Architectural Press is an imprint of Elsevier
Linacre House, Jordan Hill, Oxford OX2 8DP, UK
30 Corporate Drive, Suite 400, Burlington, MA 01803, USA

First edition 2007

Front Cover: Kronsberger Strasse, Model 055
Image courtesy Bernhard Binder

Designed by Ben Weaver
Assisted by Sandra Zellmer

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data
A catalog record for this book is available from the Library of Congress

ISBN–13: 978-0-75-068202-2

For information on all Architectural Press publications visit our website at www.architecturalpress.com

Printed and bound in Italy
06 07 08 09 10 10 9 8 7 6 5 4 3 2 1

Flexible Housing

Tatjana Schneider

&

Jeremy Till

AMSTERDAM • BOSTON • HEIDELBERG • LONDON • NEW YORK • OXFORD
PARIS • SAN DIEGO • SAN FRANCISCO • SINGAPORE • SYDNEY • TOKYO

Architectural Press is an imprint of Elsevir

Contents

1

INTRODUCTION TO

FLEXIBLE HOUSING

INTRODUCTION TO FLEXIBLE HOUSING

1.1 View from the Arts Tower, Sheffield. In the foreground a landscape of design stupidity that builds in obsolescence.

We are writing this book in a room at the top of the tallest building in Sheffield with views out over the city. Laid out in front of us is a landscape of contemporary housing. [Fig 1.1] In the middle distance there is the memory of the Kelvin Flats, a huge 1960s housing development of deck-access housing based on the pattern of the seminal Park Hill housing. These projects were built in Sheffield's heyday when it had the confidence to dream of new futures and when the Architectural Review devoted an entire issue to its pioneering architecture. Park Hill has just about clung on and is now Europe's largest listed building, but the Kelvin Flats were demolished just thirty years after their completion. Opposite us, more 1960s housing has just been pulled down and is being replaced by eight storeys of student housing. These are designed down to very minimum and very specific standards; we watch as prefabricated bathroom units are hoisted up and clamped into place, closely spaced along the length, a long length, of corridors. Once there, these units are immovable, fixing the layout of individual rooms with ensuite bathrooms and making subsequent conversion to any other form of housing all but impossible. Rumour has it that elsewhere in the city student housing built two years ago is still half

empty, and the owners in despair about what to do with it. In front of us more 1960s housing, this time in tower blocks that have recently been overclad at great expense, bringing the insulation standards up to contemporary expectations. Cowering under the tower blocks is a new development of semi-detached developer housing, fiddly little cavity-wall buildings with load-bearing internal partitions and pitched roofs stuffed full with timber trusses, all denying the scope for extension or change.

It is a landscape of design stupidity. Why, just why, would one build housing that so quickly becomes redundant? It is too simplistic to say that the Kelvin Flats failed just because of its design inadequacies (though the rigidity of the concrete cages certainly left little room for manoeuvre in terms of conversion), but the other three examples in one way or another build in a degree of obsolescence. The student housing with the immovable prefabricated units, the tower blocks with their non-exchangeable external panels, and the semi-detached housing with its non-adaptable construction. All of these could have been avoided with the application of straightforward design intelligence and little, if any, extra expense. However, in the rush to construct, short-term expediency overcomes long-term sense.

This book is about an understanding of a long-term view of housing. The first clues as to how to avoid the potential redundancy of so much contemporary housing may also be found out of our window. In the distance nineteenth century industrial workshops in the old cutlery-making quarter are being converted into 'loft' apartments. To the left, streets running up and over the hills are lined with Victorian terraces: originally family houses, these are now converted into apartments, extended out the back, occupied by groups of students, used for home-working.

And then, right in front of our noses, the office tower in which we work has gradually evolved over time, rooms knocked together, studios converted into computer suites (when computers were so special that that they had to have a space of their own) and then back again (when computers and IT became pervasive.) In all three cases these buildings have been flexible enough to accommodate changing lives and lifestyles. Our question from the beginning is what makes one set of buildings head towards obsolescence whilst another set can adjust over time? The germ of an answer may be found in a generalised analysis of those three evolving forms of architecture: the nineteenth century industrial building, the Victorian terrace and the 1960s office. All three are direct in their construction and generic in their spaces; they tolerate change whilst still retaining an identity; they are modest and work in the background rather than asserting a foreground. The book moves out from this generalised summary into a more detailed discussion of what we have termed 'flexible housing'.

What is Flexible Housing?

Our broad definition of flexible housing is housing that can adjust to changing needs and patterns, both social and technological. These changing needs may be personal (say an expanding family), practical (i.e. the onset of old age) or technological (i.e. the updating of old services). The changing patterns might be demographic (say the rise of the single person household), economic (i.e. the rise of the rental market) or environmental (i.e. the need to update housing to respond to climate change). This definition is deliberately broad. It includes the potential to make changes prior to occupation as well as the ability to adjust one's housing over time after occupation. Flexible housing thus works across the life of a housing development. Prior to occupation, a flexible

approach will allow future users a degree of choice as to their layouts. Post occupation it enables people to occupy their homes in a variety of ways, not tied to the specifics of room designations, and allows them to make adaptations to their home. In the longer term, flexible housing allows housing providers to adapt the mix of units, to change internal layouts, and also to upgrade their properties in an economic manner. Flexible housing in our definition is thus a wider category than some of the other terminology applied to housing that can be adapted for changing needs. For example it exceeds the definition of 'Lifetime Homes', the term used to describe dwellings that can be adapted to accommodate users' changing physical needs, in particular as they grow older or lose full mobility.[1] Flexible housing as described in this book is compatible with the tenets of Lifetime Homes, but in terms of both design and construction, goes beyond them.

At its core, therefore, flexible housing is housing that can respond to the volatility of dwelling. It does this by being adaptable or flexible, or both. These two terms are sometimes confused or used to describe the same thing. The clearest distinction between the two is made by Steven Groák, who defines adaptability as 'capable of different social uses' and flexibility as 'capable of different physical arrangements'.[2] Adaptability is achieved through designing rooms or units so that they can be used in a variety of ways, primarily through the way that rooms are organised, the circulation patterns and the designation of rooms. Adaptability thus covers 'polyvalency', the term employed in particular by Dutch architects and theorists to describe spaces that can be used in a variety of ways, generally without making physical changes.[3] Flexibility on the other hand, in Groák's definition, is achieved by altering the physical fabric of the building: by joining together rooms or units, by extending them, or through sliding or folding walls and furniture. Flexibility thus applies to both internal and external changes, and to both temporary changes (through the ability to slide a wall or door) and permanent changes (through moving an internal partition or external wall.) Where adaptability is based around issues of use, flexibility involves issues of form and technique.

In this book the term flexible housing is used to cover issues of both adaptability and flexibility. As will become clear, our sympathies lie with approaches that have a sensibility towards adaptability, and it may have been more sensible to call the book *Adaptable Housing*.[4] However, we felt it important to address head-on both the problems and the potential of the word 'flexible'.

