being emerges, something that could not have been predicted from the bacteria. In different circumstances they would have developed into something else. (Kauffman 2008 : 64–65). The “adjacent possible” is how the universe works, according to Kauffman, the way creativity epitomizes itself. Stephen Johnson (2010) describes the adjacent possible very well when writing:

The adjacent possible is a kind of shadow future, hovering on the edges of the present state of things, a map of all the ways in which the present can reinvent itself. (Johnson 2010 : 31)

The adjacent possible is also a scalable concept that can be applied to living organisms as well as to any other process of becoming. In contrast to nature, a human-made construct like a standard building of today can be refigured extensively into something totally different, but it does not follow any adaptive or strategic path that makes the building evolve. These kinds of abrupt changes also need extensive resources and do not really represent the adjacent possible from an evolutionary perspective.

To be able to create “organic” diversity within the building stock according to people’s needs, the spatial configuration of the space units should be such that each component can interact with the neighbouring component and change its status to the adjacent possible. But the system needs a particular configuration to allow this and so enable the multi-usability of space. This has to be intended in the design, as its strategic dimension, even though the context and content of the adjacent possible is not known beforehand. If we want to create this kind of artificial self-organizing characteristic for space, it means creating a kind of self-organizing flexibility that gives capability to the components, modules, units or whatever name we give them, to function independently and to interact with each other in various ways. In the context



of space, this independence means that the space cannot be independent if it is used as circulation space. The spaces in buildings can be then divided roughly into passage space and space units. Even if the space has the character of a room and can be used in different ways, if it works as a passage space for other spaces it is not considered an independent space unit.

The difference between modules and units

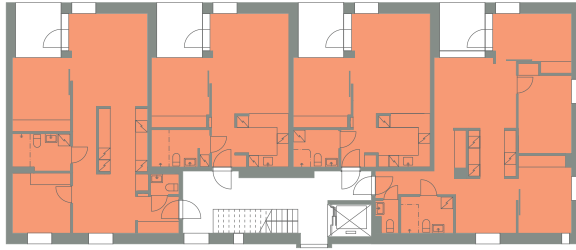
I have preferred to use the term space unit partly because the term space module, which refers more straightforwardly to modularity, can be misleading due to the way it has been generally used in architectural discourse. This is why I have wanted to emphasize the way the space unit differs from the module in a modular construction system, and to note that space unit refers to the abstract modularity presented earlier. It does not necessarily refer to fixed structural boundaries, rather it refers to the potential of becoming one. Modular structural components are usually closed entities carrying and tensing themselves.¹⁹³ See Fig. 73.

The reason for using module systems is usually based in a production logic that does not necessarily consider flexibility or uses over the lifespan of a building. As discussed in an earlier chapter, modular construction is very often linked to parameters defined by transportation or by the span of the modules as determined by the production method; spatial conditions have to be accommodated within these limitations. The use of modular components can even hinder flexibility if the boundaries of the module are not defined in a flexible manner as, for instance, in the Capsule Tower by Kurokawa, presented earlier.

In space unit thinking, entrances, courtyards, window openings and views should be configured in a manner that allows the natural differentiation of space units as

¹⁹³ The term component on the other hand is not used because it is too easy to confuse it with construction components.

Fig. 73. The difference between space unit and module. The abstract modularity describes the division potential to space units, whereas the concrete modularity forms a structural boundary of the module.



well as rooms from each other. The most natural measure for a space unit would be the size of the smallest possible dwelling, or work space, which could be combined into a bigger whole of the dwelling. Space unit can also be understood in a way that it can be connected to another space unit even though as such it does not act as a totally independent unit. Individual space units refer to space units that have their own entrance from a public or semipublic space, while sometimes it can refer to situations where the unit can be attached to other space units in diverse ways as the managerial extent of the dwelling expands or contracts without necessarily having its own entrance property. In this manner the dwelling can even consist of both owned and rented spaces within the same managerial entity. However, if space unit is not independent but dependent of a certain space unit, it can in the context of an apartment building lock the change to certain configurations.

The changing of dwelling

Space unit can also be both a concrete and an abstract term. It can refer both to the structural boundaries and to the potential of becoming one physical entity. The space unit can be combined to form a bigger entity or divided into separate entities even if the structure is not yet fully present. In contemporary housing production, which sees the dwelling as the spatial unit per se, it has been difficult to alter the boundaries of the dwelling because of load bearing walls on its perimeters. The dwelling has been seen at the same time as a structural as well as a managerial context of possession of a household. This assumption is partly influenced by the fact that a dwelling always constitutes one fire compartment.¹⁹⁴ But by differentiating the managerial point of view from the structural point of view, the space unit and dwelling change into different concepts that brings us to the source of multi-usability. The space unit becomes a com-

¹⁹⁴ Housing design today normally proceeds by making the walls between dwellings load-bearing walls. Fire compartments can, however, also be bounded by light-weight walls.

Fig. 74. Example of well-designed housing project that reflects the current demands in housing design. The physical perimeters of the dwellings and the perimeters of the dwellings are carrying walls and there is only one entrance to bigger dwellings.

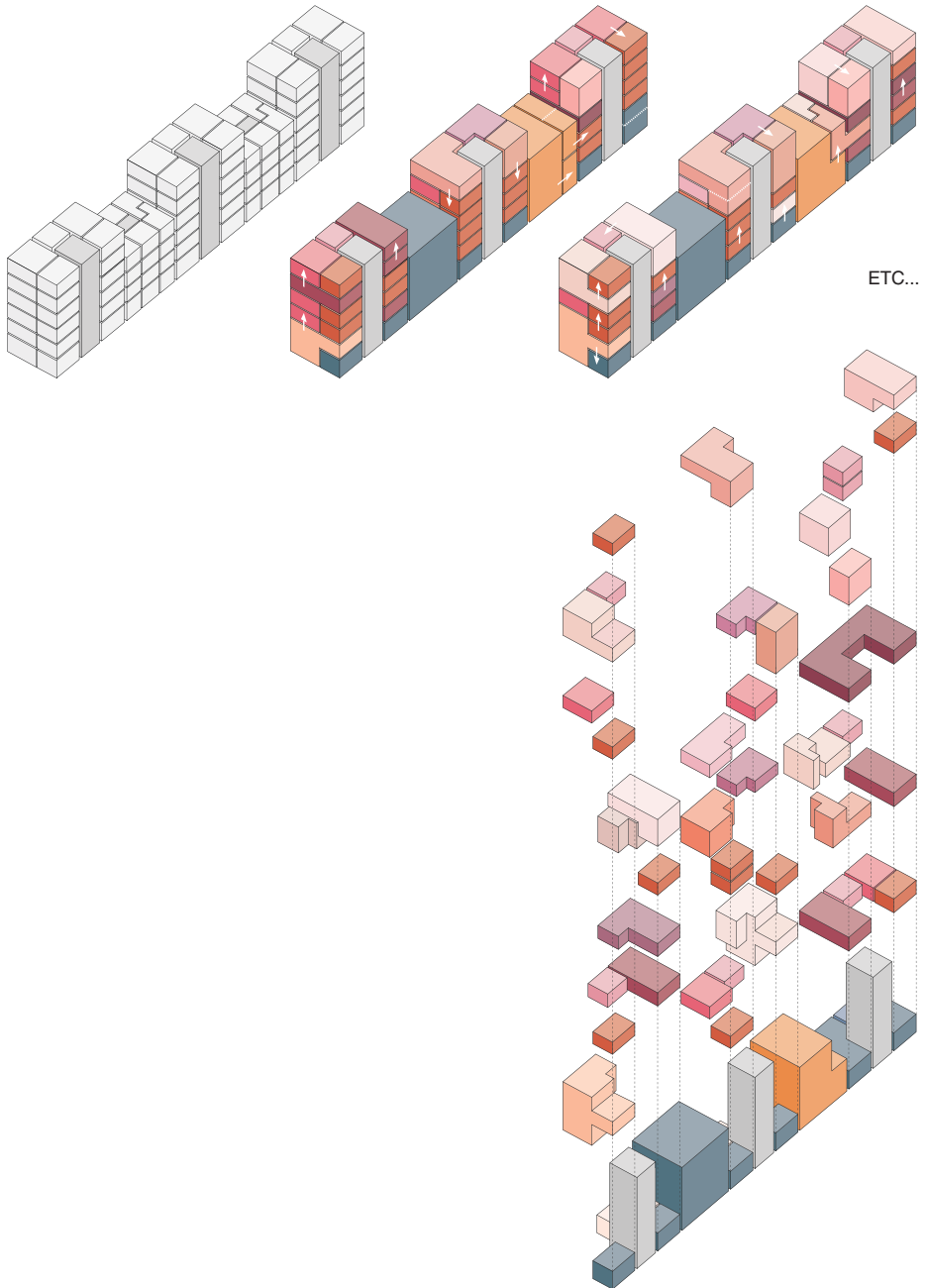


Fig. 75. The potential combination of space units that can continually live during the life span of the building. The space units can be used as dwellings or put to other uses.

Living House © Karin Krokfors Architects.

ponent of the dwelling, which the household (or any user) occupies at any perceived moment. Different managerial contexts can be created within *space unit thinking*. A household can then manage several space units, and these can be called the dwelling at that point of occupation. The more there is potential to interact with neighbouring space units, the more different permutations are available, and then also the more typologically flexible the building is. See Fig. 75.

In space unit thinking, dwelling becomes a managerial term and less a physical term. It is a holistic understanding that can support the effective use of space at every scale of the built environment, from dwelling to city region and even globally. See Fig. 72.

A new understanding of the efficient use of space in space unit thinking

It has been very difficult to transform or divide dwellings into smaller units or even combine units into bigger entities in contemporary housing production, because the structure of the load-bearing walls frequently defines the perimeters of the dwelling. The use of space has been also very difficult to change because of the passage properties designed for the building. See Fig. 74.

The focus in every day housing design has been on numbers of rooms and square metres in dwellings, even though these are quite limited parameters for understanding the use of space. In fact, this has led to a very limited understanding of dwelling and space in general, one which does not reflect diversifying needs.

The room spaces have become rather small, close to the minimum standards even in market housing (Krokfors 2016a), particularly in countries where market housing is the dominant way of producing housing. It does not recognize the interaction of spaces and space units as the target of development, but mainly the spaces per se. The combining of dwellings into bigger entities has been marginally applied, mainly by combining one room flats into bigger dwellings. Because the dwellings in apartment blocks usually have only one entrance, it has made it impossible to divide them into smaller dwellings or independent units. To be able to do that usually requires looser stairwell solutions or more stairwells than is considered enough in every day housing in Finland. The efficiency demand has then minimized the overall flexibility of combining and differentiating dwellings into different sizes.

The lack of flexible features in the building stock has created a situation where households are not necessarily occupied in a relational manner that fits the household's needs. Even though individuals' aspirations and needs for space are different, there are cases when an occupant would like to live in a smaller space but does not want to move away from home and familiar surroundings.¹⁹⁵ This tendency

¹⁹⁵ In Helsinki, most households are one-person households like elderly widows living alone often occupying bigger flats than young families.

towards single households is a general trend in industrial countries. Because the dwelling cannot be divided into smaller units, the possibility to create new kinds of activity and services in the contexts of existing dwellings, or simply to cope with the management of an oversized flat, is ruled out. Elderly persons usually do not want to move to a smaller flat or a senior home far away from familiar services and surroundings, leaving a home filled with memories and friends nearby if they can still cope at home. They would not need to move away from their home when their partner dies or their financial situation changes if there were a possibility to rent out a part of the flat, and this might postpone the moment of having to move away when most vulnerable in their life situation. Part of the dwelling could be separated and made totally independent in use, which would reduce the need for management of the rest of the dwelling and create extra financial resources. Or it could give the opportunity of renting out part of the dwelling to someone such as a student or other person who could take care of the elderly person on a part-time basis. In senior homes, on the other hand, the space unit thinking could help in the management of the real estate in the best possible way, and the space units could be either combined into another size of dwellings or used as a service or office space when the actual demand changes.

To plan the use of space in a more resourceful way and at all societal levels simultaneously, the focus has to shift from the tendency of making singular dwellings more effective by squeezing more rooms into the same number of square metres. In the bigger picture of the existing conditions, we can ask whether the efficiency guidance offered so far really helps people and societies, or furthers the objectives of resilient development. One argument for this kind of efficiency objective for singular dwellings has been that it lowers energy consumption per person, which leads to thinking that we should live in smaller flats in order to consume less energy. This thinking could be understood to promote the production of smaller dwellings. This, however, usually benefits the producers, but not necessarily the living conditions of people, nor resilient spatial production in the long run. In the bigger picture, the spatial needs have effects not only at the building level but can also be better targeted at the areal or city level and even on the global level, if space unit thinking expands. In fact, the need for building small flats, that always stay as such, diminishes. It is more essential that the produced space is used resourcefully and proportionally on the area or city level, reflecting the actual demand.

The background assumption of the dwelling as a space unit is so strong that it has even affected the way we look at flexibility and its manifestations in gaining efficiency mostly within the boundaries of a dwelling. The approaches in flexibility, particularly considering forms of transformability, have sprung in the first instance from the objectives of efficient use of dwelling. Multi-usability objectives on the other hand, concern the long-term persistence of buildings and how they can serve the people and their needs. This brings us towards a different kind of interpretation of the efficiency of space from what has been common practice within the production sector. In the space unit approach, the focus is at the level of building, and how, by enabling people to adjust their spatial demands according to their needs, the whole building can be used in a more effective and resourceful way. An example of this is when a person can rent out or sell parts of the dwelling when the dwelling becomes too big or too expensive, for example, in the case of divorce. The person or family does not necessarily have to immediately move to a smaller dwelling but can manage her/his financial situation based on their life situation – which might be temporary – by renting out part of the dwelling.

Change of use

Another problem from the point of view of resilient development has been the production of space for a certain purpose, such as housing, which cannot be easily adapted to any other use. In many areas, the development has been intrinsic, in the sense that the buildings for housing are mostly inhabited in the beginning by families with children, but after a decade or two they become the minority. The requirements for the configuration of a dwelling have changed, as too have the services that people seek. For example, there may be a decline in the spatial needs for kindergartens as mentioned earlier. If kindergartens would to some extent be more organically connected to apartment buildings, the spaces could later be used for housing when the need for kindergartens diminishes.¹⁹⁶ Another example used earlier is that local services near the home are especially important for older people. People's more transient needs for living, such as having small work spaces or even spaces for starting small-scale enterprises and production spaces, cannot easily be located in the city structure, which is mainly focused on housing with no adaptive characteristics. This condition also locks development of the areas into certain configurations. With flexible spatial configuration which also has the potential to switch use, an even more efficient use of space could be accomplished at the building, area or city level because the spatial potential would be present in the buildings. This is because the spaces would be in use according to demand and resources.

¹⁹⁶ This puts the emphasis on the type of tenure. In owner-occupied buildings for housing the reversal of use is usually more difficult.

In the context of change of use, the space unit configuration should also take into account the capacity of the technical systems as part of the spatial configuration so that the changes needed are as easy as possible to make when a new need emerges. Ventilation is particularly problematic if it is drawn up for bigger entities and cannot be considered for smaller units. Change of use from housing to commercial space can also be problematic because different regulations apply and their ventilation systems cannot be mixed. This does not mean, however, that it is impossible to execute. The modularity of technical changes has also to be premeditated in the design of typologically flexible buildings. It primarily needs new attitudes towards space and new ways of approaching spatial design and its technical aspects.

Architecture and the meaning creation in space unit thinking

Defining space unit thinking within typological flexibility does not mean that we have to give a certain look to a building. Nor does space unit thinking in some way or another hinder the spatial qualities of the dwelling or its architecture. On the contrary, it is also very important to consider the mental dimensions in design when applying space unit thinking. A dwelling should always be a meaningful whole, a home, for its inhabitants. This demands a lot of the design of the spatial configuration and of the architecture. The typological flexibility that emphasizes multi-usability and the connectivity of the space units should not be understood to mean that the dwelling is a mere collection of different connected spaces. The dwelling always forms a mental whole for its inhabitant. So it is crucial to design in a manner that takes this into consideration, that is, the notion that each permutation can be perceived and conceived as an entity of architectural quality of any potential dwelling.