The Rhetoric of Flexibility

The word 'flexible' has very specific connotations for most architects. At face value it suggests almost immediate potential for movement and change. There is a simplistic association of flexibility with progress: something that can move escapes the shackles of tradition, something that can be changed is forever new. To this extent flexibility, read literally, provides a convenient and immediate fix to that common architectural need to be allied to the 'progressive' forces of modernity. It is therefore not surprising that the received history of flexibility in architecture is dominated by a list of seminal, one-off, experiments that play directly with the rhetoric of flexibility: buildings with parts that actually move (Rietveld's Schröder Huis, Le Corbusier's Maisons Loucheur and Chareau's Maison de Verre set the pace in the 1920s) or buildings that signify the potential for change (the Eames House,

1.2 Eames House, Charles and Ray Eames, 1948.

Cedric Price's Interaction Centre and Piano & Rogers' Beaubourg). It is the actuality of these latter buildings, those that provide a literal image of flexibility, that is most telling: once built their parts remained fixed in place.[5] As Alan Colquhoun notes: 'The notion of literal adaptability presents problems when it is translated from the realm of the ideal into that of the real... the Beaubourg scheme demonstrates these problems in a dramatic way.' [6]

The clearest lesson about the image of flexibility can be learnt from the Eames House. The clarity of its aesthetic and its association with the industrialised ethos of the Case Study movement makes us want to believe that with a couple of spanners and screwdrivers one could take it all apart and reconfigure it. The story that the Eames' decided to completely redesign the house once the steel had been delivered to site only reinforces this belief in the physical flexibility of the house, as does the received wisdom that it is made up of a kit of parts.[7] But this is to miss the point. It is not just that a spanner would not be much use in the face of multiple windows welded to the steel frame, but more that this kind of flexibility, driven by technical change, was not the prime motivation behind the house. The clearest intent for aesthetic change was that the coloured ply panels might be repainted, but even these have retained their original colour.[8] Beyond this the Eames' are clear that the house is there to act as a 'host'. [Fig 1.2] As Beatrix Colomina notes: 'the house had to efface itself in favour of the creative choices made by its occupants. Its only role was that of the "shock absorber" that protects a unique and ever-changing lifestyle.' [9] We can thus understand that the Eames House, despite all the visual leads it gives us, is first about social adaptability and not about physical flexibility. In escaping the limits of the rhetoric of flexibility, it suggests another way of approaching flexibility in housing. A shock absorber, there to soak up the dynamics of living. A spatial softness that belies the presumed hardness of its industrialised aesthetic. Soft over hard.

Soft and Hard

It is the natural tendency of a researcher to want to categorise in order to make sense of the mass of information in front of him or her. We were no different. Faced with our collection of over 150 examples of flexible housing, we came up with a simple method of division: soft and hard. In its binary the classification

is quite crude, but it does identify the tensions evident in much flexible housing.[10] 'Soft' refers to tactics which allow a certain indeterminacy, whereas hard refers to elements that more specifically determine the way that the design may be used. In terms of use it may appear a contradiction that flexibility can be achieved through being either very indeterminate in plan form or else very determinate, but historically both approaches have developed in parallel through the course of the twentieth century. Soft use allows the user to adapt the plan according to their needs, the designer effectively working in the background. With hard use, the designer works in the foreground, determining how spaces can be used over time. As we shall see, soft use generally demands more space, even some redundancy, and is based on a relaxed approach to both planning and technology, whereas hard use is generally employed where space is at a premium.

The natural tendency of architects is towards the hard, because it is in the realm of the determinate that one maintains a sense of control. Flexibility here, as Adrian Forty points out, is a means of allowing architects 'the illusion of projecting their control over the building into the future.' Flexibility, in its hard guise, extends the apparent reach of the architect when confronted with the dilemma that their involvement in a building 'ceased at the very moment that occupation began.' [11] Hard use is often allied with the rhetoric of flexibility: sliding doors, moving walls, and fold-down furniture come to the fore as a set of mechanisms that frame the user as an operator of architectural equipment. Soft use, on the other hand, passes control over to the user, allowing them to appropriate the space as they see fit. The architect, if indeed there is one, here plays the role of facilitator rather than determiner or, in Zygmunt Bauman's terms acts as interpreter rather than legislator.[12]

The parallel histories of hard and soft use identify a paradox in the term flexibility. The hard view can be seen as extending the influence of the architect, and thus becomes part of the wider regime of control that modernity is associated with. Flexibility is provided, but on the architect's terms. In the soft view, flexibility dissolves the control of the architect and hands it over to the user. In Forty's similar interpretation, 'on the one hand it (flexibility) has served to extend functionalism and so make it viable, but on the other hand it has been employed to resist functionalism.' [13] Wherever one locates oneself on the soft/hard spectrum, the importance in the design of flexible housing is to be aware of the tension between indeterminate and determinate approaches because it serves as a constant reminder of the tension between the reality and ideals of spatial occupation.

The soft/hard analogy can also be applied to the methods of construction in flexible housing. Hard technologies are those that have been developed specifically to achieve flexibility. As will be seen, the history of flexible housing is full of examples of projects that have been driven by technological systems, often invented from anew. The systems range from those that exploit concepts of modularity to those based around servicing strategies, but the common theme is that the technological solution is the prime motivation and determinant of the housing design. In contrast to such 'hard' strategies, one can identify schemes that have used softer technological tactics. Soft technology is the stuff that enables flexible housing to unfold in a manner not completely controlled by the foreground of construction techniques.

Of course use and technology are not mutually exclusive categories: one finds plenty of projects where hard

technology is both symptom and cause of hard use, and equally plenty of projects in which soft use unfolds in the setting of soft technology. In another context, we have designated the conjunction of soft use and technology as 'SoftSpace'.[14] The spirit of SoftSpace is analogous to the sensibility that Jonathan Raban develops in his book *Soft City*: 'the city goes soft; it awaits the imprint of an identity. For better or worse, it invites you to remake it, to consolidate it into a shape you can live in.'[15] As both designers and theorists, our own approach lies at the softer end of the spectrum. The reason is there in Raban's urban construal: the potential for others to imprint an identity is paramount in any building, but most of all in housing, where there is an ethical imperative to allow the dwellers to live out their own lives and not that of the architect. In this way the word 'flexible' in flexible housing assumes a social and political role that challenges the authority and dominance of the architect's and housing provider's hand.

It is no coincidence, therefore, that two of the three forms of evolving architecture seen out of our Sheffield window, the terraced house and the industrial workshop, probably never had an architect come near them. They are closer to the world of the vernacular, and non-professional, than they are to the world of the professional. This does not imply the renouncing of the role of the architect in the design of housing — one only has to look at the poverty of the majority of developer housing to see the dangers of that — but to call for a redirection of architectural intelligence in the design and making of flexible housing, a move from legislator to interpreter. To design a building with the specific intent for it to be changed in any way is to accept that the building is in the first place in some way incomplete, or even imperfect. This is of course counter to normal architectural values, which privilege completion and perfection. In addition, to admit to social flexibility is to admit time into our buildings, and architects, as Karsten Harries notes, live in the 'terror of time'.[16] It is not surprising, therefore, that architects have concentrated more on the determinist aspects of flexible housing in an assertion of their control over space, time, and the user within it. Against this we advocate an architectural approach to flexible housing that is at the same time more modest and more canny. Only then can one fulfil Raban's vision, in which we have replaced the word 'city' with the word 'home':

> We shall need more daring, more cool, understanding than that we are displaying at present. We live in our homes badly; we have built them in culpable innocence and now fret helplessly in a synthetic wilderness of our own construction. We need — more urgently than architectural utopias, ingenious traffic systems, or ecological programmes — to comprehend the nature of citizenship, to make a serious imaginative assessment of that special relationship between the self and the home, its unique plasticity, its privacy and freedom.[17]

Notes (About the Book)

This book grew out of a research project funded by the Arts and Humanities Research Council. In our pitch for the grant we said that we would combine two research methods from the humanities, historical survey and design research. The structure of the book reflects this intent. Chapter 2, *Episodes in Flexible Housing*, presents a historical overview of flexible housing, mainly using twentieth century examples. It identifies three drivers that influenced the development of flexible housing: the need for mass housing after the first world war, the rise of industrialised methods of construction in particular after the second world war, and finally the interest in the role of the user in housing in the 1960s. Chapter 3, *The Case for Flexible Housing*, presents the arguments for flexible housing. The best argument of all would be if there was empirical evidence that flexible housing 'worked', in the sense that it does indeed allow different living patterns to unfold, and that it is cost effective in the long term. However, research in both these areas, post-occupancy evaluation of flexible housing and its whole life costing, is very limited and was never in the scope of our research project. Chapter 3 therefore argues the case through a number of themes based around the common need to avoid obsolescence.