THE SOCIETAL BENEFITS OF SPACE UNIT THINKING

Resilient development

From the point of view of resilient spatial development, the production of space that springs from space unit thinking is a significant improvement; it promotes energy efficiency, social sustainability and effective use of space based on existing needs. If space is not in effective use, reflecting the people's needs at the building and city level, it usually means producing space somewhere else or even replacing already existing space and so increasing the use of energy and natural resources. If the building stock in general is not in efficient use, this can also have consequences for the social context. If, for example, the number of people using a space diminish in an area, this leads to inefficient use of buildings and even affects the services provided in the area. Through typological flexibility the managers and owners of buildings could better promote the utilization capacity of space. Even the city structure would become more efficient in use and at its best it could also promote new economic activity.

The profiling of buildings and areas

Space unit-based spatial configuration not only serves individual people through its self-conditional character but it also significantly affects the way the urban areas are profiled in general, and so has an impact on the long-term social sustainability of cities. Overly one-sided inhabitant profiles created by dwelling sizes and types can affect the social fabric of an urban area. When buildings are based on space unit thinking, urban areas can be freely formed by different kinds of people representing different inhabitant profiles. Occupying a space would be more based on existing demand rather than on the dwellings types available as in present day housing production.

Reducing the volatility of space

The developer-manager would also benefit from space unit design strategy as well as the easy transformability of the spatial contexts of the dwellings. The developer-manager can decide the flat size and its characters based on demand even close to the completion of the buildings, or even later if the dwellings do not sell or are not rented, as well as during the whole lifespan of the building. Dwellings sizes are then not based on fallible predictions of economic cycles because the capacity within buildings continually live. The inhabitants of owner-occupied buildings can also lose the value of their investment if the perception of the area changes due to social changes based on strict profiling and lack of services. People could also manage the risks of their investment in space in life-changing situations, which can also have other instrumental effects on general economic activity if the uses of space can also change. Formulation of dwellings based more on space units and ease of changing use can also lower the risk of volatility of national wealth tied to real estate.

With space unit thinking, all kinds of changes in the urban area can be taken into consideration. It then becomes a question of having planning regulations that define to what extent the use of buildings can be altered, in order for areas to sustain their livability and maintain a balance between housing and other uses through some allowed fluctuations. Also, later investment in an area can be less resource intensive if the buildings allow for easy changes of use. Later changes have generally turned out to be rather costly and therefore also slow to execute, which has affected urban areas for a long time. This is usually the case when dwellings of the wrong size are situated in the wrong places, and service provision and commercial space have been modest.

Risk management

Risk management is much more difficult with fixed dwelling sizes that do not allow division of spaces into independent parts. When the risk management of an investment in space is based on space unit thinking the risk is easier to handle for both the developer and for the inhabitant. The possibility for change of use can also help to manage the risk in economic circumstances when the need for some service or

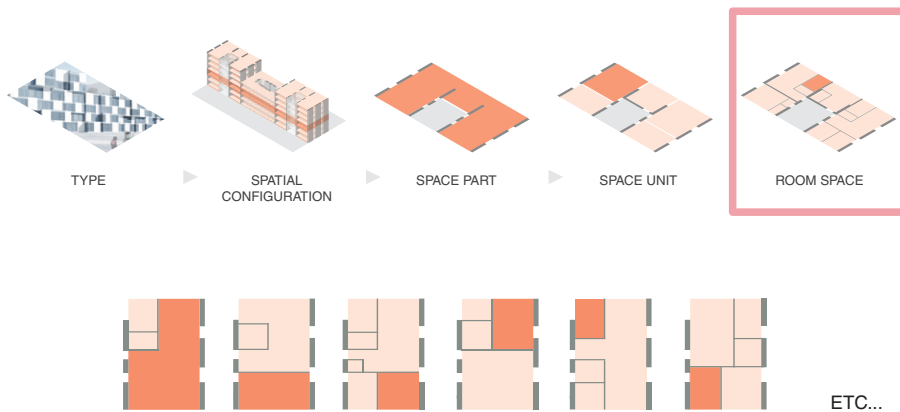
housing diminishes. The long-term managerial risk for developer managers of rental buildings is also smaller if dwelling sizes can be freely changed according to the needs apparent in markets. In the management of real estate it is easier when the sizes of dwelling and uses in building complexes are not fixed permanently to certain uses and urban contexts, but the buildings can react to the demand of dwelling sizes and other services needed. Alterations and modifications always put financial pressure on all parties involved. A developer that does not manage the buildings later on, on the other hand, can delimit the risk in selling dwellings in owner-occupied buildings because the sizes and uses can be altered close to completion and even later if the dwellings do not sell. This will also help them to lower the cost of the risk.

Self-correcting tendency

One of the most significant features in space unit thinking is its capacity to correct itself both at the building level as well as at the urban level. There is no fear of producing dwellings that are either too small or too large in the long run because of the flexibility of size of dwellings. All sizes of dwellings can be found in building stock that bases its spatial logic in space unit thinking. For example, the developer that manages the building after its execution can, say after 10 years, change the sizes of dwellings easily. The change might be slow in buildings in general, but at least it is not hooked onto a certain configuration that might turn out to be non-resilient. The contexts of dwellings do not have to be decided on so precisely either if space unit thinking also considers changes of room types such as kitchen and bathroom through premeditated strategic transformative potential within the building. Then the decisions of earlier inhabitants do not necessarily lock up the situation, and change is easy and less resource-intensive. This self-correcting tendency works on both the individual and societal levels. At its best, if a space unit thinking approach forms a critical mass of the building stock, it could promote diversity that could also constantly recreate itself.

ROOM SPACE

Within space unit logic the question of room division arises, that is, how rooms can be created within the space units for different purposes. The room is usually the most intimate and clearly defined space. Like the space unit, room space based on typological flexibility can exist both as abstract potential and concrete structural entity, within already defined managerial and physical boundaries. Room space is always considered as part of an already fixed entity such as a space unit or dwelling that is controlled and managed by the same household. This means that the division does not need the same fire or acoustic definitions as those required between separate dwellings made of space units. See Fig. 76.



I have differentiated between space unit and room, because a single room itself does not necessarily have the capacity to act independently in the way the space unit can. The interactive feature of a room space is usually a door, but a room does not necessarily have any other dynamic character within the spatial configuration of the building. Depending on the spatial configuration, a space unit can be divided into room spaces or it can even be created as one single room. But to work as independent entity like a small dwelling, a space unit needs several room spaces to be included within it. If the space unit is considered the smallest possible dwelling then the space unit already consists of several specified rooms that minimally contain a studio room, kitchen area as well as a bathroom. The bathrooms as well as kitchens are specified spaces, and they are the most demanding spaces from the point of view of transformability.

The most flexible solutions for room divisions are gained through some level of transformability, which enables room spaces to be specified in several locations, so that the use of space does not have to be decided beforehand in any way and so that the room spaces can be freely allocated to different functions. Many open building applications actually concentrate on the problem of changing the location of kitchens and bathrooms within a dwelling. At the room level, transformability is usually easiest if specified rooms such as bathrooms and kitchens already have fixed positions, but for the sake of extreme multi-usability where all spaces should be specifiable into any kind of uses, transformability comes into play more strongly.

Potential room

Although the concept of room is very concrete and tangible, it can be also understood merely as a potential for a room to emerge, as in the context of space unit. In that way, it is an abstract term denoting potential rather than an existing physical entity

Fig. 76. The room division potential within space unit or space part.
Living House ©Karin Krokfors Architects.

with physical boundaries. A room can be formed in different ways and sizes within the spatial configuration and space unit thinking that the building comprises. In identifying the parameters of rooms, the design of technical systems has to chime with the objective of flexibility. As soon as differentiating and combining room spaces through transformability becomes laborious or complicated, it will not be applied so easily and change will become less probable. A spatial configuration of the kind that gives the possibility to divide rooms freely by light non-loadbearing walls, enabling different uses of rooms, is an essential part of the typological flexibility that springs from the potential of transformability.¹⁹⁷ The needs for room sizes as well as for the number of rooms within dwellings can vary across people and situations making the flexibility potential important for dividing the rooms according to needs within space parts and space units.

The connecting passage is the prerequisite for the flexible use of a space unit, as it is of a room space. Free space like loft space is usually not so free anymore once the passage and entrance properties of the space are defined and the rooms within the loft space start to take form. The free space and its organization are always linked to the passageways and to the division of windows in the elevation, unless the elevations can be adjusted as well. In Scandinavian climate conditions it can be a rather laborious operation to try to affect the elevations. Because the organization of the passage is maybe the most important factor in creating modularity and multi-usability during the lifespan of a building and at all scales, it is important to go through the potential ways of configuring the rooms at least to some extent, in designing spatial configuration and defining the space units, so that the potential of flexibility can be tested. In that way designing typological flexibility resembles the scenario design that Brand calls for.

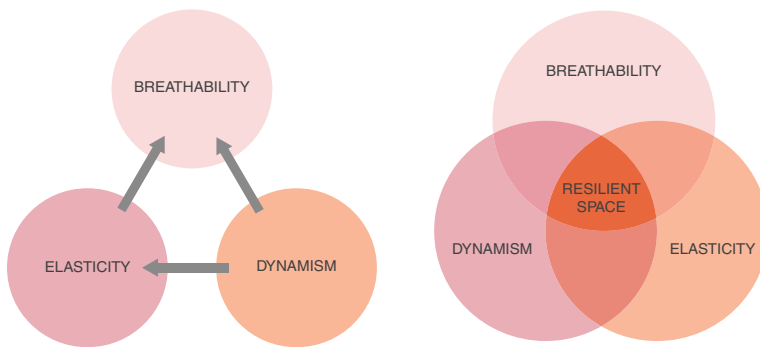
4.2

THE GENERAL OBJECTIVES OF TYPOLOGICAL FLEXIBILITY

There are certain general characteristics of typological flexibility, defined here as *breathing*, *dynamic* and *elastic* qualities, which epitomize the objectives of typological flexibility. The contexts of these concepts will be dealt with next. They will also help in the assessment of whether typological flexibility has been achieved or not. All the named characteristics are concepts that work in and between different scales.

Flexibility is always somehow dynamic in its character. The flexible building comprises qualities that the flexibility is based on, as certain systemic and dynamic characters – the dynamism that produces the different ways of using the space or

¹⁹⁷ Rooms are usually created with temporary lightweight structures unless the whole concept relies on a room-typology that is already very fixed. Even then there should be a possibility to connect rooms or to divide the room space into smaller rooms, which can be used independently of each other.



transforming it to certain purposes. This dynamism always starts from the structural features such as the loadbearing and tensing structures of the building, as well as from a certain spatial configuration created in the design that rely on certain forms of modularity. Thus, the flexibility produced through the understanding of typological flexibility springs first and foremost from the overall typology of the building, which forms the adaptive character of the building and affects the city structure.

The character of a building that springs from multi-usability is also considered dynamic even though the space itself might not need any alteration to comprise different uses. Dynamism refers to the potential that the space possesses as its intrinsic character, so it can accommodate or produce different kind of uses. In typological flexibility the main focus of transformability is how it can help to foster the multi-usability of space and building. The dynamic flexibility produced with the help of transformability is always connected to physical alterations of space. Naturally, all spaces can be altered even with or without flexible features premeditated in design. Even loadbearing structures can be altered to some extent, although it is often very difficult and laborious. From that point of view, all transforming cannot be considered flexibility. Transformability within flexibility is always much less demanding than building a new building or repairing an existing one, and it should produce flexibility that will allow different kinds of uses for the space. The greater the need for transforming the physical realms of the space, the more transformability is distinct from multi-usability. This attribute of typological flexibility that moves between multi-usability and its assisting transformability is what I have named as the elastic quality of space. Elasticity of space defines how much the space needs physical alterations to be multi-usable.

When the examination is widened to the scale of the whole building or to the urban context as well, the prime objective of multi-usability starts to possess another under-

Fig. 77. The different objectives and qualifiers of typological flexibility.

standing of adaptive and flexible qualities within the concept of typological flexibility. I call this quality breathability. The metaphor is borrowed from the term referring to the metabolic process of breathing in and out.¹⁹⁸ The reference to metabolism springs from the quality that enables the organism to stay alive and “breathe in” and “breathe out” different uses. On the metaphoric level, the built environment, like an organism, needs some kind of metabolic or systemic character to survive and be resilient in the long run. This kind of metabolism and breathing quality can be accomplished best by a typology that enables the “organism” to be self-organizing and to allow the emergence of new social as well as physical contexts as integral to it. The breathing quality also conveys the reversibility potential of the changes. No state of being is the right one and no state of being is fixed. After each “move” several moves are still possible. This keeps the vitality of the whole organism – from room to city – alive.¹⁹⁹ See Fig. 77.

THE QUALIFIERS FOR THE CONCEPTS OF BREATHABILITY, DYNAMISM AND ELASTICITY

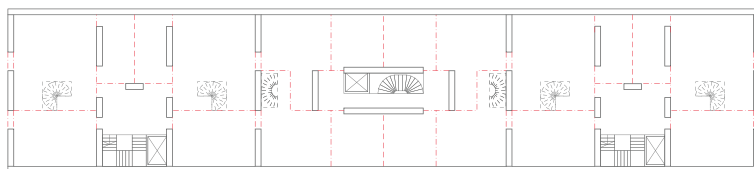
This section studies in more depth the qualifiers of breathability, dynamism and elasticity active in the concept of typological flexibility. However, there are two other notions linked to them that help to define the concepts. These are the core state and potential, which was already discussed in the section on space unit and room.

Core state

Core state is the starting point of the overall spatial configuration that enables adaptability. See Fig. 78. It is the basic condition and idea of typological flexibility in the building. The essence of the core state defines the particular typology in which space, building and city structure are able to self-organize and enable the emergence of novel uses of the spaces and buildings. The core state can be seen to some extent as a reference to a frame that creates generic space (Leupen 2006a) but it comprises more than

¹⁹⁸ This has no reference to the Metabolist movement that fused ideas about architectural mega structures with those of organic biological growth. The Metabolists perceived the systems more in how they grow in contrast to breathability that refers to the act of breathing, i.e., possessing something and releasing something as an act that enables living in general.

¹⁹⁹ I examine elasticity, dynamism and breathability as characteristics of space, buildings and the city. These concepts can be applied at all scales from the urban space to a room. Breathability is particularly understood to be active at the building and urban levels. Breathability can, however, also be examined as a feature of a space unit or room. Then it could be understood as an act of diverse uses that change within the boundaries of space part or room in time. Elasticity can be seen, respectively, as a characteristic of city structure, referring to the changes needed to pursue multi-usability on a city scale. City structure can be also dynamic in its character when buildings are designed in a dynamic manner that promotes self-organization that in turn has its effect on city scale. It can then generate different kind of uses as its intrinsic organic feature, for the buildings as well as the public spaces connected to them.

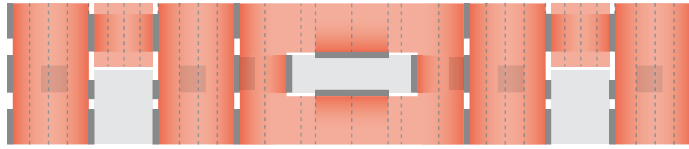


just the permanent tangible physical loadbearing structure of a building. Technical systems, stairwells and other boundaries are also important for creating flexible options. However, the key to the typologically flexible condition is in the way all aspects of the typology of the building work together within a spatial configuration that promotes abstract modularity. Core state defines how space units can be formed and rooms organized within a spatial organization, even when they are not yet perceptible in the physical realm. They cannot be detected just by looking at the structure. There is a “hidden” dimension in design, like DNA, that allows the self-organizing quality of the typological flexibility to be executed. It is not only the skeleton or support but the thought – the strategic dimension – behind the skeleton that makes it adaptable and alive. Thus we arrive also at the notion of potential.

Potential

I define the potential of space as the becoming of things even though in the physical realm it does not yet exist or is not perceivable in its core state. I have considered the potential of space a very essential notion of typological flexibility. In many interpretations of flexible solutions the question arises what potential there is to divide the rooms in diverse ways. See Fig. 79. Potentiality is seen as a pre-defined character of spatial becoming, which not only takes into consideration the existing boundaries but also the possibility to transform spatial realms into something else and to some unknown uses. From the point of view of multi-usability and transformability, potential presents itself differently. In transformability it is the potential to build or dismantle something. In multi-usability it is the potential to use the space differently.

Fig. 78. Core state of Living House © Karin Krokfors Architects.



---- CONNECTED TO WINDOW DIVISION

BREATHABILITY OF SPACE

On the level of city and building, the change of use of space is based on cyclical societal processes. An adaptable building can accommodate very different uses over its lifetime. This gives a living character to a building, which the term connected to metabolism also epitomizes. If buildings are to be sustained much longer than we understand the life span of a building to be at present, then they will be able to see several changes, including radical ones, over their existence: changes that we cannot predict or whose context we cannot even guess at. The purpose of the building or the way it is used may be changed when an unpredictable use emerges within society or done by individuals. To be able to persist in a resilient way, so that resources are not wasted, a building need characteristics that contribute to this cyclical understanding. The concept of breathability captures just that. It is the general objective that all typologically flexible buildings have in common.

The main qualifier for breathability is always some kind of adaptation possibility and potential to emerge into something new and unpredictable. In breathing buildings, the actions are also reversible. Any changes the building goes through will then not be irreversible or demand excessive work and resources to the extent that its whole existence is jeopardized. What is meant by core state in the context of breathability is a situation where the changes that need to be performed are not final solutions in terms of structure and spatial configuration. What is meant by final in this context is that making alterations is laborious, which draws us closer to building something totally new or requires substantial modifications that demands excessive resourcing. All the changes should allow new variations of space to be performed after each change. Even returning to the core state is always possible in some form. This all keeps the building alive and “kicking” through the metabolism that is preconceived in the design of a typologically flexible building, which helps to avoid a threshold that might end the life of the building.

Fig. 79. Example of potential as the room division potential based on the window arrangements. Living House © Karin Krokfors Architects.

In the end, breathability is gained as a result of type, or to put it more precisely, defined through spatial configuration, which can vary from one building to another depending on the architect's way of creating the type. It is very much a question of the divisibility parameters of the building. From the point of view of breathability, the most important feature in space unit thinking is the independence of each space unit and the potential interactions between space units. It can also allow free space to be created within a space part that is not necessarily divided into space units and can, as such, more easily accommodate uses other than housing.

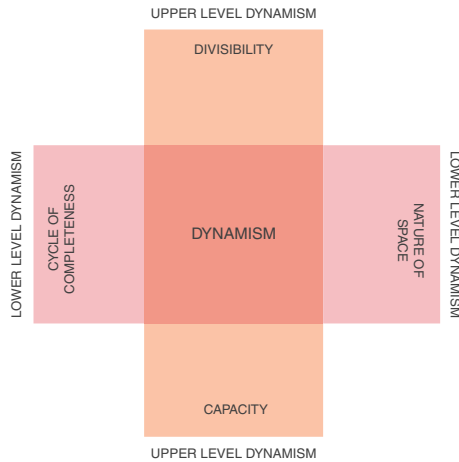
DYNAMISM OF SPACE

If breathability embodies the more general objective of typological flexibility, dynamism characterizes the way of bringing about adaptability and flexibility in a building. Dynamism refers to the qualities of actual spatial modes for gaining adaptable and flexible character in building and space. Generally, the dynamism of space requires some degree of transformability, but a space can be dynamic in its character even if it is not modified. In that case the dynamic character of space is manifested in the multifarious and dynamic possibilities of using the space in different ways. The dynamic character of the space is the factor that defines the elasticity and breathability of space. Dynamism is about the capacity that the space and building can possess so that it can bend to a variety of uses or even partly change its form. Dynamism can be accomplished in many ways and its various approaches have been part of the thematic of flexibility in architectural thought for a long time. In my licentiate thesis I defined the different spatial types concerning flexibility particularly in small-scale housing (Krokfors 2006a).²⁰⁰ Variations of flexibility are legion and this diversity is well portrayed by Schneider & Till (2007) as well as Leupen (2006a) in their comprehensive studies of flexibility.²⁰¹ Leupen's study concentrates on changeability during use. As mentioned before, he divides flexibility related to dynamism into different categories: *alterability*, as internal alterations; *extendability*, as enlarging the surface area of a dwelling; *polyvalence*, as multiple use of space without architectural or structural alterations (Leupen 2006a : 24–25). Schneider and Till, on the other hand, define the dynamic qualities of flexibility through the understanding of different strategies that move from more general to more specific design tactics (Schneider & Till 2007 : 131). They name them as *hard and soft*, *indeterminacy of space*, *circulation*, *movable elements* and *house as furniture* (Schneider & Till 2007 : 131–159). For them, soft means understanding the

²⁰⁰ I defined them as *room type*, *dividable large space* and *expanding and contracting space* as well as *spaces differentiated as their own entities*, which can conjoin qualities of the latter types.

²⁰¹ Because I divide the qualifiers of typological flexibility into three concepts, breathability, dynamism and elasticity, and study them through nested panarchical modes, type, spatial configuration, space parts, space units and room, I cover the same viewpoints on flexibility mentioned by others.

TYPOTOLOGICAL FLEXIBILITY



space as more indeterminate, hard as more determinant (Schneider & Till 2007 : 131). Indeterminacy is characterized as *indeterminate building, raw space, excess space, slack space, adding on, joining together, switching it, dividing up, moving in* and *rooms without labels*. Circulation is divided into *external circulation, internal circulation* and *permeable circulation* (Schneider & Till 2007 : 149–151). Movable elements that already represent the more specific tactics of flexibility, they divide into *sliding and folding* and *moving wall*. They also talk about a *house as furniture* and subordinate to it the *room as furniture*. While Leupen's categorization is more general and concentrates on the frame as the liberator of space as generic space, Schneider and Till define the dynamic characteristics of flexibility much more precisely. They all, however, emphasize access and circulation as important features of gaining flexibility.

Tarpio (2015) has studied extensively the different logics of flexibility in Finland, also in connection to Finnish cultural contexts. He bases his definition on the earlier work done by Till and Schneider among others. Tarpio (2015) divides the flexibility of dwellings into seven spatial logics: *open space logic (avotilalogiikka)*, *hallway and rooms logics (halli ja huoneet logiikka)*, *many routes logic (monireittilogiikka)* that embody *multi-functionality*, and *switch room logic (kytköhuoneologiikka)*, *conversional area logic (muuntoalueologiikka)*, *modular structural logic (moduulistrukturilogiikka)* and *from nucleus growing logic (ytimestä kasvamisen logiikka)* that embodies *modifiability*.²⁰²

What I want to emphasize in defining dynamism the way I do are the different

²⁰² Translations by Karin Krokfors. *Multi-functionality* and *modifiability* are more commonly used terms in English but they can also be referred to multi-usability and transformability, as used in this thesis. Tarpio uses also the division of multi-functionality (*monikäyttöisyys*) and transformability (*muunneltavuus*) but his approach is slightly different from this thesis because he is defining them as equal categories and not as vehicle for self-organization and general objective (multi-usability) and assisting concept (transformability).

Fig. 80. The different levels of dynamism.

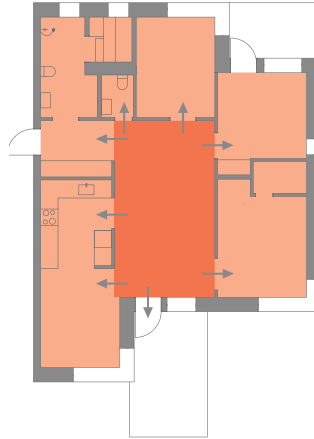
dynamic ways that flexibility works from the point of view of self-organizing space. I have wanted to include various approaches to flexibility that in some form can tackle the systemic features of flexibility. I have divided the different modes of dynamism into a family of concepts by which dynamism can be approached. They are the different basic starting points that reflect the objectives of multi-usability supported by transformability. These are 1 *divisibility*, 2 *capacity*, 3 *cycle of completeness* and 4 *nature of space*.²⁰³ The first two, divisibility and capacity, constitute the upper level dynamism that guides the formation of the lower level dynamism, namely level of completeness and nature of space. The upper level constitutes the conditions for the lower level dynamism. The relationship between the upper level and lower level dynamism is often overlapping. Divisibility and capacity usually form the basis for cycle of completeness and nature of space to emerge, but they can also all be present at the same time as characteristics of dynamism in certain types and spatial configurations. See Fig. 8o.

It is important to notice that not all kinds of dynamic spaces necessarily lead to a multi-usability with a self-organizing character. Without easy modifiability it is not possible to promote multi-usability. The organization of passage is also a crucial factor for creating dynamism from the point of view of multi-usability. So, breathability is an important factor in all manifestations of dynamism. This is a particularly important consideration in the nature and level of completeness of space, which do not necessarily promote cyclical multi-usability of space. In this case, the flexible character draws closer to being a tool that helps to cultivate the space towards the aspirations of the first inhabitant. The same feature might not be possible for the future inhabitants as it has been for the first. When flexibility also takes future inhabitants into consideration, the tactical and strategic character of the space and building must allow easy adaptability or transformability or plain multi-usability to also meet the needs of inhabitants to come.

Divisibility

Dynamism from the point of view of divisibility designates the potential for multi-usability that arises from abstract modularity. Divisibility potential is based on the spatial configuration and how the space units are divided and organized in relation to each other; how spaces are entered from the public or semipublic domain as well as based on the overall circulation potential in building. As mentioned before, even

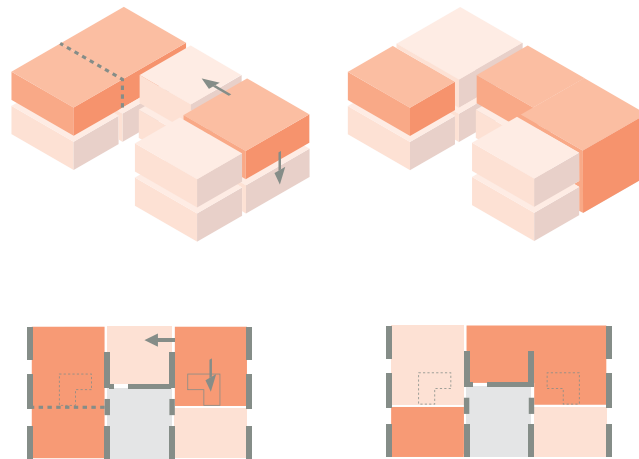
²⁰³ In my article (Krokfors 2010), I have divided the characteristics of typological flexibility into three categories: *the character of space*, *the configuration of space* and *the degree of completeness*. The character of space includes *specific and neutral space*, *the internal polyvalence of dwelling or building*, *the different types of spaces as differentiated as their own entities*. The configuration of space is divided to *passage between spaces*, *combining and differentiating the space units* and as *expanding and contracting of space*. The completeness of space I divided as *growing inwards and outwards* as well as *slack space*, *raw space* and *semi-finished space*. I have developed this earlier categorization in my thesis as the dynamic characters of space.



if the space is a large open space that could be divided into many different sizes of room spaces, the use of rooms is always restricted by other envisaged aspects, such as how the passage to each potential space is organized and how the access to natural light by the window division is arranged. These factors control the divisibility of space into different kinds of units like space units and rooms. At the level of space unit, dynamism determines how the rooms can be divided within the space unit or dwellings defined as the composition of space units. Passage in this case means the passage from one room to another and into the space unit or dwelling. If the space entails transit through another space, the use of space is usually less flexible and it is difficult to change it into any other independent use. See Fig. 81.

The differentiation of space for passage and other spaces, which are not considered transit spaces, enables the space to be private and promotes the independence of the spaces from each other. A passage can be, for example, vertical like a stairwell or horizontal like a corridor or another kind of hall type or room type space. If the space is used, for example, as a working space or for another use that needs to be differentiated from the spaces reserved for housing, it is important that the dwelling, as a composition of space units, has at least one entrance per space unit. In same manner, the use of space is more flexible if the larger rooms within space parts or space units have several entrances, allowing the independent use of each room when separated. If an abundance of entrances can be sealed or taken into use, it usually benefits the objectives of multi-usability in the long run. The advantage of this kind of divisible dynamism is that at different phases of life, the need for space is different as are the resources for managing space, so people can have spatial premises in their own use

Fig. 81. Existing dwelling in Helsinki, in which the living room acts like circulation space. There is also very little proper wall space left as the doors and openings divide and take up wall space.



according to their resources. This also means that people can use the space as a resource in different ways at different times by renting or selling out part of the dwelling or just having part of the dwelling in different use.

Several issues are at play in the concept of divisibility. Type and spatial configuration determine how space units are divided and how they can be *combined* and *differentiated* from each other. The concepts of *contracting* and *expanding* refer to the possession of space units. These definitions are based on who controls the spaces. Besides these concepts, there is the possibility of *sharing* and *switching* some space units/rooms inside the dwellings between different households or any other controlling body, as Schneider & Till (2007) have also portrayed in their research.

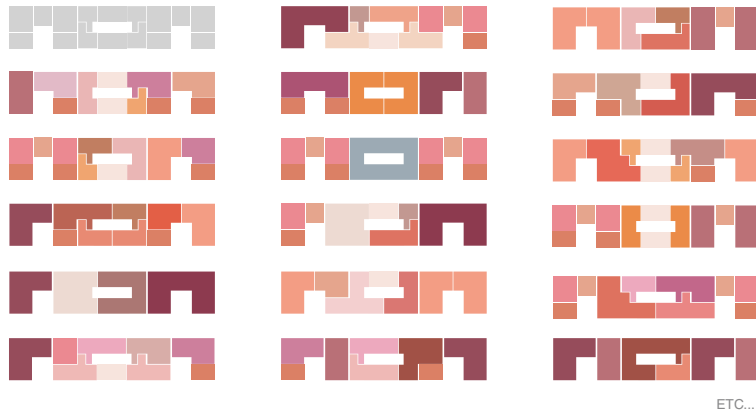
Differentiating and combining of space units

This kind of dynamism refers to the way the space units can be combined or differentiated from each other within the spatial configuration. Differentiating refers to the possibility of separating parts of the dwelling into entities like smaller dwellings or for other uses than housing. See Fig. 82.

Contracting and expanding

Contracting and expanding are managerial terms that concern who controls and occupies the space. Contracting means giving up some space by selling or renting it out. Expanding on the other hand refers to possession of space units by buying or renting extra space units. It is also possible to have a part that is rented from a neighbour in an owner-occupied dwelling, as mentioned earlier. See Fig. 83.

Fig. 82. Examples of how space units can be combined and differentiated in Living House. ©Karin Krokfors Architects.



Sharing and switching

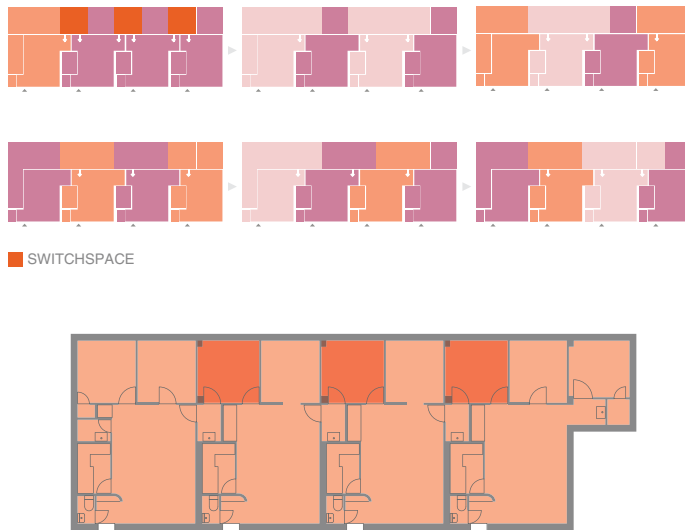
Sharing refers to a situation in which different households share a space with each other. It is another form of possession of space that the inhabitants of different households share. The concept of switching, on the other hand, refers to the way the room or space unit can be connected to different dwellings at different times. Both concepts could enable the contracting and expanding potential for families whose demands on space vary considerably at different times. This can happen, for example, in the case of reconstituted families whose children live at home only every second week.