The second half of the book concentrates on how flexible housing had been achieved in the past and how it might be designed in the future. We make a distinction here between the design of flexible housing in terms of its use (Chapter 5) and the making of flexible housing in terms of its construction and technologies (Chapter 6). The two aspects are brought together in Chapter 7, *A Manual for Flexible Housing*. Rather than attempt to come up with a prescriptive and singular approach to the design of flexible housing, we have based our recommendations on a careful analysis of precedents, attempting to interpret what has and has not worked in the past. Eighty of the more important examples are presented in some depth in Chapter 4, *Case Studies in Flexible Housing*, and the rest in summary in Chapter 8, *Projects of Flexible Housing*. Case studies are referred to throughout the book with the number code thus: 010 and projects thus: 011 The case studies are placed centrally in the book because we think they are central to the argument. Each has specially drawn plan(s) at the scale of 1:200, with the elements that contribute to the project's flexibility picked out in a colour. The plans are the raw evidence from which we initially worked in coming to our interpretation of flexible housing; by presenting them back in an easily comparable manner the intent is that others can re-analyse them and come to their own conclusions about the efficacy of the various approaches to flexible housing.

Chapter 1 Notes

1 Julie Brewerton and David Darton, *Designing Lifetime Homes*, York: Joseph Rowntree Foundation, 1997, Caitriona Carroll, Julie Cowans, and David Darton, eds., *Meeting Part M and Designing Lifetime Homes*, York: Joseph Rowntree Foundation, 1999.

2 Steven Groák, *The Idea of Building: thought and action in the design and production of buildings*, London: E & FN Spon, 1992, p.15.

3 This is the definition given by Herman Herztberger: 'A form is polyvalent... (if) it can be put to different uses without having to undergo changes itself.' Herman Hertzberger, *Lessons for Students in Architecture*, Rotterdam: Uitgeverij 010 Publishers, 1991, p.147. Bernard Leupen gives a good summary of the various definitions of polyvalence, flexibility and adaptability. Bernard Leupen, *Frame and Generic Space: a study into the changeable dwelling proceeding from the permanent*, Rotterdam: 010 Publishers, 2006, p.25. See also H. Priemus, 'Flexible housing: fundamentals and background', *Open House International*, 18, no. 4, 1993 for another categorisation.

4 Another reason we did not call the book *Adaptable Housing* was

so as not to confuse it with Avi Friedman's important book on related themes. Avi Friedman, *The Adaptable House: Designing Homes for Change*, New York: McGraw-Hill, 2002.

5 The Pompidou Centre has of course had some internal changes made to it, but the overall framework with its aesthetic of change has recently been faithfully restored back to its original state.

6 Alan Colquhoun, 'Plateau Beaubourg', in *Essays in Architectural Criticism*, Cambridge, Mass: MIT Press, 1981, p.116. Our emphasis.

7 See James Steele, *Eames House*, London: Phaidon, 1994, p.10. But in reality the much vaunted kit of parts is little more than standard steel sections cut to specific size, and in this is not much different from any steel framed building. The only difference is that the Eames' so insistently chose to express those sections. A more intentionally flexible house is the unrealised Kwikset House of 1951, which used prefabricated elements under a large roof structure, with rooms divided by large storage units, the placement of which would be decided by each owner. John Neuhart, Marilyn Neuhart, and Ray Eames, *Eames Design*, London: Thames and Hudson, 1989, p.155.

8 As explained in Beatrix Colomina, 'Reflections on the Eames House', in *The Work of Charles and Ray Eames*, ed. by Murphy, D., New York: Abrams, 1997, p.132.

9 Ibid. The term 'shock-absorber' is from Eames, as quoted in Colomina: 'The house must make no insistent demands for itself, rather aid as background for life in work. This house... acts as re-orientator and 'shock-absorber.'

10 Our website, www.flexiblehousing.org, has these 150 projects divided into hard use, soft use, hard form, soft form – form here referring to the way that the housing is constructed. Whilst the boundaries are more blurred than this basic classification system, it does give a starting point for the understanding of the primary means of each project.

11 Adrian Forty, *Words and Buildings: a Vocabulary of Modern Architecture*, London: Thames & Hudson, 2000, p.143.

12 Zygmunt Bauman, *Legislators and Interpreters: on modernity, post-modernity, and intellectuals*, Ithaca: Cornell University Press, 1987.

13 Forty, *Words and Buildings: a Vocabulary of Modern Architecture*, p.148.

14 This was in an MArch design studio at the School of Architecture, University of Sheffield, 2005-6. In our studio we described SoftSpace in the following terms, many of which could apply to our approach to flexible housing: 'SoftSpace is in time • SoftSpace is adaptable to changing use, climate and technologies • SoftSpace is designed but probably not overdesigned • SoftSpace allows choice • SoftSpace is not predicated on order but is not necessarily chaotic • SoftSpace accommodates the flows of contemporary life • SoftSpace is more background than foreground • SoftSpace asks who the designer is • SoftSpace may be blobby but could equally be straight.'

15 Jonathan Raban, *Soft City*, London: Hamilton, 1974, p.12.

16 Karsten Harries, 'Building and the Terror of Time', *Perspecta*, 19, 1982, p.65.

17 Raban, *Soft City*, p.3.

2

EPISODES IN

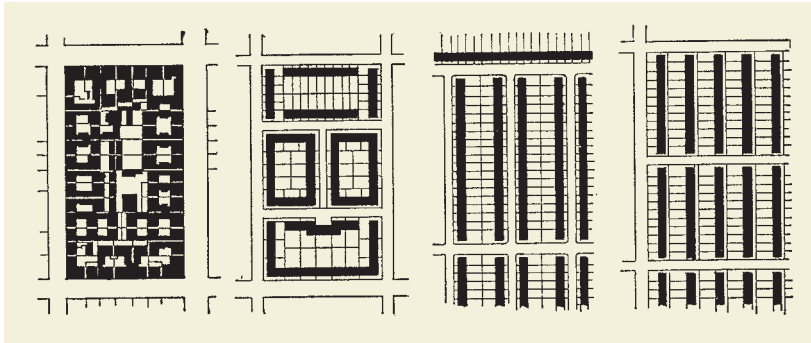
FLEXIBLE HOUSING

EPISODES IN FLEXIBLE HOUSING

It is probably not possible to write a history of flexible housing, if by history one accepts the traditional notion of a developmental sequence of cause and effect. One cannot trace a linear route through flexible housing, with one exemplar apparently informing the next in a determinist way. [1] Instead, flexible housing may be seen to have developed in two ways. The first is as a result of the evolving conditions of the vernacular. The second is as a result of external pressures that have prompted housing designers and providers to develop alternative design solutions, including flexible housing. If the former is the response of the non-architect, deriving solutions through long-term adjustments to patterns of use and cultural formations, the latter is the response of the architect, deriving solutions through the authority of expertise. The story of the former is mainly untold in the 'official' architectural histories and so one relies on a few scholars such as Paul Oliver and his magisterial *Encyclopaedia of Vernacular Architecture* and book on the vernacular house, *Dwellings*. Oliver notes that 'with the growth of families, whether nuclear or extended, the care of young children and the infirm, and the death of the aged, the demands on the dwelling to meet a changing family size and structure are considerable.' [2] In vernacular housing the range of responses to these issues is then oriented by culture and climate, ranging from a single space used for the whole gamut of family rituals to a collection of individual cells arranged around a courtyard. The system of individual huts arranged around an open space is extremely flexible, because the use of the hut can be varied according to circumstances: 'each unit (hut) is in effect a room, and the whole compound constitutes the dwelling.' [3] (Fig 2.1) In a way this arrangement of the vernacular compound is the precursor to the type of modern apartment plan in which a central hall gives on to a number of undifferentiated rooms that can be adopted for various purposes. One might also read the single room arrangement found in cultures across the world as the prototype of the open plan flexible space of modernism, the former being physically divided through curtains, changes of level and lightweight screens (and socially divided through significant symbolic and cultural understanding), the latter through more technologically advanced systems.