So far, these modes of possession do not usually exist as part of housing design. From the managerial point of view, sharing is challenging. It is somewhat difficult to execute due to present day norms for fire and acoustic conditions between two different dwellings, but technical solutions could be developed to also cater to this kind of need.

Capacity of space

Capacity of space is usually connected to a very long-term focus in the use of buildings. Usually this means a capacity that takes into consideration the potential for other uses of the space than housing in the future. Unpredictable uses may require stronger structures than are used in housing solutions today. Referring to this kind of situation, Brand (1994) talks about “over”-capacity, by which he means the potential and capacity that is created by over-sizing, for example, the loadbearing capacity of the building that is needed, for example, for housing. It gives flexibility for unpredictable transfor-

Fig. 83. Examples of certain temporal situations in the possession of space units as dwellings in Living House. © Karin Krokfors Architects.

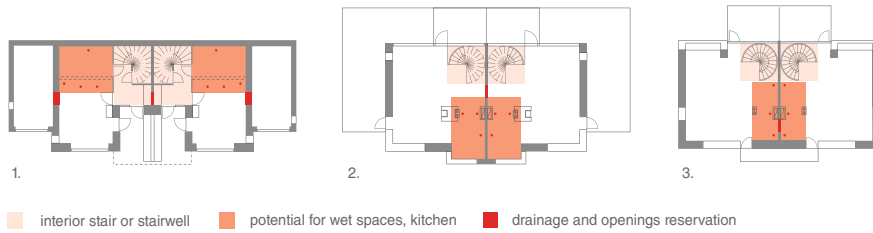


mations in the future. It can be understood as a new interpretation of optimization, which gives systemic choices for flexibility when the structures are not only sized for purpose-built uses as they are in housing design conventions today. “Over”-capacity can also be interpreted in other ways in structural and technical systems, such as making reservations that do not necessarily come into use right away. These can be reservations like openings in the structure or reservations for technical systems. Like in Kellokas Housing there are “lowtech” reservations like openings and strategic ways to organize the passage within the buildings differently. See Fig. 85. and 86. It could also mean higher ceilings than in everyday housing production or using bigger windows in certain places to enable the change of use from housing to something else.

All in all, if you consider the lifespan of a building to be several hundred years, it is probable that “over”-capacity will come into use in one form or another. The capacity gives the space the potential to be used in multiple ways. Old industrial buildings that have been taken into use as lofts and other kinds of housing solutions, have been very much linked to this aspect of capacity either in its carrying capacity or in its excess of room height. Another feature of capacity is the frame in general and the frame depth of the building, which can best promote the multi-usability of a building. The capacity can also consider other uses than housing to take place later, such as the consideration, discussed earlier, regarding higher ground floors with big window openings in planning guidance in Copenhagen. See Fig. 86.

Fig. 84. Example of switch space by Alvar Aalto. Staff dormitory dwellings at Paimio sanatorium, (Aalto 1932). Because of the switch space, there is potential to form different sizes of dwellings.





There are generally two different ways of creating “over”-capacity that help the multi-usability of space. The first is the capacity that is incorporated into the structure, such as a load-bearing capacity that does not need any alterations during the lifespan of the building; the second is usually understood as the capacity that needs some form of transformability when taken into use. This kind of capacity can be, for example, connected to technical arrangements that do not necessarily come into use right away. Capacity through transformability is also linked to the concept of elasticity, which is dealt with more thoroughly later.

The capacity of the frame

The frame forms the overall capacity of the building. This capacity can be prone to change of uses as an integral feature. The characteristics of the frame are usually the floor height, carrying capacity of the frame, frame depth, flexible window arrangements, and the divisibility potential of room spaces that the window arrangements allow.

The capacity through transformations

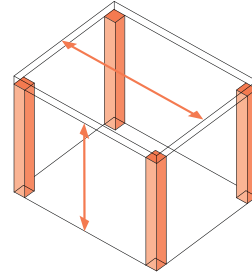
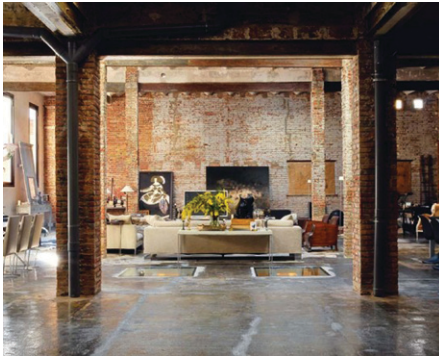
The other type of capacity for multi-usability is the oversizing potential that comes into use through transformability. These can be, for example, the “over” capacity of technical features that need some alterations when taken into use.

Cycle of completeness

Flexibility can materialize through dynamic characteristics when a space is still “unfinished” or growing. A space can be raw space, which can be used for functions that are in synchrony with the needs of the inhabitant and the space’s level of finishing. This kind of space need not fulfil the criteria usually considered for housing space. The character of the space can vary; it may just lack the final finishing or it may be a space that is only used for part of the year. It can also be considered a potential of space for spatial growth into an actual finished housing space. The understanding of what is considered actual housing space and what is the character of raw space

Fig. 85. Kellokas Housing strategic reservation potential.

Fig. 86. Kellokas Housing (2009-2011), an infill building in the protected Vanhakaupunki district of Helsinki, was designed so that the ground floor windows are big. The building and can also be put to other use besides housing, which could enliven the streetscape. The ground floor can also be converted into individual entities and used for different purposes.



can vary very much between people and different cultural contexts. Nevertheless, the character of the raw space can be described as something that has the potential to be completed in one form another.

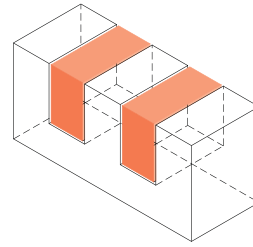
Dynamism can also be manifested as *specialization of space*, which can have a cyclical character and relate to solutions in which the context of space can be defined by the inhabitant. An example of this is another characteristic of the cycle of completeness of space that can *grow outwards* or *inwards* within the architectural concept. These concepts will be defined more closely in the following.

The important point in all of them, however, is that in order to be typologically flexible, in some way the actions based on certain configuration should be reversible. They are intended as a potential of space encompassing a cyclical character, which is usually the feature that distinguishes it from just cultivating the space. The cycle of completeness is always to some extent connected to transformability. If there is a tactical and strategic feature in the architecture that allows it to be completed easily in different ways, and still possess a potential for changes in use, the space can be considered as typologically flexible in character, which serves the self-conditionality of space overgenerationally.

Growing outwards

This means building extra space at a later stage in the life cycle of the building, after it has already been taken into use. The growing potential means the possibility to extend the building by converting the outdoor spaces or bringing semi-warm space within the spatial realms of the building for indoor use. The challenge of doing this lies in perceiving the architectural character in such a way that the growing and later operations can happen in a manner that does not diminish the architectural or urban qualities, and does not diminish the flexible qualities of the other spaces while

Fig. 87. Old industrial or office space turned into housing. Depending on the capacity of the frame this could also work in reverse if the need arises.



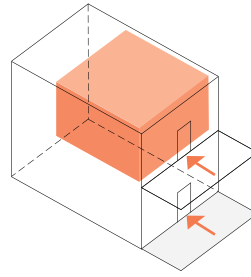
growing. The best way to approach this concept is usually to note that the extended space is subservient to the core architectural concept that allows this growing. One good example of this kind of organic growth is the concept of *slack space*. It is another form of the adding on term used by Schneider and Till (2007).

The concept of slack space refers to incorporating parts of the architectural exterior features in the architecture of the building such as roofs, balconies, terraces and other in-between space, and rebuilding them as indoor dwelling spaces. Slack space is an integral part of a building and its architecture that can be built over, in and through space. The potential of reversibility of actions is an important part of the characteristic of breathability. In slack space breathability concerns the future changes until the last slack space is taken into use or it is configured to form new indoor spaces. Slack space can also be configured in a manner that makes spaces multi-usable in one form or another through time. See Fig. 88.

Growing inwards

This refers to a situation where, for example, a high space is divided into several levels, as is the case often in old industrial spaces that have been taken into dwelling use. The idea is then to introduce architectural flexible concepts in which the actual usable floor area grows by introducing new levels into the space. For the sake of the objectives of multi-usability and breathability those spaces should be able to be used independently. It is also important in this dynamic feature of space that in the building of extra levels the changes can to some extent be reversible and do not limit the flexible qualities of the space in general. The growing tendency and potential has to be pre-designed in a manner that takes into consideration all the angles for approaching cyclical flexibility as breathability. This is also closely linked to the entrance properties available. See Fig. 89.

Fig. 88. Example of growing and slack space in Elemental Chile, in Temuco, Chile, © Künzel Architects, which was based on their winning entry in an architectural competition, 2004.



Raw and excess space

Raw space is space attached to the building block that can be used for non-housing purposes or as housing, depending on the occupants' way of living. It is considered as extra potential that can be later developed as part of the living area or other everyday use. This way it closely resembles the concept of slack space. By raw space I mean space that differs from the definitions that living space normally encompasses, and that differs from the general standards used for housing. To be typologically flexible, raw space should also be able to offer some cyclical and reversible features and multi-usability so that it avoids being just another way of cultivating the space in a delayed manner. This is usually accomplished through organizing the passage to raw space. See Fig. 90. Raw space can also be something shared with other dwellings, which also puts the emphasis on the configuration of space and the passage possibilities to all spaces.

Specialization of space

Specialization of space refers to how the space can change its status through the strategic or tactic characteristics embedded in type. At its best, the character of the transformable room is so dynamic that the inhabitant can decide its specific function. Minimum standards for rooms are usually designed and dimensioned with certain purpose in mind, such as for sleeping, with room for a bed, small cupboard and tiny worktable. There is frequently as little as only one way to position the bed in a small bedroom, because of its overall size and dimensioning. As stated earlier, the dynamic character aims at multi-usability, which is connected to circulation and window properties as well as room size. The dynamism of a room can be formed in a manner that allows the inhabitant, from her/his own starting points, to define the sizes of rooms

Fig 89. When a building is typologically flexible, higher space can be divided vertically into separate dwellings with an increasing inward dynamics if an extra entrance to the property exists. Extra entries can also be interpreted as capacity. Image Nemausus Social Housing © architect Jean Nouvel 1987.

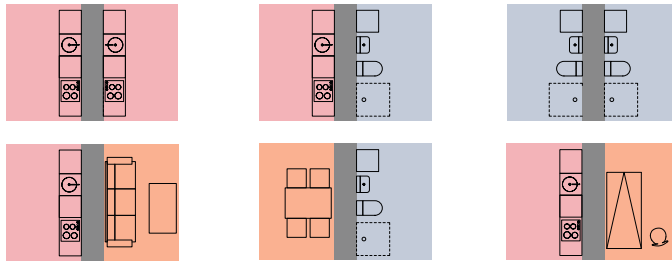


and the way they are dividable and used, preferably with the help of light partition-wall structures.

For a dynamic feature of specialization of space, the easiest solution is that in which the particular spaces are set in certain locations that do not demand considerable changes. This refers, for example, to a situation where the spaces like the kitchen and bathroom are situated in a certain area within the space unit that never changes use, but all the other rooms can then be used freely. However, this can restrict the use of a space unit or space part in general and it puts the emphasis on how the passage to all rooms is organized so that they stay multi-usable.

The free specialization of space means spaces or rooms in a dwelling that can be used for different uses, for example as bedrooms, living rooms, kitchens or bathrooms. The space is most dynamic if the most difficult changes involving rooms like kitchens and bathrooms, with their special fixtures, are interchangeable or changed into living, sleeping or working rooms and vice versa. The fittings can then be located in several positions in the space units and space parts, contrary to normal existing housing in which their location is fixed beforehand in the free specialization of space. The inhabitant can locate and build them according to their aspirations and resources. The specialization of spaces demands special structural and technical solutions for easy transformability. Then the technical systems should also be considered in a strategic manner so that changes are as easy as possible to perform. The relationship of load-bearing structures to light structures and to technical systems, like air, waste water and electricity and data transmission, should not prevent flexible use, otherwise it can jeopardize the timeless strategic character of the building.

Fig 90. Example of excess space, © Lacaton & Vassal Architects 2011.
Transformation of existing housing in Paris, which introduced a new sector
of raw space in front of the existing building.



By specialization of space, the inhabitant can also influence the price and quality of the infill, which is normally replaced faster than other parts of the dwelling. In many cultures *semi-finished* space is a very common way of building, one in which, for example, the inhabitant brings the kitchen and bathroom fixtures themselves to the dwelling. However, semi-finished space can also be understood as cultivation of space if it does not comprise the potential of cyclical transformations that make the changes easy for the next inhabitant as well. The concept of semi-finished space does not really fall into to the category of multi-usable concepts unless it can enable different uses of space in some other way through the cyclical specialization of space. Specialization of space usually means that the technical aspects of installing fittings are taken into consideration in design in a manner that supports reversibility, upgrading or changing the locations of the specified space. See Fig. 91.

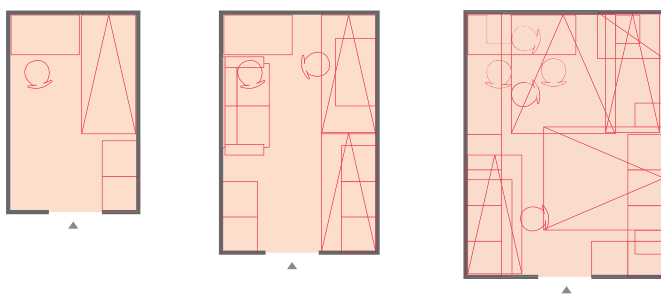
Nature of space

The nature of space refers to multi-usability that springs from the specialization potential of space, discussed in the context of cycle of completeness, that can be either specific or neutral in character. It is differentiated from the concept of identity, which is linked solely to the architectural features of the building and is part of the overall concept of type.

Specific and neutral space

Mostly spaces are considered either specific or neutral in their character. As defined in connection with typological flexibility, space can be considered neutral when its use is not defined in advance and more than one way of using it is possible. A space is usually considered multi-usable if it is designed so that its size allows a variety of

Fig. 91. The room spaces can become specialized into all kinds of rooms.
Living House © Karin Krokfors Architects.



uses instead of only certain purpose-built functions. The main character of a neutral space is usually its sufficient size. In typical housing design in Finland, the minimum room space has generally been considered to be 7m^2 , which does not bend to a variety of uses and is usually used as a single bedroom for a child or as a small workroom.²⁰⁴ See Fig. 92.

A specific space is usually one that refers to a specific use of the space, such as a bathroom, kitchen or bedroom. Through specialization of space the same location in the space part or space unit can have the potential to be either specific or neutral depending on whether the flexible condition and character of dynamism allows this. This most extreme case of dynamism is based on the nature of space that can encompass very different manifestations of use as discussed earlier.

Identity of space

It is important to emphasize that the nature of space means something other than the identity of space architecturally or from mental starting points for the inhabitants. Identity as I have defined it refers to the architectural character that makes it specific in some form. From the point of view of flexibility, space can be neutral even though its architectural character – identity – is specific. A space can have special architectural identity, but be very neutral for different uses because of its sufficient size and connectiveness to other spaces and passages. On the other hand, the understanding of identity at a mental level is also important, as could be seen in MIT's Building 20, which had a very strong identity as a playful space while being quite neutral in its architecture.

²⁰⁴ This was a regulation earlier that has since been withdrawn, but many designers still take it as their starting point in design in Finland (Interview 4).

Fig 91. The bigger the space the more multi-usable it is.

ELASTICITY OF SPACE

Elasticity in this thesis is considered to be a characteristic of space. It is connected to some defined spatial entity such as a room space or a conglomeration of room spaces within a building. Elasticity defines how multi-usable a space is in reality. The elasticity of space is high when the space needs hardly any or no alterations when it changes its use. The more the space needs modifications to be able to accommodate different kinds of uses, the less elastic it is. The thinking is close to Schneider and Till's (2007) concept of soft and hard in the context of flexibility, as noted earlier. Their concept soft is parallel to what I call high elasticity, that is, when a space needs hardly any alterations. The concept of hard parallels with low elasticity, when a space requires essential alterations.

Elasticity as a concept, however, has been used in different ways in the context of flexibility. It has been used to refer to the agile character of a space, which can in one form or another be elastic. Aalto understood the concept of elasticity in the context of flexibility as the possibility to connect room space between two different dwellings, thus enabling the variability of dwelling sizes according to need. In this thesis, Aalto's understanding of elasticity is located under divisibility properties in the context of switching.²⁰⁵ Bakema, an active member of Team X in the 1960s, understood elasticity as the flexible organization of space in which the dwelling grows from a minimal nucleus, which is standardized (Bakema 1962 : 66). The way Bakema describes it, elasticity does not epitomize the stretching character of the actual space itself but rather the potential to which the space can expand in the long run. Bakema's idea of elasticity could be included in this thesis in the capacity of space as a growing concept epitomizing a particular dynamism through transformability.²⁰⁶

My interpretation of the concept of elasticity operates on the level of action needed – or more precisely the amount of stretching needed – which has its objectives in gaining multi-usability but which is accomplished through the action of transformability. The elasticity of space is produced generally as a characteristic of dynamism, which can be manifested in very different ways. See Fig. 93.

²⁰⁵ See, e.g., the staff dormitory dwellings in Paimio Sanatorium, 1932. Aalto calls it the “Elastisen asuntuuruuden järjestelmä”, which can be translated as “The system of elastic dwelling size”, (Aalto 1934).

²⁰⁶ I have included this thinking as a sub-concept of dynamism as its growing character. It is understood as a built-in potential or characteristic of already existing space from which the space can grow within the architectural concept premeditated in design. It is designed as a strategic potential, which does not resemble growth that can be attached to any building. Growing potentiality, as in Bakema's thinking, has a character that unites the whole but still maintains its flexible character.

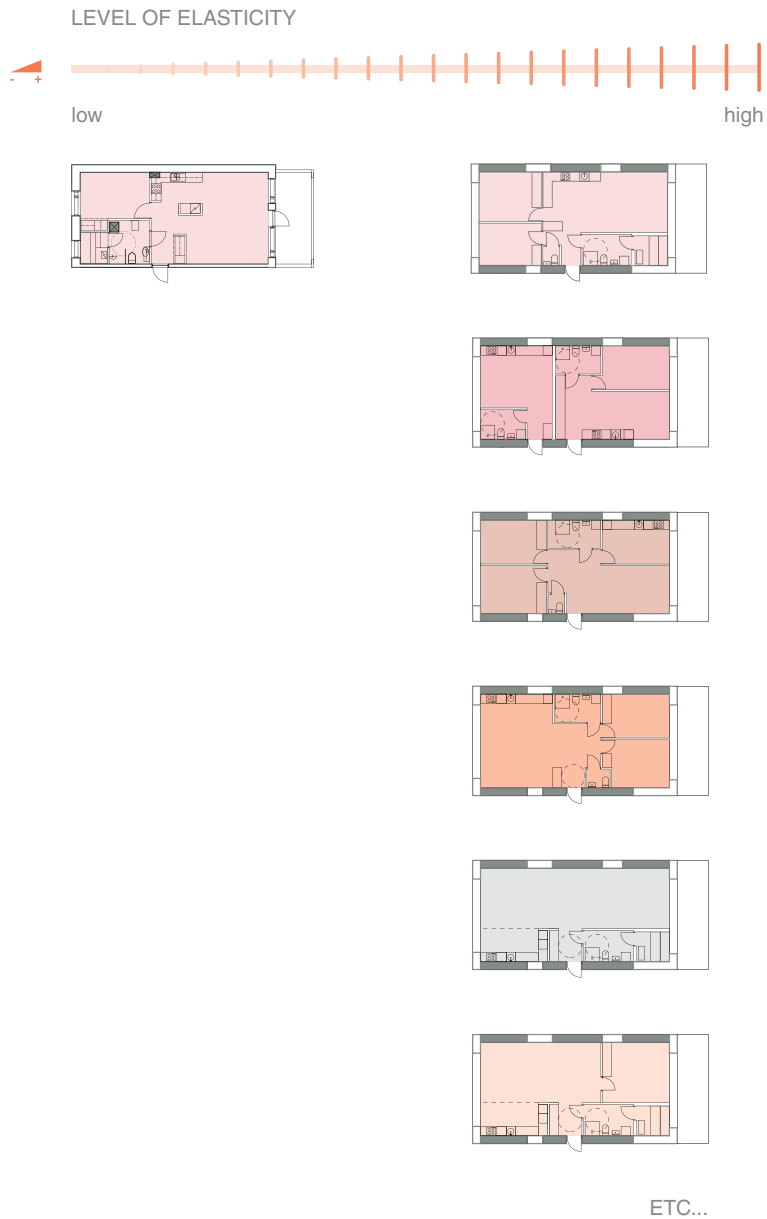


Fig. 93. The higher the elasticity, the more variation potential there is in the plans. On the left, 3-room dwelling in Jätkäsaari, Helsinki, and on the right, Living House © Karin Krokfors Architects.

4.3

ASSESSMENT OF TYPOLOGICAL FLEXIBILITY

So far, I have portrayed the idea of typological flexibility, which is fulfilled through the qualities of breathability, elasticity and dynamism. They are all connected to the nested understanding of the spatial parameters of a building as type, spatial configuration, space part, space unit and room. The objectives all have slightly different trajectories even though their purpose is to fulfil the criteria of typological flexibility. See Fig. 94.

In the context of flexibility, typological flexibility promotes proactivity in buildings and space by enabling creative solutions for its inhabitants – the creative dwellers – during the lifespan of the building. The space itself does not then narrowly define how it should be used but gives an opportunity for emergence – the creation of something novel – which cannot be predicted when the space is designed. To be able to assess whether typological flexibility has been achieved or not in design, I have created the table below. See Fig. 95. Each part of the table portrays a different quality of typological flexibility. I have used qualifiers that help to define and determine the level of fulfilment of typological flexibility, as follows:

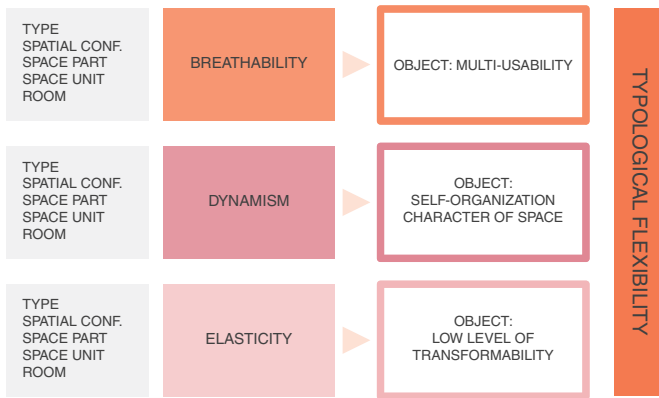
Low – The spatial entities are mainly designed for one possible purpose, and it is limited to that particular use, or the space cannot be configured differently in connection with other spaces. There is only a single spatial configuration possible.

Medium – The spatial entities have at least two possible uses or they can be configured in two different ways as part of the spatial configuration.

High – The spatial entities can have more than two different possible uses and they can be configured in several ways as part of the overall spatial configuration.

The aim of the table is not to achieve exact information in any form. This is partly because exact examination would necessitate a quite precise definition of the different solutions of flexibility.²⁰⁷ A precise description can also become a straightjacket for typological development, whereas the concept of typological flexibility can be reached in multifarious ways. A relational examination can, however, give almost the same information without fixing the concept into certain manifestations of type. The aim of the table is to make it perceptible whether the solution is adaptive enough under temporal and self-conditional examination for it to also be applied to design, control and planning practices. It is important to notice that the examination relates to the whole building, not to a single dwelling, even though the table includes typologically flexible qualities on all levels including the room level. This effectively captures

²⁰⁷ This was actually the problem with the early open building methods conducted by the SAR.



the systemic understanding of space and the qualities that work towards the same purposes in all scales of conduct.

The assessment can be made by studying the number of qualifiers of low, medium and high in the table. If most of the different qualifiers locate in the low – medium scale, then the design can be considered typologically inflexible or not very typologically flexible. If most of the qualifiers locate at medium – high scale the design can be considered typologically flexible. This very simple table has been developed as a tool for the assessment of design, not as a design guide. The architect designing the building is responsible for the type and its application. The strength of the table is that it changes our outlook on how we should design housing or space in general. It is strongly connected to the paradigmatic change in housing design that recognizes the strategic dimension in design. The table comprises a completely different set of objectives for design than has been the case in everyday housing design until recently. New attitudes are also needed in the architects for the design process to produce typologically flexible buildings. However, the assessment table can play a part in design guidance by defining the objectives imposed on design, even though in fact there are multifarious ways in design that can attain these objectives. The creative solutions and the context of typological development are left to the designers. To use the table and interpret it requires design understanding and some design skill if one is to assess whether a scheme really fulfils the criteria of low, medium or high character of typologically flexible design. If the table is completed by the architect responsible for the design, the architect should also use diagrams to demonstrate the potential encompassed in the spatial configuration.

There are 15 parts in the table to be filled in. It works as a checklist for typological flexibility. New viewpoints can be added as new approaches or special solutions emerge

Fig. 94. The linkage between the aspects of typological flexibility.

or are needed based on new observations. The table is thus open to development and parts can be easily added, removed or modified. I see it as a vehicle for change and an open source interface that can continue its life and development after this research. However, when a paradigmatic change in multi-usability, adaptability and typological flexibility has been accomplished at a more general level in housing production, there will no longer be a need for the table.

Low, medium and high can also be defined as numbers. Adding the numbers together makes it easier to assess whether overall typological flexibility has been obtained.

low = 0, medium = 1, high = 2

low	= 0
low-medium	= 1–2
medium	= 3
medium-high	= 4–5
high	= 6

BASIC TABLE Example

	<i>breathability</i>	<i>dynamism</i>	<i>elasticity</i>	
<i>type</i>	1	2	1	= 4
<i>space configuration</i>	1	1	1	= 3
<i>space part</i>	0	1	2	= 3
<i>space unit</i>	1	1	2	= 4
<i>room</i>	2	2	2	= 6
<hr/>				
<i>Average</i>				= 4
				(medium–high)

*The definition of 'hardly any', 'some' and 'a lot of' in the table are interpreted in following way:

'Hardly any' means that the changes are very easy to make.

For example, it might mean transforming a door opening to fulfil acoustic and fire regulations.

'Some' means that the changes are considered worth doing to achieve the aspirations of the people, rather than applying another strategy to gaining these same aspirations.

For example, it might mean changing, removing or attaching new bathroom or kitchen fixtures to existing connections and the changes stay local.

'A lot of' means that the changes are rather extensive and require so much effort that it might even hinder the change.

For example, it might contain so much changing, removing or attaching of new bathroom or kitchen fixtures that require a lot of piping and other work, and the changes do not stay local.

BREATHABILITY		DYNAMISM		ELASTICITY	
TYPE		CONFIGURATION		TYPE	
SPATIAL		SPACE PART		SPACE UNIT	
ROOM		ROOM		ROOM	
(H) 2	The type comprises adaptive qualities in relation to urban context and building that promote multi-usability as well as reversibility.	(H) 2	The type comprises several adaptive qualities in relation to urban context and building that promote changes in divisibility .	(H) 2	The type of the building requires hardly any <i>*transformability</i> to promote multi-usability in the context of the building and city.
(M) 1	The type comprises two different adaptive qualities in relation to urban context and building that promote multi-usability as well as reversibility.	(M) 1	The type comprises two adaptive qualities in relation to urban context and building that promote changes in divisibility .	(M) 1	The type of the building requires some <i>*transformability</i> to promote multi-usability in the context of the building and city.
(L) 0	The type is fixed and it is not adaptable in relation to urban context and building and does not promote multi-usability and reversibility.	(L) 0	The type comprises no adaptive qualities in relation to urban context and building that could promote changes in divisibility.	(L) 0	The type of the building requires a lot of <i>*transformability</i> to promote multi-usability in the context of the building and city.
(H) 2	The passages and other spaces in the building are configured in a manner that allows divisibility in several different ways and which are also reversible.	(H) 2	The passage and other spaces are configured within the building to allow several different ways of combining space units .	(H) 2	The spatial configuration requires hardly any <i>*transformability</i> to promote the divisibility of space in the overall spatial configuration of the building.
(M) 1	The passages and other spaces in the building are configured in a manner that allows divisibility in two different ways which are also reversible.	(M) 1	The passage and spaces are configured within the building that allows two different ways of combining space units .	(M) 1	The spatial configuration requires some <i>*transformability</i> to promote divisibility of space in the overall spatial configuration of the building.
(L) 0	The passage and other spaces in the building are configured in a manner that does not allow divisibility in different ways.	(L) 0	The passage and spaces are configured within the building that allows only one way of connecting space units .	(L) 0	The spatial configuration requires a lot of <i>*transformability</i> to promote divisibility of space in the overall spatial configuration of the building.
(H) 2	The space parts can be divided in several ways into space units and rooms and these actions are reversible .	(H) 2	The divisibility options of space parts allow for several potential ways of combining space units .	(H) 2	The space parts require hardly any <i>*transformability</i> to divide them in different ways.
(M) 1	The space parts can be divided in two possible ways into space units and rooms and these actions are reversible .	(M) 1	The divisibility options of space parts allow two ways of combining space units .	(M) 1	The space parts require some <i>*transformability</i> to divide them in different ways.
(L) 0	The space parts can be divided only one way.	(L) 0	The divisibility options of space parts allow only one way of combining space units .	(L) 0	The space parts require a lot of <i>*transformability</i> to divide them in different ways.
(H) 2	The space units allow different uses (either in a singular unit or in a conglomeration of units) based on the passage into them and their independent character in relation to each other. These actions are reversible.	(H) 2	Each space unit allows several ways of combining them with each other based on the passage into them and their independent character in relation to each other.	(H) 2	The combining and subtracting the space units from each other requires hardly any <i>*transformability</i> .
(M) 1	The space units allow two different uses (either in a singular unit or in a conglomeration of units) based on the passage into them and their independent character in relation to each other. These actions are reversible.	(M) 1	Each space unit allow two ways of combining them with each other based on the passage into them and their independent character in relation to each other.	(M) 1	The combining and subtracting the space units from each other requires some <i>*transformability</i> .
(L) 0	The space units allow one way of using them based on the passage into them and their independent character in relation to each other.	(L) 0	Each space unit allows one way of combining them with each other based on the passage into them and their independent character in relation to each other.	(L) 0	The combining and subtracting the space units from each other requires lot of <i>*transformability</i> .
(H) 2	The potential rooms can accommodate several different uses in them. The changes are reversible.	(H) 2	Space units can be divided into rooms in several different ways.	(H) 2	The division of potential rooms needs hardly any <i>*transformability</i> .
(M) 1	The potential rooms can contain two different uses in them. The changes are reversible.	(M) 1	Space units can be divided into rooms in two different ways.	(M) 1	The division of potential rooms needs some <i>*transformability</i> .
(L) 0	The potential rooms can contain only one particular use in them.	(L) 0	Space units can be divided into rooms only in one way.	(L) 0	The division of potential rooms needs a lot of <i>*transformability</i> .