2.1 Dogon House Compound, Mali.

Finally, the relaxed way in which so much vernacular architecture can accept additions is an inspiration to a contemporary soft architecture that is explicitly planned with a view to being extended. Embedded in the vernacular is a series of profound insights into the way that buildings may be open to adaptation and flexible usage, as opposed to the fixity of so much architect-designed housing in which the response to changing family sizes in contemporary western cultures is to sell up and move on, but this is the 'least immediately



2.2 Housing Typologies: 4 Stages in German Block Planning. From *Das Neue Frankfurt, 1928* showing a typological approach to site planning that can equally be extended to house plans.

responsive and most expensive option.'[4] A book such as *Dwellings* thus has as much to tell us as the modernist canon of flexible housing. 001 004

Where vernacular building typologies generally embody means that are in balance, readily available, appropriate to the local economy, open and therefore adaptable, most modern housing developments are focused on the repetition of units that would suit the average dweller or shaped by a determinist and technocratic funding regime. Where the vernacular building could interact successfully with the changing needs of those who lived in these spaces, the modern house typically cannot cope with any specific circumstances; it is inaccessible and ultimately alienating to the user. Whilst it is tempting to stay with the vernacular, the rest of this chapter will explore that more 'official' version of flexible housing in which architects have attempted to design housing that is responsive to change. It concentrates on the twentieth century and architect-led proposals in a reflection of the way that in the twentieth century housing became a focus of so much architectural attention; flexibility became one of the specialised solutions deployed by architects which lifted housing out of the realm of the everyday and into the sphere of the expert. Flexible housing has been in and out of focus over the course of the twentieth century: at times it has been at the forefront of the discussions about housing and at other times relegated to a backwater for aficionados. The difficulty in proposing a 'history' of flexible housing is symptomatic of the history of housing as a whole. Of all building types it is housing — and in particular public housing — that is most exposed to outside influences. Politics, economics, social demographics, technologies — all these and many more influence the design of housing more than architects usually acknowledge. Housing is too often taken by architects and historians away from the contingent forces that shape it, and shunted into an autonomous cul-de-sac, there to be ordered into typologies or described as part of an architectural value system of aesthetics or technique. (Fig 2.2) Whilst housing may be easier for the architect to 'control' when it is in this cul-de-sac, the reality is somewhat different. To engage with the history of housing, one has to eschew any autonomy and instead fully acknowledge the range of external forces that affect

2.3 Hufeisensiedlung, Berlin, Bruno Taut, 1925 onwards. Aerial view of development with over 1000 dwellings, typical of the period in providing mass housing in the face of acute housing shortages. 010

the production of housing. This chapter identifies those episodes when flexible housing has come to the fore and in particular identifies the wider influences that led designers or architects to look to flexible housing as a solution. Three key drivers influenced the development of flexible housing. The first, in the 1920s, arose out of the need for European social housing programmes to provide mass housing. The resultant downwards shift in space standards, as well as new methods of construction, prompted architects to develop designs that allowed flexible usage so that users were not constrained by the new minimum standards. The second driver, starting in the 1930s and 1940s and continuing to the present day, arose out of a belief that prefabrication and emerging technologies could and should provide solutions to mass housing provision. It was thought that flexibility would be inherent in industrially prefabricated and systematised buildings and their components. Thirdly, the move towards participation and user involvement in the 1960s and 1970s led to a renewed interest in flexible housing as a means of providing user choice. What is apparent in all these episodes is that flexible housing is most successful as a response to real and pressing needs. It is much less successful, or even counterproductive, when it is treated as a self-contained credo, employed by architects as an end in itself as opposed to a means to an end.

Episode 1: Modernity and The Minimal Dwelling

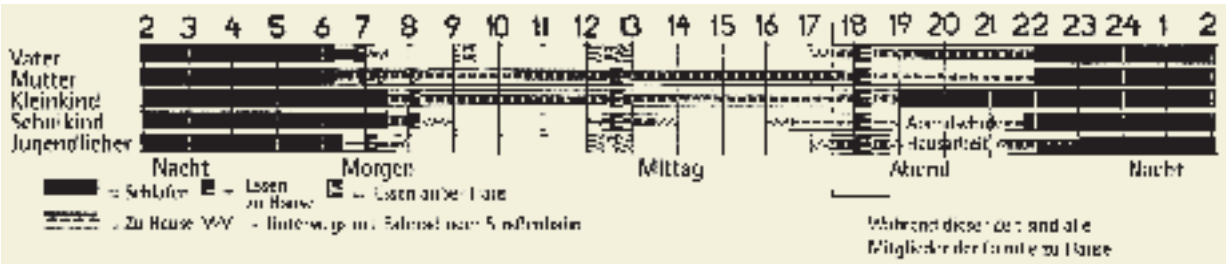
Following the First World War, European nations were faced with an unprecedented demand for urban housing, particularly for the working classes.[5] (Fig 2.3) Previous

2.4 Book cover for *Die Wohnung für das Existenzminimum*.

2.5 Use Cycle studies, Heinrich Leppla, early 1930s.

models of urban housing, based either on the bourgeois apartment block or the standard terraced house, simply did not meet needs in terms of economics, density or the required scale of provision. In order to provide sufficient numbers of dwellings at minimal cost, space standards were dramatically reduced and became the subject of legislation, and thus designers' attention, in most European countries. The second CIAM congress of international architects held in Frankfurt in 1929, entitled *Die Wohnung für das Existenzminimum* (literally translated as The Subsistence Dwelling) was a forum for debate as to the best solutions for the new reduced space standards. (Fig 2.4) One response was to introduce the notion of flexibility. If there was to be less space, then that space needed to be used in as efficient and flexible a manner as possible. This led to architects developing new plan types for housing, many of which had elements of flexibility. Whilst in Germany this generally resulted in the standardisation of the size, division and furniture of dwellings, architects and planners in the Netherlands tended to look at the processes of use.[6] The attention of Dutch architects such as Willem van Tijen, Johannes Van den Broek and Mart Stam turned to the changeability of use, not only during the course of one day but also for the specific conditions of each member of a family and potential changes during their lifetime.