Fig. 95. The assessment table of typological flexibility.

DISCUSSION

“Whatever you’re meant to do, do it now. The conditions are always impossible.”

The quote from Doris Lessing, with its obvious reference to an individual’s life, can also be interpreted in a societal context. There are always good reasons for not implementing profound changes in society and its systems but rather emphasizing small steps of development, based on existing structures and lines of thought. If you are a single stakeholder in the complex system that creates the built environment and you feel you cannot affect the problems themselves, you usually try to affect the nearest things that you are able to do with ease. Also, there is generally such a haste to solve current problems, such as housing shortages, that spatial development is not considered as crucial on a societal level. The housing shortages, which have been “the continual current problem” for decades, if not centuries, as a result of people migrating to cities and metropolitan areas, have often reinforced existing practices and short-term quantitative agenda with mediocre character (chapter 1). The low quality has, as a result, generally caused tighter regulations and norms in order to reach at least a minimum quality criteria in housing production (chapter 1). The self-perpetuating circle of housing construction has become petrified into a system that is distancing societies from an in-depth understanding of a resilient built environment. In the present system those actors that do not promote long-term resilient development seem to profit most.

The new legislation serving the sustainable development agenda has put forward new demands for changes that, however, in terms of building design, dwells mostly on construction that emphasizes energy efficiency (chapter 1). The way it has been executed in Finnish guidance and regulations has promoted the optimization of parts instead of advancing a holistic understanding of the processes and their systemic conditions. The need for renewal of the spatial criteria in housing production has appeared in Finland mainly through the co-housing initiatives and developments, mirroring the differentiated aspirations in housing solutions (chapter 11).

In Finland, developers, due to the increasing cost of construction as well as the profit demands, have promoted affordable dwellings that are spatially extremely efficient and continually getting smaller. Minimum dwellings have been promoted even for reasons of sustainable development (introduction; chapter 1). Mini- buildings that are also to some extent multi-usable have validity as infill structures in small scale housing districts, as well as to some extent as temporary living solutions. The way the minimum dwelling solutions have been surfacing is, however, like a déjà vu of many of the controversial design ideas of early modernism.

The 1960s experienced a flame of creativity and new understandings of science, society and the human condition that also affected architectural field. Its path to housing design development was nevertheless very short-lived, particularly as regards

the 1960s, and rather than making housing design more innovative it turned buildings into replaceable consumer products that followed universal solutions to suit most people, thus reflecting the accelerated consumerism and over-exploitation of natural resources (see chapter 1). So, what went wrong?

This is a big question, but it is possible to speculate why the original ideas became deformed in the process of implementation into one-sided housing production and geared towards high profit-making expectations. The crucial factor lies in the background assumptions of early modernism as well as the industrial housing solutions since the 1960s (in Finland), that have evolved very little as they emphasize short-term efficiency and optimization in housing production (see introduction; chapter 1 ; hapter 11). The same understanding of living and efficiency of space still guide many initiatives that see buildings as purpose-built entities with certain functions, and as huge consumer products rather than an evolving architectural whole, of which the contexts of use cannot be predicted (see chapter 11). This understanding of human habitat still adopts a mechanistic world view springing from the machine metaphor and a reductionist understanding of purpose-built living solutions that intrinsically exclude the experimental and personal.

The changes needed are much more in-depth and structural than just tinkering with the processes. The cure so far has been based on same thinking that caused the problems in the first place (see introduction; chapter 1). To be able to promote change in a resilient manner, you have to change the basic assumptions behind the systems which are the operating structures and processes. A change in housing production can only be accomplished by rethinking the problem settings for the formation of processes, understanding the systemic interdependencies and setting new and wider objectives that are based on resilient development, as well as understanding resources and design thinking in a new way (introduction; chapter 111). It is of extreme importance to deliver the new understanding through actual practices, rather than just remaining on a theoretical level. Even though the policies drawn up for change are necessary, the steps for implementing them in practice are of paramount significance (chapter 11).

The lack of developmental tendencies in the formation of living environments is influenced by certain mental models that guide the formation of the processes that produce the built environment (chapter 1; chapter 11). Moving from the industrial building phase to more comprehensive period of co-configuration and co-evolution in housing production, which also aims at resilient socio-spatial development, means that people could be in charge of their living contexts based on the more adaptable and flexible characteristics of buildings during the lifespan of the building and even extending the life span. (chapter 11).

As regards the development of processes, this thesis mainly considers how they affect the actual building design. More in-depth future research is needed to be able to establish a comprehensive view of the processes and structures in the building cul-

ture, based on an understanding of resilient development. However, concerning the implementation of typological flexibility and its socio-spatial dimensions (chapter IV particularly), I propose some steps that could advance its adoption in Finnish contexts and elsewhere. In the first instance, this requires change in some many mental models that lie at the roots of processes and how we understand housing and its production.

THE MENTAL MODEL OF UNDERSTANDING THE CREATIVE DWELLER AND THE CONTEXT OF LIVED SPACE

The significant mental model at the root of the new design paradigm is the novel understanding of inhabitants as creative dwellers who can take in a much broader way the possession of the contextual determination of their spatial premises. This does not, however, undermine the need for professional actors. On the contrary it can even strengthen those stakeholders' position who can deliver this choice for people in order to promote resilient development. Nevertheless, their roles as professional stakeholders are being to some extent reconfigured and broadened (chapter III).

CHANGE IN POLICIES, PROCESSES AND PRACTICES

This changing agenda means updating the policies and processes that now spring from the existing compromise between public and private interests that currently obstruct a more personal level and spontaneous existence of living environments. The processes, from planning to execution, should not define too precisely the contexts of the built environment and its functions, but rather should give space for the potential of a new typologically-flexible design thinking to emerge. This again could promote new ways of using space and buildings during their whole life span and create new societal and economic activity. It demands more strategic ways of planning guidance that allow for flexibility not only considering the execution phase but more so during the whole life span of the buildings (chapter II). To promote typological flexibility that gives the inhabitants tools to be more creative about their spatial contexts also means giving a more prominent role to architects who are responsible in the projects for creating the spatial contexts of the buildings. Concerning planning as well as private guidance, there should be much more freedom to manoeuvre with the building typology. This would to some extent widen and change the role of planners, even though it would not change their essential function as the gatekeepers of the overall development of the city, and guardians of urban quality. However, they would work from more strategic starting points. Also, the actual building design paradigm, which is now closely shepherded by the developers with their effectivity objectives, should be developed towards more liberated contexts (chapter II).

Pilot projects

A significant factor in taking the step from theory to practice is the power of examples – pilot projects – that bring up solutions showing how people can take advantage of their own spatial premises through typological flexibility. The importance of pilot projects cannot be emphasized too much, but the real question is how new approaches in spatial design that promote typological flexibility can emerge from the margins into an everyday building construction (chapter 11). Promoting development projects that simultaneously benefit many different stakeholders could more easily promote a paradigm shift in design.

Lowering the risk factor of in-depth developments

Due to the modest risk-taking initiative of developers and construction companies (chapter 1), it is difficult to encourage them to introduce innovations. If the developers could also see the benefits of typologically flexible design, their risk-taking would be more worthwhile. On the other hand, if a pilot project is not beneficial for the developer until it becomes viable business, the risk could be partially covered by public support of some kind, such as distributing sites for the developments or developing other forms of public initiatives for risk taking. The business sector usually takes an interest in innovation only after they can see some profit can be made from it. The road to this point of the innovation is already very long and therefore there would be a need for public support before it becomes viable business (chapter 11).

Public sector involvement

Change in operation models usually requires a push and pressure from the public side as well as of some form of benefits for the developers in return for ambitious development that really induce changes in production agenda. This would make the paradigmatic shift happen and it would become easier in the long run (chapter 11).

It is also important that the public stakeholders recognize the developments that in practice would benefit the range of socio-spatial development. Even though the ecosystem of different kinds of development agendas is important, it is equally crucial not to promote projects that are less ambitious and only apparently experimental, because they could block or take resources away from more genuine or ambitious developments. By apparent is meant development which either fails to include a developmental tendency, or is not ambitious enough to advance the development of spatial practices with the construction culture. The biggest problem with apparent or less ambitious developments is that they can override more in-depth and more resource-intensive developments. This happens if it is easier for the developers to get some public support with less ambitious projects. Few developers want to do more ambitious projects if they get benefits with less effort (chapter 11).

A hierarchical divide for developments with public support could partially solve this problem. The related aid could swing between short-term and long-term development objectives, or between the more ambitious and less ambitious developmental expectations. The resources distributed by the public sector to the private sector could be greater for more in-depth development modes than for less ambitious development with short-term objectives. The reward for developers could be, for example, a lowering of the price of the site or distributing several sites for further development if the project expectations are met (chapter 11).

Auditing the projects

If the new innovation as a pilot project involves public support, then monitoring the outcomes and following a good track record of developers responsible for the pilot project would play a significant role. Auditing should largely be covered by public funding in order to stay independent and non-partial. It would be best if the auditing could be conducted by impartial stakeholders, such as universities, research centres or non-partisan researchers whose expertise is linked to the skills and objectives of the development project. Auditing would most likely raise the ambition level of developers in projects in order to gain future benefits. Monitoring could also be beneficial for cities, because the involvement with research and best practices could shed light on how to recognize and then promote potential developmental modes. To be able to track the developmental contexts and their affects, it would also be beneficial for the development agenda to conduct, approximately every ten years, a more comprehensive review of the development of the housing and living contexts and its extent in the city (chapter 11).

DIFFERENT MODES OF DEVELOPMENT

It is also necessary to promote all types of production and development modes, including those that are developed by inhabitant groups, so that new ideas can surface through them. They can also spur the professional stakeholders and developers to perform better (chapter 11).

It is not easy to accomplish a change in the long-standing understanding of optimization and efficiency as the guiding principle in housing design and production. To be able to gain a paradigmatic shift on the mental level of design thinking as well as in the overall building culture is usually a very long process. To accomplish it, all kinds of change agents (inhabitants, architects, planners, building controls, developers, building industry, etc.) are required. To promote resilient development as well as competition, a diversity of approaches as well as actors is crucial (introduction; chapter 11).

With this in mind, it is significant that the policies drawn up for new developmental modes in housing do not direct the developments for other reasons towards

developer-led practices conducted so far in every day housing production. The contextual decisions about the productions are in these cases taken over by professional consultants and other similar stakeholders. This requires a conscious configuration of policies and practices that involve the different dimensions, as in the case of co-housing, from financing to consumer protection. Consumer protection, for example, should not be developed separately from developmental potential in projects (chapter 11).

THE MENTAL MODEL OF UNDERSTANDING EFFECTIVENESS AND OPTIMIZATION OF SPACE AND BUILDINGS

CHANGING THE UNDERSTANDING OF EFFICIENCY AND OPTIMIZATION

To be able to meet production expectations and decrease the cost of housing in overheated markets, the discussion often dwells on lowering the quality of housing by promoting practices for fast construction and smaller dwellings that lack resilient spatial conditions in the long run and do not promote developmental tendencies (chapter 11). If the problem of the high price of dwellings is cured by lowering the architectural and technical quality of the building, the cost is usually just postponed for the coming generations or even within our own lifetime, as epitomized fairly recently in the execution of suburbia. (chapter 1). In the past the simplification of construction processes in order to reduce the construction costs was not carried over to the price of dwellings either (chapter 1). On the contrary, because of the lack of developmental modes and competitive markets as well as not promoting skills in construction, it has also caused the construction prices to continually grow disproportionately (chapter 11). Although the location and the housing shortages affect the dwelling prices to a great extent, it is the general level of construction costs that set the prices at a certain level and limit development in non-competitive markets.

Reconfiguring the object of optimization

The understanding of efficiency and optimization that in Finland is generally aimed at making singular dwellings more efficient and reducing all circulation space in buildings, is actually guiding the development away from a resilient trajectory (chapter 1; chapter 11). One reason for the current understanding of efficiency thinking concerning semi-public passage space is the high demand for common spaces within buildings in Finland. Their proportional relation to dwelling space has increased in recent decades. This could be affected by creating communal spaces not at the building level but on the block or area level. This condition requires a rethinking of what efficiency and optimization comprise.

For the new understanding of efficiency and optimization there is a need for a paradigm shift in housing design thinking. The new space unit thinking introduced in typological flexibility usually requires more spacious conditions, particularly for semi-public passage spaces, than that of today's housing production.

Typological flexibility, which emphasizes multi-usability as the key essence of resilient spatial development, sees effectivity on a much larger scale than on the singular dwelling level (Introduction; chapter IV). Multi-usability as defined in this thesis breaks away from seeing the dwelling as the object of optimization and the key unit of conduct, but rather sees dwelling as a composition of units that can interact with each other. It also enables the dwelling sizes and their uses to "live" during the whole life span of the buildings and be in appropriate use, reflecting the concurrent needs (chapter IV). To be able to promote new spatial contexts that are also more "inefficient" means lowering the price of construction and dwellings, and to ensure that the decrease in construction costs also reduces the cost of dwellings (introduction; chapter IV). This will also require considerable creative thinking about processes as well.

FINDING THE TRUE CAUSES OF THE HIGH COST OF HOUSING PRODUCTION

In a modestly developing building culture that Finland also represents, doing things differently usually adds to the costs of construction, because it demands skills and practices that are unfamiliar to builders in a homogeneous building culture that also lacks a competitive character. In skills-advancing and continually developing building cultures the construction method is not so determinative for the rise of construction costs. In a non-developing and non-competitive system, the only thing that develops is usually the price of dwellings because there is no urgent need to develop the construction methods and production processes when everything sells anyway.

The one-sided contexts of building cultures and the fixed assumptions of what is good housing results in giving most of the profits of housing solutions to professional actors, rather than benefiting the inhabitants, beyond them getting a home and roof over their heads. The investment in dwelling could be compensated by benefiting also the inhabitants in various ways from social to economic benefits, which the new strategic dimension in design could advance. This would also work for the benefit of society by promoting societal activity and small scale growth as well as social capital. To understand the systemic conditions that affect the cost of construction requires more specific research in the future that digs deep into the roots of the system's structures (chapter II). The FIAT research mentioned earlier has been a good starting point for this kind of development.

THE MENTAL MODEL OF HOLISTIC THINKING AND UNDERSTANDING OF PROCESSES AS INTERTWINED AND NESTED SYSTEMS

INFLUENCING THE SYSTEMIC EFFECTS

Recognizing the systemic condition of building culture is a prerequisite for its development (introduction, chapter 1). To be able to produce resilient buildings, the changes have to be much more profound than the tinkering with details that has mostly been the case so far. Although it is impossible to completely control systems, it is possible to guide them to some extent towards more resilient paths and to make them somewhat self-correcting (introduction).

Non-systemic understanding, on the other hand, has uncontrolled systemic effects that can in the long run turn out to be non-resilient or collapse (introduction; chapter 1). Failing to understand one's own role in the development and blaming other parties for the problems is connected to the very non-discursive contexts and sectorized settings of the production processes (chapter 1; chapter 11). The non-discursive contexts are partially related to policy making and regulating and to the forms of execution that interpret the policies. Too loose regulating can cause low quality outcomes while too tight can cut the wings of development. It is a difficult equation to move processes in more strategic and self-organizing directions, particularly when lobbyists of all kinds want to benefit from changing situations. For any process to succeed and develop continually, and also be able to revise itself, discursive practices are usually required, which means a steep learning curve for all parties involved (chapter 11).

PROMOTING DISCURSIVE PRACTICES

The best way to deal with this kind of “jungle” environment is to open up the discussion in very transparent manner, and the discussion should include all possible viewpoints and be based on relevant research (chapter 1). Discursive practices involving all the stakeholders simultaneously means a culture change in the Finnish context, particularly in big cities where the local authorities are more distanced from each other, and other stakeholders also do not really get to talk face to face at important phases of the process (chapter 11). The introduction of a non-partial stakeholder similar to CABA (before 2011), who could promote learning and work as a non-partisan mediator and promoting the best of the built environment and people, could be tested in Finland (chapter 11).