Internal variability of dwellings was a key element in this work — driven by the desire to make minimum sized apartments as tolerable and cheap as possible. Van Tijen's competition entry for cheap workers' housing is composed of a frame structure with no load bearing walls, which allows the adaptation of the dwelling to changing circumstances. Van den Broek collaborated with the German émigré Heinrich Leppla on studies



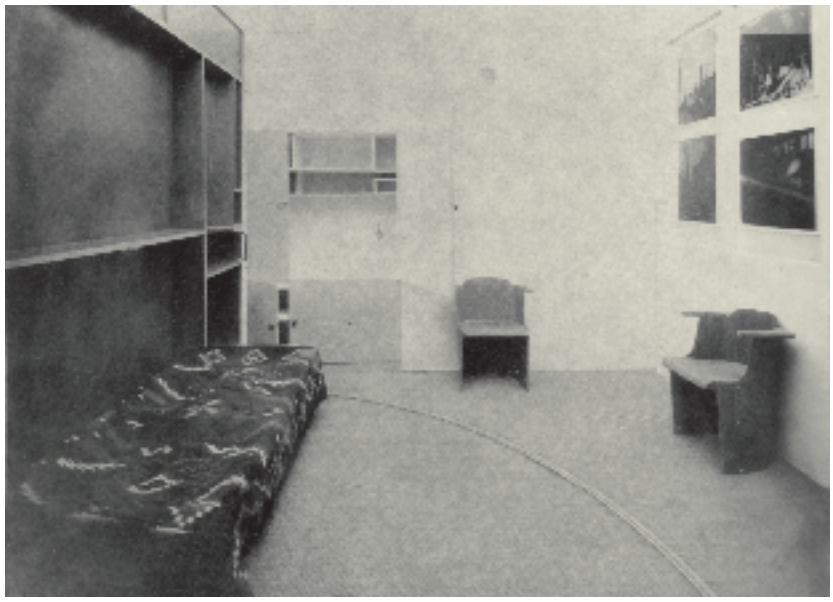
2.6 Daily Activities of Family Members, Mart Stam, 1936.

of use cycles. A series of their drawings show the permanent part of a dwelling and how an apartment could be used variously by a young couple, an average family with 2 to 3 children and an extended family with 4 to 5 children. (Fig 2.5) The analysis of the social element was then overlaid with a temporal study (both day / night and now / future). [7] Similar drawings were produced by Mart Stam, who looked at the daily cycles of a family consisting of a father, mother, a toddler, a young child and a teenager over the course of 24 hours. (Fig 2.6) These drawings look at domestic activities such as sleeping, relaxing at home and eating at home, as well as external activities such as travelling to the home and working. Because some rooms were hardly used for large stretches of a day, Stam deduced that these spaces could be dedicated to different uses during that time. The floor plan should be, he argued, 'no longer fixed and immobile, but... designed in a way that the dwelling can be regrouped and arranged according to the needs of the respective hour of the day'. [8]

As well as these empirical responses to an immediate need, flexibility became one of many tools in architecture's alliance with the forces of modernity, signalling a progressive challenge to established values. If one accepts Le Corbusier's astounding argument that minimum standards in housing are in some way 'an appeal to scientific certainty to overcome customs of tradition', [9] then flexibility becomes an essential lever in that positivist mission, allowing architects to reinvent traditional living patterns. As Alan Colquhoun argues:

> The philosophy behind the notion of flexibility is that the requirements of modern life are so complex and changeable that any attempt on the part of the designer to anticipate them results in a building which is unsuited to its function and represents, as it were, a 'false consciousness' of the society in which he operates. [10]

It is no surprise therefore to find one of the first explicit references to flexibility in housing coming from one the harbingers of modernism, Bruno Taut. He writes in 1920: 'Versatile is the house: just like men, flexible yet solid.' [11] Variable and flexible plan forms, for architects and clients alike, signified the true beginning of modernism, driven both by necessity and also by a strong belief in the liberation these plan forms would bring to their users. The building as well as the individual residential unit was approached as something that could and would change over time. In a challenge to the stability of tradition, flexibility responds to the flux and dynamism of modernity as El Lissitzky makes clear when he writes: 'convertible spaces have to be created that allow multiple



2.7 Demonstration Room, El Lissitzky, 1930. Model of a demonstration room exhibited in the Soviet Pavilion at the International Hygiene Exhibition, Dresden.

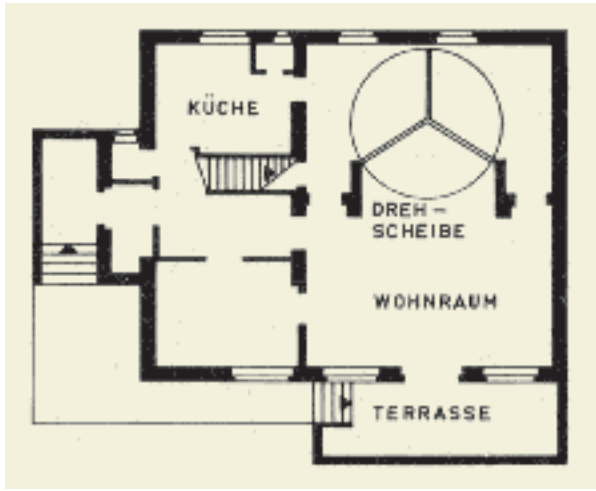
ways of use and movement. [...] Every form is the frozen momentary image of a process. Therefore the building is a moment of becoming and not a solidified end.' [12] These are heady words, challenging architects to completely revise notions of their art as the representation of stable, timeless, forms and instead to see buildings as flexible as the times they are placed within. (Fig 2.7) It is a theme developed by the group that developed around Ernst May and the magazine *Das Neue Frankfurt*, founded in 1926. It was May who hosted the 1929 CIAM Frankfurt conference on *Existenzminimum*, in a city whose housing programme was unrivalled anywhere in Germany. [13] 019 A deliberate aim of the work done by May and his colleagues in Frankfurt was to 'ensure that the housing needs of the poor and the underprivileged were alleviated, as one aspect of the increasing emancipation of all individuals.' [14] As Hilde Heynen notes this architectural programme was clearly linked to an interpretation of the dynamic spirit of the new epoch, a connection made explicit by Marcel Breuer who writes in *Das Neue Frankfurt*:

> Because the outside world of today affects us in the most intense and disparate ways, our way of life is changing more rapidly than in previous times. It goes without saying that our surroundings will undergo corresponding changes. This leads us to layouts, spaces, and buildings of which every part can be altered, which are flexible, and which can be combined in different fashions. [15]

In thus aligning flexibility to wider cultural forces, flexible housing becomes as much a social and, in the modernist's minds, moral imperative as it does a pragmatic response to the intense demands of the housing crisis. Deployment of flexibility in what was to become known as the minimal dwelling take two routes. First, the notion that flexibility could be achieved through the provision of rooms that were indeterminate in use. 010 Rather than prescribing certain uses to specific rooms as happened in the bourgeois dwelling, these plans allowed the user to decide how their home was to be occupied. The second method of achieving

flexibility within the modernist minimal dwelling is, however, much more architect-determined. Here the word flexible is taken at face value, with architectural elements folding and unfolding in response to differing needs within the same space. It is this approach that accords with Breuer's call for buildings 'of which every part can be altered'. Foldable furniture, initially designed for sleeping cabins on trains and on ships, was incorporated in the dwelling in an example of technology transfer typical of the period. Different functions were superimposed, and what was a living room during the day would become — through mechanical changeability — a bedroom at night. From 1928, Le Corbusier produced a series of designs based on day/night scenarios, notably Maisons Loucheur and, in 1931, Carl Fieger showed a similar concept for a small apartment at the building exhibition in Berlin. 016 018 Both proposals demonstrate, through the use of sliding walls and movable furniture, the capability of an apartment to offer plenty of space despite restrictions in actual size.[16] Corbusier, in typically polemical style, even argues that the purchaser is only paying for 46m² of space but through the cleverness of the design is actually getting 71m² of effective space.

Whilst Bruno Taut suggests that such mechanisms could be applied to mass-housing ('The apartment is always... a "box" with a single living space... partition walls moveable so that the interior can easily adapt to every wish')[17] the reality was that the vast majority of experiments into moving walls, folding furniture and mechanical changeability were for the one-off house. Thus Erich Mendelsohn's extraordinary *Drehbühne*, or changing stage, a rotating and compartmented device that transforms the living room into three different sets may be just about suitable for its proposed use in a 1923



2.8 Four single-detached houses in Berlin-Zehlendorf, Richard Neutra + Erich Mendelsohn, 1923. Attached to the living room of two of the four houses was a 'Drehbühne' or revolving stage. This was done in an attempt to vary the function of a room by rotating-in a set dining room table, a piano or an additional seating area.

Berlin villa but it is difficult to see its principles being carried over into mass housing. (Fig 2.8) The problem lies in the specificity of the solution, with the modernist architect determining or, rather, over-determining the way spaces are used. This is true of probably the most famous 'flexible' house of all, the Schröder Huis in Utrecht, 009 designed by the Dutch architect Gerrit Rietveld in close collaboration with the client, Truus Schröder.[18]

This house is an intense response to the extremely specific needs of the client. The complex sliding walls and folding screens have been fetishised by architects ever since, largely ignoring the fact that they become largely redundant without the original client and her intimate knowledge of how to use the building through its daily cycles. The Schröder Huis has probably done

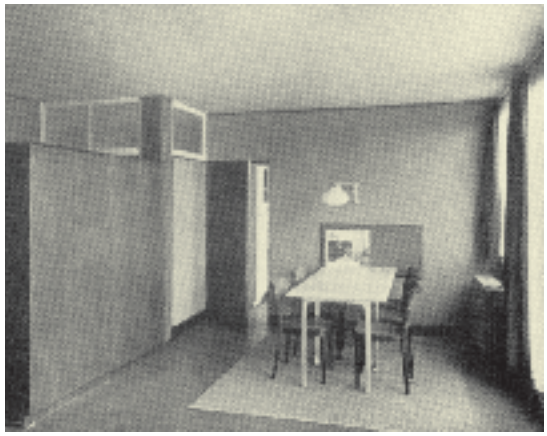
more than any other building to promote the myth of flexibility to architects fascinated by the mechanism of objects over and above their social relevance or practicality. It is an extremely rarefied version of flexibility as noted by one critic at the time who doubted that, 'this extreme flexibility and changeability will seem convenient in the long run.' However, this same critic then went on to say that this 'does not alter the fact... that a certain amount of changeability of arrangement, especially for the small house, can be very desirable'. [19] In a later scheme, the Erasmuslan Block, Rietveld did indeed back off the extremes of flexibility and introduce a dramatically simpler version based on a fixed core and open plan space divided by sliding screens. 017

Rietveld, Taut and Mendelsohn were typical of architects who took an interest in flexibility as a response to the new demands of housing provision. Most famously, Ludwig Mies van der Rohe argued that buildings should last longer than the function for which they were initially designed. He saw 'flexibility as one of the most important concepts of architecture, and frame construction as the most appropriate form of construction to balance the fixed need for efficient forms of construction with the changing needs of its occupants'. [20] This approach to indeterminate open space was facilitated by the new constructional systems available to the early modernist architects, allowing larger span structures and light infill partitions. In a statement remarkably prescient of future approaches to flexibility, Mies writes:

> For the present, I only build the perimeter walls and 2 columns within, which support the ceiling. Everything else ought to be as free as possible. Were I to succeed in producing cheaper plywood walls, I would only design the kitchen and bathroom as fixed rooms, and the remaining space as variable unit, so that I would be able to subdivide these spaces according to the needs of the occupant. This would also have advantages insofar as it would provide the possibility to change the layout of a unit according to changes within a family, without large modification costs. Any joiner or any down-to-earth laymen would be in the position to shift walls. [21]

In his design for the apartment block at the Weißenhofsiedlung in Stuttgart, the structural frame of the building and system of one metre wide ply panels as internal partitions gave the potential 'to rearrange partitions to comply with different living situations.' [22] 014 This inherent potential was demonstrated by calling in 29 architects and designers who finalised the interior arrangements, as well as the furnishing, of his apartments. (Figs 2.9, 2.10, 2.11) Catherine Bauer, the American scholar who studied European housing in order to better inform the development of American housing, writes in her seminal book *Modern Housing* with a sense of wonder: 'there are even apartments that can be rearranged with comparatively little trouble and expense.' [23] The building was perfectly capable of accommodating not only different living situations but other functions as well: for a short period of time after the end of World War II, it served as the city's children's hospital.

What one finds in this first outburst of interest in flexibility in the 1920s and early 1930s is a tension between the realities of flexibility and the rhetoric of flexibility, a tension that remains with us today. On the one hand a pragmatist response to the necessities of the minimal dwelling, and on the other a more polemical stance that allies flexibility with new modes of living and mechanised technology, both of which are seen

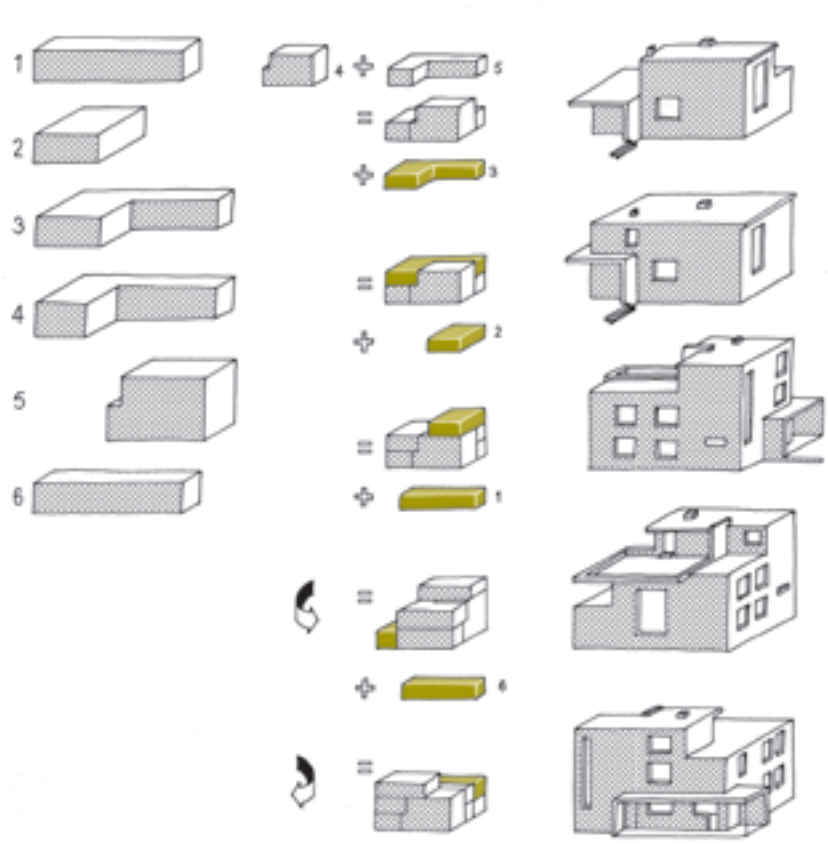

2.9, 2.10, 2.11 Weißenhofsiedlung, Stuttgart, 1927. Interiors by two different architects: Schweizer Werkbundkollektiv [Fig 2.9 and 2.10] and Mies van der Rohe [Fig 2.11] 014

as progressive traits of modernity. It is this latter, ideological, mode of flexibility that is championed in the standard architectural histories. However, using the word is not the same as using the principle. In these early modernist experiments, as in many since, the word 'flexibility' sometimes stands for more than it can deliver. What one also finds in these projects is the tension between flexibility as the imposition of architectural control, and flexibility as the loosening of the architect's grip. In the end the positivist inclinations of early modernism tend to favour the harder, more determinist, approaches to flexibility, a tendency continued in the second episode.