Rethinking and reconfiguring the roles of stakeholders

To advance the Finnish production landscape it is crucial to promote new structures in the production environment and advance the emergence of new actors in the processes. They could, for example, be new kinds of developers and small-scale competitive construction companies.²⁰⁸ To achieve more strategic planning practices and be able to guide the private stakeholders towards more developmental practices, the final say and decision-making power should stay with the local authorities that guide the overall development of the cities. Nevertheless, the public sector local authorities as well as the developers need a new mind set along with discursive practices in order to work together in a sectorized organizational culture. (chapter II).

FROM SHORT-TERM FOCUS TO LONG-TERM THINKING

The most important objective and driver for change is a move from having a short-term focus to long-term thinking. The guidance should be based on existing societal needs as well as unpredictable future needs, which means adaptable strategic contents for buildings that can evolve and also promote new societal and economic activities (chapter II; chapter III). So much is taken for granted in our spatial production in comparison with any other sector of production that is continually evolving. Because of the lack of competitive standing and long-term objectives that are geared towards contextual change, the absence of a developmental trajectory in spatial production reflects almost authoritarian tendencies (chapter II). The areas of development modes should not be over-shepherded, because we cannot know what will end up becoming the most successful factor in the promotion of resilient building. An ecosystem of different approaches also lowers the risk of making major mistakes in societies if the developmental mode turns out in some phase to be non-resilient.

However much we regulate or guide, a truly high quality of socio-spatial existence and construction culture is generally created by the will for it by all the stakeholders involved. An understanding of the importance of a high-quality built environment and typologically flexible buildings will only be accomplished through an in-depth understanding of resilient development, particularly from its socio-spatial premises. This kind of development and the surfacing of it in the physical environment could be advanced by new initiatives that combine practical and theoretical knowledge and would also mediate them into practice so that it becomes the “normal” condition of society.

²⁰⁸ As the FIAT research has shown, the advancement of owner-developing after the Austrian model, in which smaller construction companies compete on quality rounds, could be promoted. The construction is not necessarily handled by one big constructor, with several subcontractors, that takes the responsibility for the whole project. When smaller companies are each responsible for different parts of the project under the professional owner-developer, it has promoted quality and also diversity of solutions in the general building culture. It does mean though that the owner-developer should have a lot of experience in construction and demand quality, as well as having a developmental mindset instead of just bringing in the financial resources for the developments.

GLOSSARY

Abstract modularity

Refers to modularity as understood in systems and resilience thinking that promote adaptability. Abstract modularity refers to a type of modularity in spatial planning and design, in which the boundaries of spaces are not yet apparent, but they exist as a potential in the spatial configuration of the building.

Adaptive cycle

Occurs in socio-ecological systems and has different phases: 1 *rapid growth*, 2 *conservation*, 3 *release* and 4 *reorganization*.

Adaptive system

A set of interacting or interdependent entities forming an integrated whole, that together can respond to environmental changes or changes in the interacting parts. An adaptive system is also a “learning” system.

Breathability

A character of typological flexibility. A cyclical and processual understanding of an architectural entity, area or city that has a metabolic character enabling it to “breathe in” and “breathe out” unpredictable uses in time.

Building type

Largely understood through the function of the building, such as residential buildings or commercial buildings.

Co-configuration

Refers to prosumer processes in which the customers or users of the products take part in some way in the product development.

Configuration of space

How all spaces are arranged together in the building. It depends on the structure and divisibility properties of spatial units within the building.

Co-housing development

A type of housing in which a group of people develop housing for themselves in such a manner that they can affect the contexts of their living situations.

Complex system

A system in of which the components can interact with each other.

Creative dweller

A concept that draws from the notion of how people can, through typologically flexible buildings with self-organizing qualities, define their ways of living from personal and even economic starting points. They are able to do so much more profoundly than is possible in everyday housing today.

Design thinking

A concept that refers to creative design strategies that develop the design field.

Dynamism

A characteristic of typological flexibility. It characterizes the way that strategic flexibility and adaptability are defined in the typology of the building.

Ecological resilience

An understanding of resilience which refers to the magnitude of disturbance that a system can absorb before it changes its structure.

Elasticity

A characteristic of typological flexibility. The level of transformation needed for space to be multi-usable. The elasticity of space is high when the space needs hardly any or no alteration when its use is changed.

Emergence

Caused by the capability of the system to self-organize. It refers to the formation of something totally new that cannot be foreseen or determined by the parameters of the system, but is formed in the interaction between the parts in the system.

Engineering resilience

An understanding of resilience in which the systems returns to equilibrium after upheaval.

Evolutionary resilience

An understanding of resilience in which systems are conceived as complex, non-linear, and self-organizing, permeated by uncertainty and discontinuities. It challenges the idea of equilibrium and sees that a system can change over time without external disturbance.

Feedback

A concept connected to systems thinking. It is the stabilizing effect of self-organization. Feedback can be positive or negative. Feedback is said to be positive if a recurrent influence reinforces the initial change. It is negative if the reaction is opposite to the initial action, so the change is opposed or counteracted.

House type

Generally understood as a mixture of form and character of a building, like single-family house, apartment building, town house.

Immaterial resources

Qualitative resources is interpreted as an intellectual framework for design and innovations that promote the wellbeing of people and societies as well as further all productive activity. All people and their activity is perceived as a resource.

Material resources

Material resources are epitomized by quantifiable resources, like natural and economic resources, that are a precondition for all building.

Modularity

A feature of all living systems and an important feature of systems thinking and resilience thinking. The system is composed of several self-sufficient components that can interact with each other. The system components can be separated and combined and the non-functioning ones can be replaced without distracting the system as a whole.

Multi-usability

Refers to the quality of space that can be used in several ways without necessarily transforming it in one way or another.

Open building

Design and production strategy which defines the hierarchical levels of influence of space. In the theory of open building the main hierarchical levels are supports and infill, which are clearly distinguished from each other. The load bearing structure, i.e. supports, is something permanent whereas the infill in dwellings is flexible and thus changeable according to different needs of the inhabitant.

Panarchy

All systems are composed of a hierarchy of linked adaptive cycles operating at different scales and times. These linked sets of hierarchies are called panarchy. What happens at one scale can affect what happens at another.

Polyvalence

A concept introduced in architecture by architect Herman Hertzberger. It derives from the French term *salle polyvalente* meaning a multi-purpose hall. The idea behind polyvalence is that space does not necessarily require any changes to be flexible, but is multi-usable as such.

Room

The dividable unit within space units (as well as space parts).

Resilience

A system's ability to cope with change.

Resilience thinking

It offers a different way of understanding the world and a new approach to managing resources. It embraces human and natural systems as complex entities continually adapting through cycles of change, and seeks to understand the qualities of a system that must be maintained or enhanced in order to achieve sustainability.

Self-conditionality

Refers to the way in which people can use space and co-create their spatial conditions based on their own starting points.

Self-organization

A characteristic of all organisms and complex systems. An important notion in the theory of self-organizing systems is that it is a spontaneous process and its outcomes cannot be predicted. Even a very small factor can start a process that can have outcomes unforeseeable in the parameters that caused the change.

Spatial configuration

The overall organization of spaces within a building.

Space part

The biggest possible open space(s) within a building surrounded by loadbearing and tensing structures or other not easily transformable parts in a building.

Space unit

The smallest unit that a building can be divided into that can exist independently. Usually the smallest size of dwelling or work space whose use is independent of other space units.

Space unit thinking

Understands a building to be comprised of space units that can be conjoined as different sizes of dwellings. The result of space unit thinking is that dwelling becomes a managerial term meaning the possession of a particular set of space units or space unit at a particular temporal phase.

Systems thinking

Sees a system as a set of interconnected parts. Each part may be seen as a system in itself and the whole system may be regarded as but one part of a larger system.

Tacit knowledge

Opposed to explicit knowledge. It is a kind of knowledge that is difficult to transfer to another person by means of writing or verbalizing. It evolves from personal experience.

Transformability

Refers to flexible architectural features in which the physical context of space can be transformed.

Threshold

A concept related to systems thinking. It refers to a certain point in a system when the system changes its trajectory or collapses.

Type

In the context of architecture, type refers to the holistic understanding of an architectural entity. It portrays a certain configuration and architecture as well as the meanings it evokes in people. The parts of a type cannot be dismantled in order to understand it. Type also comprises continual renewal as part of the concept.

Typological flexibility

Refers to the idea of a building and its spatial configuration based on the concept of type. A design feature that enables unpredictable use of a building and space in a self-organizing manner and promotes emergence of novel socio-spatial context.

Typology

The study of types. In architectural discourse it refers to the way a dwelling or building is derived from a certain type and its spatial configuration.

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Heikki Myllyniemi

According to *Invented Here. Maximizing Your Organization's Internal Growth and Profitability*.

Victor & Boynton 1998

Fig. 18. Helena Sandman

Hollmén, Reuter and Sandman Architects

<http://www.ukumbi.org/projects/womens-center.html>

Fig. 19. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 20a. *Asuntoarkkitehtuuri ja suunnittelu*

Kahri & Pyykönen 1984.

Fig. 20b. *Suomalaisen asuntoarkkitehtuurin tarina*

Lehtovuori 1999

Fig. 21. Rebcon Group

<http://rebcon.com.au/home/home-portfolio/>

Fig. 22. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 23. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 24. Salt Productions

Fig. 25. Kerrostaloasumisen tilaratkaisujen kehitys Helsingissä vuosina 1997–2012

Krokfors 2016b

Fig. 26. Kerrostaloasumisen tilaratkaisujen kehitys Helsingissä vuosina 1997–2012

Krokfors 2016b

Fig. 27. Kerrostalot 1880–2000

Neuvonen 2006

Fig. 28. Nordhavnen 2012

Fig. 29. Allies and Morrison Architects 2008

Fig. 30. Karin Krokfors

Fig. 31. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 32. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 33. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 34. Jussi Tiainen

Fig. 35. Diagram

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Fig. 36. Housing for the Millions, John Habraken and the SAR (1960–2000).

Bosma et al. 2000

Fig. 38. Walter Gropius – Der Architekt und Teoretiker

Probst & Schädlich 1986

Fig. 39. Diagram

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Fig. 40. Archigram

http://www.archigram.net/projects_pages/plug_in_city.html

http://www.archigram.net/projects_pages/walking_city.html

Fig. 41. From Metabolism to Symbiosis.

Kurokawa 1992.

Fig. 42. Moduulirakentaminen, Ratkaisumalleja tulevaisuuden asuntorakentamisen haasteisiin

Kotilainen 2013

Fig. 43. Christopher Alexander

<http://www.europan-europe.eu/fr/exchanges/open-space-fabric>

Fig. 44. A Pattern Language: Towns, Buildings, Construction.

Alexander et al. 1977

Fig. 45. Le Corbusier Architect of the Century

Raeburn & Wilson 1987

Fig. 46. Le Corbusier: The Poetics of Machine and Metaphor.

Tzonis 2001

<http://www.cronologiadourbanismo.ufba.br/apresentacao.php?idVerbete=1384>

Fig. 47. How Buildings Learn.

Brand 1994

Fig. 48. How Buildings Learn.

Brand 1994

Fig. 49. How Buildings Learn.

Brand 1994

Fig. 50. The Social Logic of Space p.150–151

Hillier & Hanson 1984

Fig. 51. Words and buildings – A vocabulary of Modern Architecture.

Forty 2000

Fig. 52. Fondation Le Corbusier

<https://www.failedarchitecture.com/le-corbusiers-visions-for-fascist-addis-ababa/>

Fig. 53. *On Typology. Oppositions, Summer 1978*

Moneo 1978

Fig. 54. *Modern Architecture since 1900.*

Curtis. 1982

Fig. 55. *Herzog & de Meuron. Natural history.*

Ursprung 2002

Fig. 56. Constant Nieuwenhuys

<https://agnesedamore.wordpress.com/>

Fig. 57. *From Agit Prop to Free Space: The Architecture of Cedric Price.*

Matthews 2007

Fig. 58. *Housing for the millions, John Habraken and SAR.*

Bosma et al. 2000

Fig. 59. *Housing for the millions, John Habraken and SAR.*

Bosma et al. 2000

Fig. 60. *Sisärakennusjärjestelmä avoimeen asuntorakentamiseen: eri maiden järjestelmien vertailua.*

Tarpio & Tiuri 2001

Fig. 61. Herman Herzberger

http://www.wikiwand.com/de/N._John_Habraken

<http://www.metalocus.es/en/news/2-domesticity-netherlands-modern-movement-present>

Fig. 62. Jörn Schiemann

Fig. 63. Diagram

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Fig. 64. Zanderroth Architekten & Herrburg Landschaftsarchitekten

Fig. 65. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 66. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 67. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 68. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 69. Karin Krokfors Architects / Matus Pajor

Fig. 70. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 71. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 72. Diagram

Karin Krokfors / Heikki Myllyniemi / Matus Pajor

Fig. 73. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 74. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 75. Diagram

Karin Krokfors / Heikki Myllyniemi / Matus Pajor

Fig. 76. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 77. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 78. Diagram

Karin Krokfors / Heikki Myllyniemi / Matus Pajor

Fig. 79. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 80. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 81. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 82. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 83. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 84. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 85. Diagram

Karin Krokfors / Matus Pajor

Fig. 86. Karin Krokfors

Fig. 87. <http://www.ineoteric.com/industrial-style-decor/>

Diagram Karin Krokfors / Heikki Myllyniemi

Fig. 88. Christobal Palma

<http://www.arcspace.com/features/elemental/quinta-monroy/>

Diagram Karin Krokfors / Heikki Myllyniemi

Fig. 89. El Croquis 65-66 Jean Nouvel 1987-1994

Diagram Karin Krokfors / Heikki Myllyniemi

Fig. 90. El Croquis 177-178: Lacaton & Vassal 1993-2015 Post Media Horizon.

Lacaton & Vassal 2015

Diagram Karin Krokfors / Heikki Myllyniemi

Fig. 91. Diagram

Karin Krokfors / Heikki Myllyniemi

Fig. 92. Diagram

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Fig. 93. Diagram

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Fig. 94. Diagram.

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Fig. 95. Diagram

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*Translation from Finnish by Karin Krokfors

INTERVIEWS

Interview 1

Interview material 2008–2009 and 2011, in England.

Interviews with English stakeholders.

Interviewees:

Chris Bearman, Partner, Allies & Morrison Architects

Peter Barber, Founding Director, Peter Barber Architects

Stephen Proctor, Founding Director, Proctor & Matthew Architects

Attzaz Rashid, Senior Development Manager, Barratt Homes

Claire Bennie, Deputy Head of Development, Peabody Trust

Deborah Mathieson, Design for London

Eleanor Fawcett, Head of Design for Olympic Legacy, Design for London

Paul Finch, Director, CABE

Matthew Turner, Senior Regions Adviser, CABE

Discussions with Richard Simmons, Chief Executive; Diane Haigh, Director of Design Review, and

Kirsteen Mackay, Deputy Director of Design Review in CABE

Interview 2

Interviews with Finnish stakeholders, in Helsinki, 2010–2011 for CABE-selvitys (CABE report, authorized by ARMI Ry and The Finnish Ministry of Environment) including a representative of architectural education, local authorities in planning and building control, The Museum of Finnish Architecture, the Ministry of the Environment, developers, associations of architects, engineers and architectural firms.