Episode 2: The Industrialisation of Housing

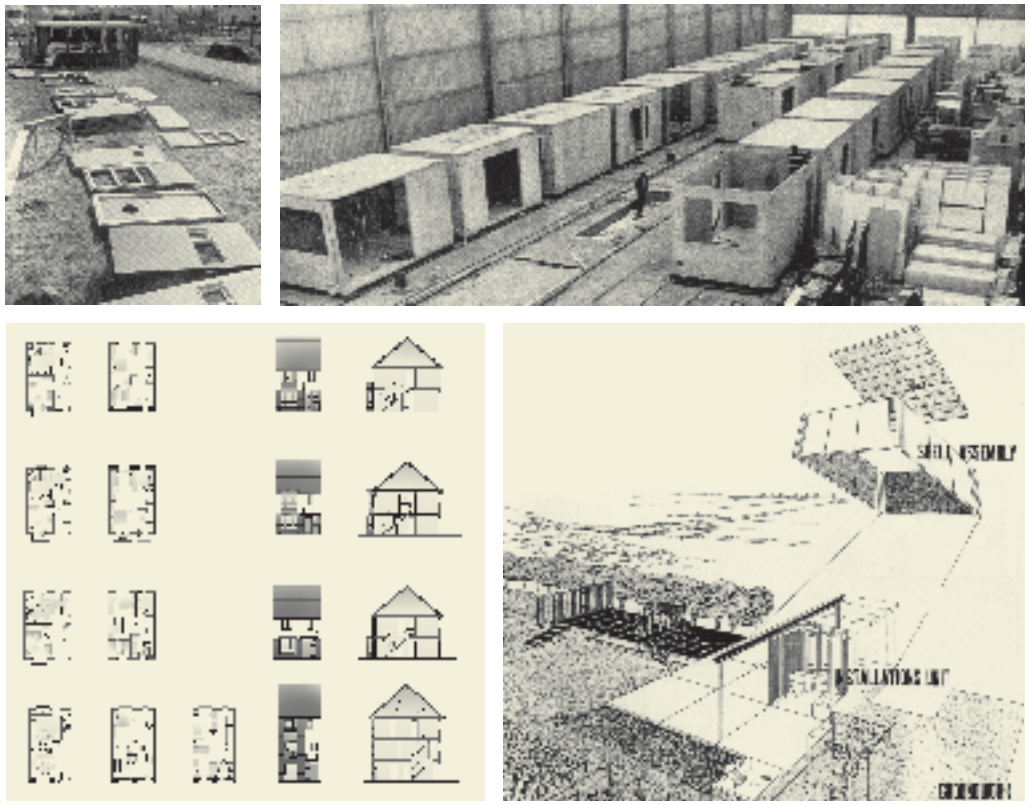
If the first episode in flexible housing was motivated by social and economic forces, the second is driven by technical influences, and in particular the adoption of industrialised solutions to housing provision. Whilst industrialisation was to have a profound effect on nineteenth century life, its employment in the provision of mainstream housing was largely delayed until the beginning of the twentieth century. [24] However, expanding technical capacity together with a rising demand for housing led to increased interest in standardisation in housing production at the start of the twentieth century. Faced with the housing crisis after the First World War architects began to develop designs for residential dwellings that could be mass-produced by means of industrial prefabrication. From 1914, Le Corbusier, one of the most fervent advocates of factory production, developed projects that could potentially be produced on an assembly line: Maison Dom-ino (1914), Maison Voisin (1920), Maison Citrohan (1922) and later Maisons Loucheur (1928) all reflect this belief. In the famous chapter on mass-produced housing in *Towards A New Architecture,* he claims that mass-production not only leads to lower costs but also 'the lightly constructed walls and partitions can be rearranged at any time and the plan altered at will.' [25] The mass-production of these houses is tied into an argument that they would be inherently flexible, in particular the Dom-ino and Loucheur examples.

However, the fundamental motivation behind the concept of standardisation in housing production, as Gilbert Herbert notes, was not only the challenge of finding a technical means of solving the housing crisis but also 'the creative and intellectual challenge inherent in the



2.12 Haus Auerbach, Walter Gropius + Adolph Meyer, 1924. Diagram of components. 008

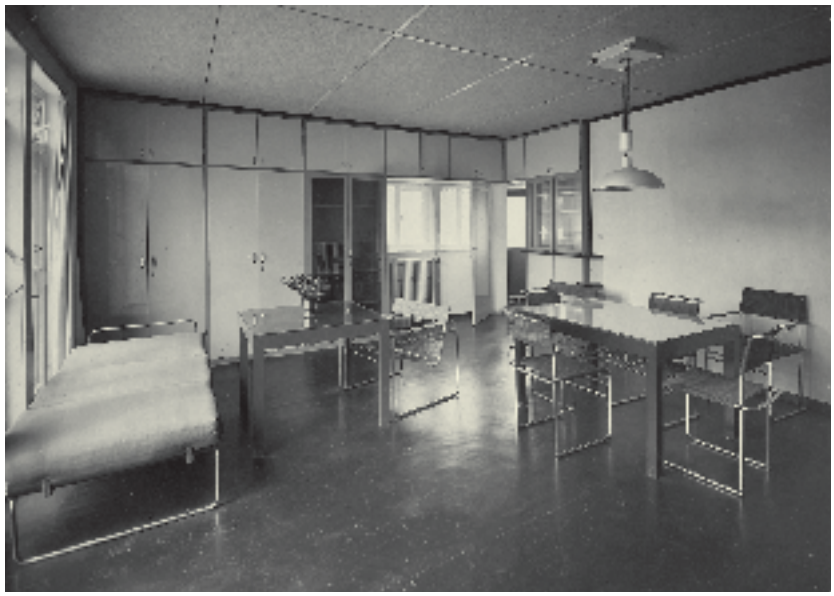
design itself.' [26] Modularity and standardisation, in the form of a series of hierarchically organised components with each component clearly defined as an element, provided a framework to achieve formal clarity and order. This technical clarity, in the case of Walter Gropius and other modernists, elided with a deep social commitment to betterment through good design: standardisation in production did not imply inflexible standardisation in housing type; quite the opposite. Prefabrication and the presumed economies of the industrialised process would, it was argued, lead to wider choices being provided to the future user. For Gropius, the standardisation of individual building components was an opportunity to provide the greatest possible variability in the floor plan.[27] In a remarkable memorandum written for the AEG electrical company in 1910 (note the date), Gropius makes the case for the mass-production of housing, an argument based on both the efficiencies of repetition in manufacture and also on the way that the choice of components will allow the client to 'compose his house according to his personal taste.' [28] Interested in the automobile as an example of the construction industry's potential, Gropius saw the house as a set of components rather than a complete product. [29] (Fig 2.12) 008 Where Henry Ford was later to use the factory line to produce a one-size-fits-all car, Gropius presciently sees the process as potentially allowing multiple options for the future client. But this inherent flexibility that Gropius



2.13–2.16 The use of industrialised approaches in housing. Top left: Werfthaus, Otto Bartning, 1932 [Fig 2.13] 021 Top right: Sigma System, Maurice Silvy, 1969 [Fig 2.15] 056 Bottom left: Oakridge, Basingstoke, HTA, 2006 [Fig 2.16] 161 Bottom right: Prefabrication, Walter F. Bogner, 1942 [Fig 2.14] 032

identified in the industrialised process did not stop at the point of providing user choice in the initial design. The use of standardised components would also allow adaptation over time, with the possibility of elements being replaced or added to with the minimum of fuss. Herbert notes that Gropius argued convincingly for the 'growing and shrinking house' by also highlighting 'other facets of dwelling flexibility, such as mobility in the face of changing site and programmatic demands'.[30]

Mostly, however, the standardisation of housing was initiated within a technological context based on the 'Henry Ford syndrome', which asks 'Why can't we mass-produce houses... in the same way Ford mass-produced cars?'[31] This Henry Ford question is one that has been consistently posited in the quest for the industrialisation of the house building industry, typically initiated by industrialists or implemented by governments in the face of particular political or social demands. These episodes start in the mid 1920s and the early 1930s (for example in Germany), continue in the early and mid 1940s (in the USA), then rise again in the 1960s and early 1970s (in France, the Netherlands and Germany), and finally have come to the fore again in the recent focus in the UK on Modern Methods of Construction. [Figs 2.13, 2.14, 2.15, 2.16] In all of these, industrialised methods of production are associated to a greater or lesser extent with the notion of prefabrication, and the argument



2.17 Weißenhofsiedlung, Stuttgart, Walter Gropius, 1927. Interior of Haus 16 with furniture by Marcel Breuer. 013

about greater efficiency is often extended to an argument that the designs thus achieved will result in the provision of more flexible and adaptable housing.