Interviewees:

Trevor Harris, Professor of Urban Design, Aalto University, Department of architecture

Paula Huotelin, Secretary General, Finnish Association of Architects

Hilkka Jaakola, Seinäjoki Head of Planning, Land Use Planning and Urban Design

Vesa Juola, Executive Director, Association of Finnish Architects' Offices

Lauri Jääskeläinen, Head of Office, Building Control Department, City of Helsinki

Juulia Kauste, Director, Museum of Finnish Architecture

Heini Korpelainen, Senior Adviser, Finnish Association of Architects

Aila Korpivaara, Director, Ministry of the Environment, Department of Built Environment

Jukka Kulberg, Head of Planning and Urban Design, Urban Planning and Land Use, City of Vantaa

Kristiina Nivari, Director of Development, Museum of Finnish Architecture

Anja Mäkeläinen, Director, Housing Foundation

Matti Rautiola, Supervising Agent, Building Information Foundation

Teemu Vehmaskoski, Vice President, Finnish Association of Civil Engineers

Interview 3

Interview with Finnish stakeholders in Helsinki, 2013, for PEKA research project, conducted at Aalto University, YTK Land Use Planning and Urban Studies Group, including chiefs of planning and building control offices, representative of TASKE (Helsinki real estate agency) and the Planning Development Manager of SKANSKA.

Interviewees:

Kyösti Oasmaa, Head of Area Development, Real Estate Department, City of Helsinki

Olavi Veltheim, Head of City Planning, Helsinki City Planning Office
Henna Helander, Senior Architect, Building Control Department, City of Helsinki
Tarja Laine, Head of Planning and Urban Design, Urban Planning and Land Use, City of Vantaa
Pekka Virkamäki, Head of Building Control, Building Control, City of Vantaa
Hille Kaukonen, Planning Development Manager, SKANSKA

Interview 4

Interviewees:

Hille Kaukonen, Planning Development Manager, SKANSKA
Ifa Kytösaho, Development Manager, Helsinki Housing Production Department
Anna Brunow, Partner, Brunow & Maunula Architects
Hannu Huttunen, Partner, ARK-House Architects
Pentti Kareoja, Partner, ARK-House Architects
Kirsi Korhonen, Partner, Korhonen & Penttinen Architects
Mika Penttinen, Partner, Korhonen & Penttinen Architects

RESEARCH PROJECTS

URBA research project, 2007-2010, at the Technical University of Helsinki (Aalto University), YTK. As part of the research project smaller working groups were organized with stakeholders involved with URBA. One working group referred to here concentrated on flexibility of housing – URBA Flexibility Working Group. www.urba.fi and *Developing New Urban Housing Concepts In: The Helsinki Metropolitan Area*, Urban Design and Planning 164 (1) 2011.

MOVE Monimuotoinen ja vetovoimainen lähiö (Diverse and attractive suburbia). YTK, Aalto University 2009-2011.

ELOISA Elävä esikaupunki (Living suburbia). Aalto University 2011-2013.

PEKA Periaatekaavoitus ja agenttipohjainen mallintaminen (Rule-based planning and agent-based modeling. Summary of research result). PEKA research project 2013-2015 at Aalto University, YTK.

Kerrostaloasumisen tilaratkaisujen kehitys Helsingissä vuosina 1997-2012 (Development of spatial solutions in apartment buildings in Helsinki 1997-2012). Research project authorized by Helsinki Building Control Department of Helsinki City, the Department of the Built Environment at the Ministry of Environment and Asuntomessusäätiö (between, 2013-2015. Aalto University 2016.

ABSTRACT

There is apparent tension between the continual social changes and the fixed and homogeneous solutions in present day housing production. It can in the long run, jeopardize the resilient development, if people in the future cannot accommodate their needs and aspirations within the built environment produced today. Basing the spatial production on assumptions of predictability and a mechanistic understanding of the world, which is geared towards universal housing solutions, cannot necessarily guarantee the longevity of the building stock. To promote the best possible way the use of natural, economic or mental resources, the thesis puts forward the significance of spatial conditions as a prerequisite for long-term resilient development of the built environment, as well as the enhancement of people's wellbeing. The focus of the thesis is in design and its context. The main research question is: how could spatial criteria for resilient spatial conditions be perceived, defined and developed from strategic starting points in design? The thesis emphasizes the creative process of design and its more autonomic character in processes as prerequisites for the emergence of new ways of living. This can be attained by means of buildings that are responsive to proactive changes throughout their whole life span. The approach is both theoretical and practical.

Housing has become a consumer product in which people are seen merely as objects of design. Instead, spatial production could be seen through the concept of *lived space* that promotes people's proactive role as *creative dwellers*. This concept takes into account the self-organizational potential of buildings and space that can spark the emergence of new social and spatial conditions in a resilient manner and understands human activity as important resource in societies. The *systems thinking* and *resilience thinking* connected to *design thinking* are the key approaches used in the thesis. They emphasize the long term view and the constant responsiveness of systems to change, which are accomplished through their intrinsic characters of adaptability and flexibility. A strategic understanding of cities and their self-organizing potential is already being applied to urban environments in cities as emerging planning practices. In this thesis the strategic understanding is taken beyond the urban approach as integral character of buildings as well. This also stresses the inseparable connection between urban and building contexts.

To better understand the uniform context of prevailing housing production solutions, the thesis examines the viewpoints and presumptions prevalent in Finnish planning, guidance and building culture. The thesis highlights the path-dependencies and systemic context that have evolved into a non-developing system. The process of producing built environment emphasize efficiency and optimization of parts, rather than being holistic and open to new typologies and adaptive solutions. To be able to better define the resilient objectives and contexts for adaptability and flexibility of

space, existing approaches and architectural theories relevant to these concepts are examined. These are studied through the key concepts of *multi-usability*, as objective of all building, and *transformability*, as assisting concept to fulfill this objective.

The conclusions emphasize resilient spatial solutions as an important criteria of sustainability that promote the advancement of resilient buildings. This demands a strategic dimension in design that understands the buildings as processes in evolutionary terms. The context of strategic dimension in design is developed through the concept of *typological flexibility*, which also recognizes the architectural character as a whole to promote meaningful interaction between people and space. The strategic understanding of buildings is based on *abstract modularity* inherent in typological flexibility. The concept interlinks all scales of conduct as in resilient systems that promote diversity and is based on *space unit logic* connected to abstract modularity. The thesis proposes *box within a box* –thinking to design, which originates from systems thinking. All aspects inherent in buildings from mental to physical can be covered in nested concepts and interlinked conceptual levels and scales of buildings named as: *type*, *spatial configuration*, *space part*, *space unit* and *room*. The characteristics of typologically flexible *buildings* are *breathability*, *dynamism* and *elasticity*. They are interpreted as the means and ends of typological flexibility that the nested concepts give rise to, and that promote resilient building stock in the long term. The metaphor of breathability (as the ends) relates to metabolism, to the breathing that enables the “organism” to stay alive and “breathe in” and “breathe out” different uses. Dynamism (as means) is the way of bringing about adaptability and flexibility in the building. Elasticity establishes the link between breathability and dynamism and refers to how breathable – and thus multi-usable – the space actually is. The more transformations the building or dwelling needs for changes, the less elastic it is. A valuation table is introduced comprising all these above mentioned attributes of typological flexibility to assess whether the building fulfills the criteria of resilient building, and can promote the emergence of the creative dweller.

TIIVISTELMÄ

Nykyisen asuntotuotannon luomien homogeenisten asuntoratkaisujen ja jatkuvan sosiaalisen muutoksen välillä on olemassa jännite, mikä pitkällä tähtäimellä vaarantaa yhteiskunnan kestävä kehityksen, jos ihmiset tulevaisuudessa eivät voi elää tarpeitensa ja toiveittensa mukaisesti tänä päivänä tuotetussa rakennuksissa ja rakennetussa ympäristössä. Tilan tuotanto, joka pohjaa oletamaan ennustettavuudesta ja ymmärrykseen universaaliudesta sekä painottaa teknologiaa, ei välttämättä voi turvata rakennuskannan pitkäikäisyyttä. Edesauttaakseen luonnonvarojen tasapainoista käyttöä sekä taloudellisten että henkisten resurssien parasta mahdollista hyödyntämistä väitöskirja tuo esiin tilallisten ratkaisujen merkityksen pitkän tähtäimen kestävälle kehitykselle ja ihmisten hyvinvoinnille. Työn fokus on suunnittelussa ja siinä kontekstissa missä se toimii. Päättökysymys on miten resilienssitilalliset kriteerit hahmotetaan, määritellään ja kehitetään strategisista lähtökodista, jotta suunnittelu mahdollistaisi joustavan ja jatkuvasti ennakoimattoman muutoksiin sopeutuvan rakennuskannan. Tämä voidaan saavuttaa rakennusten avulla, jotka kykenevät reagoimaan spontaanisti muutoksiin koko elinkaarensa ajan. Tutkimuksen lähestymistapa on sekä teoreettinen että käytäntöön kohdistuva.

Asumisesta on tullut kulutushyödyke, jossa ihmiset nähdään pitkälti suunnittelun kohteina. Sen sijaan tilantuotanto voitaisiin ymmärtää käsitteiden *eletty tila* (*lived space*) ja ihmisten aktiivisempaa roolia korostavan *luova asuja* (*creative dweller*) kautta, jotka ymmärtävät inhimillisen toiminnan yhteiskunnallisena resurssina kestävä kehitys huomioiden. Näiden käsitteiden soveltaminen tilantuotantoon edellyttää rakennuksilta ja tiloilta kykyä itse-organisoidua, joka voi tuoda esiin ja mahdollistaa uusia sosiaalisia ja tilallisia olosuhteita. Tutkimuksen päälähestymistavat ovat *systeemiajattelu* ja *resilienssiajattelu* suhteessa *suunnitteluajatteluun*. Lähestymistavat korostavat pitkän tähtäimen näkökulmaa ja systeemien jatkuvaa kykyä reagoida muutokseen sisäisen adaptiivisuutensa ja joustavuutensa avulla. Strategista ymmärrystä kaupunkisuunnittelusta, joka pohjaa ymmärrykseen kaupunkien itse-organisoiduvasta luonteesta, sovelletaan jo. Tämä tutkimus vie kuitenkin strategisen ajattelun vielä pidemmälle myös elimelliseksi osaksi rakennusten suunnittelua, mikä korostaa myös urbaanin tilan ja rakennusten elimellistä yhteyttä.

Ymmärtääkseen paremmin vallitsevan asuntotuotannon ratkaisujen kehitystä tutkimus tarkastelee näkökulmia ja olettamuksia suomalaisen kaavoituksen, suunnittelun ohjauksen ja rakennuskulttuurin takana. Väitöskirja tähdentää polkuriippuvuuksien ja systeemisten olosuhteiden merkitystä, jotka ovat muodostuneet ei-kehittyväksi systeemiksi. Nykyiset rakennettua ympäristöä tuottavat prosessit korostavat tehokkuutta ja osien optimointia ennemminkin kuin holistista näkemystä ja mahdollisuutta jatkuvasti tuottaa uudistuvia tilallisia asuinratkaisuja. Jotta tavoitteet ja sisällöt resilienssitilallisen rakennuskannan suunnittelulle voitaisiin paremmin määrittää, väitöskirjassa tutkitaan jo

olemassa olevia merkityksellisiä näkökulmia ja suunnitteluteorioita. Niitä tarkastellaan kahden avainkäsitteen pohjalta, joita ovat *monikäyttöisyys* (*multi-usability*) tilantuo-
tannon tavoitteena, ja *muunneltavuus* (*transformability*), joka edistää tätä tavoitetta.

Johtopäätökset korostavat resilienttien tilaratkaisujen merkitystä kestävä-
n kehityksen kriteerinä, jotka edesauttavat mukautuvan ja kestävä-
n rakennuskannan edistämistä. Tämä vaatii suunnittelulta strategista ulottuvuutta, joka ymmärtää rakennukset
alati kehittyvinä mentaalisisinä ja fyysisinä prosesseina. Rakennussuunnittelun stra-
teginen ulottuvuus on kehitetty käsitteen *typologinen joustavuus* pohjalta, joka ottaa
kokonaisvaltaisesti huomioon niin rakennuksen arkkitehtuurin kuin tilan ja ihmisten
vuorovaikutuksen hyvinvoinnin edistämiseksi. Rakennusten strateginen ymmärrys
pohjautuu *tilayksikköajatteluun* (*space unit logic*) ja *abstraktiin modulaarisuuteen* (*abstract
modularity*) osana typologisen joustavuuden käsitettä. Konsepti yhdistää kaikki tilalliset
skaalat, mikä on resilientin systeemin yleinen luonne, huonetiloista kaupunkiraken-
teeseen. Väitöskirja ehdottaa suunnittelun osaksi uudenlaista systeemiajattelun sisältä
kumpuavaa ”*laatikko laatikon sisällä*” (*box within box*) ajattelua. Kaikki rakennusta
koskevat näkökohdat mentaalisisestä fyysiseen voidaan kattaa sisäkkäisillä konsepteilla
ja kytketyillä konseptuaalisilla tasoilla, joita ovat: *tyyppi* (*type*), *tilakonfiguraatio* (*spatial
configuration*), *tilaos* (*space part*), *tilayksikkö* (*space unit*) ja *huonetila* (*room*). Typologisen
joustavuuden ominaisuuksia ovat *hengittävyys* (*breathability*), *dynaamisuus* (*dynamism*)
ja *elastisuus* (*elasticity*). Ne käsitetään samanaikaisesti sekä typologisen joustavuuden
keinoksi että päämääräksi, jotka edellä mainitut sisäkkäiset konseptit mahdollistavat, ja
jotka edistävät resilientin rakennuskannan muodostumista. Hengittävyyden metafora
(päämäärä) liittyy metabolismiin, joka edistää resilienttien rakennusten mahdollisuutta
”hengittää” sisään ja ulos erilaisia käyttötarkoituksia. Dynaamisuus (keino) on adaptii-
visuuden ja joustavuuden luonne rakennuksessa. Elastisuus luo linkin hengittävyyden
ja dynaamisuuden välille ja ilmaisee, kuinka hengittävä - monikäyttöinen - rakennus
tosiasiassa on. Mitä enemmän rakennuksen tilat ja asunnot tarvitsevat muunnelta-
vuutta, sen vähemmän elastinen rakennus on. Tutkimuksen osana on kehitetty arvi-
ointitaulukko, joka sisältää kaikki typologisen joustavuuden ulottuvuudet, mikä auttaa
hahmottamaan kuinka rakennukset täyttävät typologisen joustavuuden kriteerit ja
kuinka rakennus edistää luovan asujan syntymistä ja olemassa oloa.



Karin Krokfors, born in 1960, completed her Master's (1991) and Licentiate (2009) degrees in architecture at the Technical University of Helsinki (HUT), known today as Aalto University. She has taught Housing and Urban Design at HUT and at Aalto University since 1994 and is currently temporary head of Housing Design at Aalto. She has also acted as visiting lecturer and critic in several other schools of architecture in Finland, the USA and the UK. She has run her own architectural practice, Karin Krokfors Architects, in Helsinki since 1995, and has been awarded several prizes in architectural competitions in Finland, France, Japan and Sweden.

Her main motivation for housing research emerges from developmental starting points. She has been involved in many research projects in Aalto University that have been geared towards developing housing contexts in Finland. Her practice has also been recognized as an active instigator of practical housing development schemes, in which she has acted, and acts, as principal designer. Everything out of the ordinary in life interests her as long as it can contribute to people's potential and possibility to define for themselves the contexts of the ordinary.

This dissertation argues that the way space is produced today threatens sustainable development in the long run. We need to go much deeper into the roots of design and production paradigms, asking ourselves how we define housing and understand buildings as socio-spatial contexts. The spatial contexts as well as people's possibility to affect their living conditions in a much more profound way than today are essential criteria for sustainability.

The promotion of resilient development requires an increase in the lifespan of buildings by significantly advancing their potential to face the unpredictability of changing conditions. The concept of typological flexibility developed in the thesis highlights the need for a strategic dimension in design that understands buildings as living entities and as processes in evolutionary terms. Instead of considering people as objects of design, they are seen as a resource, from both individual and societal starting points. Typologically flexible buildings can allow people to create all kinds of proactive wellbeing; new mental, social and even economic capital. It celebrates the people of today, as well as future generations, as creative dwellers.

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