The relationship of flexibility with many prefabricated systems is based on the principle of components that can potentially be arranged in an infinite number of ways. For the designer of flexible housing, this has obvious advantages at the planning stage. As we have seen with Gropius' 1910 memorandum on mass-production, the ability to customise the dwelling is an important aspect of prefabrication — something that Gropius demonstrated in the design of a detached house for the Weißenhofsiedlung, 013 which introduced some of the key elements of the future prefabricated house. (Fig 2.17)

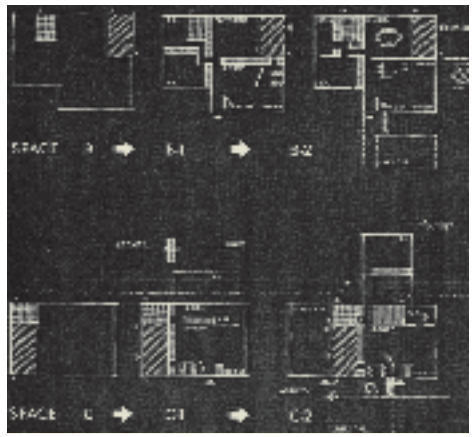
The intent of this single prototype was twofold. First to show the efficiencies of the factory based construction in terms of minimising site time and better build quality, and secondly to show how standard elements enabled variation and thereby could respond to differing customers' demands or economic means. These interests are developed by others in the first boom of standardised housing that was driven by the acute housing crisis of the 1920s and which became the subject of a number of building exhibitions and competitions. The competition *Das Wachsende Haus* (The Growing House) in 1931, for instance, called for the use of industrialised methods of construction both to reduce built costs through quick assembly, but also to guarantee extendibility of the housing in the future through the use of standardised components.[32] The sheer number of entrants (1079) is an indication of the prevailing interest in the alliance of technical and social solutions, both informed by the modernist belief in the efficiency of systems. Following the same idea, Otto Bartning's Werfthaus of 1932 utilised factory prefabrication and efficient on-site assembly. (Fig 2.13) The structure of the building, based around a core house of 25m² but expandable to up to 60m², is structured on a thin steel frame and filled in with

standardised panels. Completely prefabricated at a shipyard before being transported to the building site, its individual parts are bolted together, which also allows for quick dis-assembly and re-assembly at another site, or else for adaptation on the same site.[33]

The excess capacity of the defence industry towards the end of the Second World War provided the basis for the second surge in the development of prefabrication and standardised systems of production. Governments on both sides of the Atlantic sponsored large-scale house programmes to fill the spare industrial capacity. Architectural magazines, such as the North American journal *Architectural Forum*, started to address this situation by dedicating a 1942 issue to 'The New House 194X'. The editorial explains the background to the projects:

> The war has given a tremendous impetus to mass-produced housing. Entire towns have been built as a single construction operation, employing the most efficient field fabrication techniques. The home building industry is acquiring a vast reservoir of experience in advanced methods of construction which will have an enormous effect on postwar production. [34]

However, as in the 1920s, this programme of industrialised house production was not just driven by technical and economic imperatives. The potential of customisation through prefabrication is one of the key elements in some of the schemes put forward to the 'The New House 194X'. 030 One of the entries is described as 'built with only one permanent interior partition, containing the necessary plumbing. All other partitions could be movable, to take care of changes in family requirements'. [35] William Wurster's submission applies



2.18 Flexible Space, Skidmore Owings Merrill, 1942.

prefabrication to elements such as the kitchen, bathroom and other elements of furniture. 029

> There should be no boxlike permanent rooms on this living floor — just space. Initially, this space would be divided only by a completely prefabricated kitchen bay, bathroom and closets. Later on, with children, it would be further divided into smaller separated areas or rooms through the addition of closet units. [36]

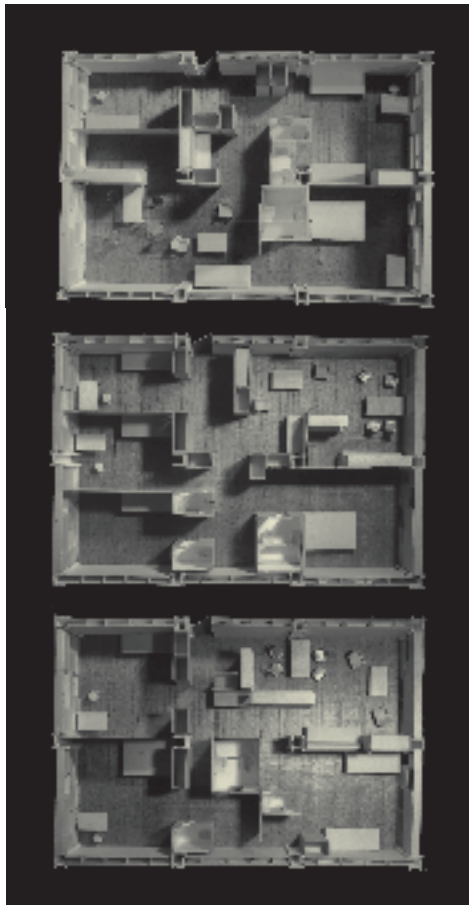
What these schemes exploit is the potential for prefabrication to deal with both the customisation of the initial house to the client's immediate desires, as well as their changing needs in the future. The politically initiated mission to employ excess industrial capacity quickly became, in the hands of the architects, one concerned with design and progressive change, joining the potential of the new prefabricated technologies with a wider view about the flexible use of space in housing. Describing the set of principles developed for *Architectural Forum*, the architects Skidmore, Owings and Merrill wrote about their project:

> How may space be enclosed? Expansive rectangular form, completely spanned, has inherent flexibility and

> structural simplicity... The basic unit can be thought of as Vocabulary, their considered relation to each other as Grammar and the final expression in space as Composition... The plans have been developed with progressive change in mind. Utilities should be replaced when obsolete, not necessarily as a complete room. Families may increase or shrink. Flexible space provides one answer. [37] (Fig 2.18)

However, this excess of architectural intent did not lead to many built examples of housing which was inherently flexible *both* at point of design and over the long term. Colin Davies, in his book *The Prefabricated Home*, traces two histories of prefabrication in housing.[38] The first is the architectural, motivated by the impulses of the twentieth century moderns and is told through the examples of the 'greats' — Le Corbusier, Gropius, Jean Prouvé and Buckminster Fuller. He argues that this history is louder than its actual products deserve — in the main they are limited to one-off experiments or unbuilt schemes. The second history is the non-architectural legacy, largely untold, but much more influential in terms of numbers of homes built. In the 1940s, the non-architectural history centres on the United States, where industrial companies quietly contributed 12% of the total housing production. Here, and in the 'non-architectural' examples ever since, the emphasis is on using industrialised methods of production to provide both economies of scale but also consumer choice at point of sale. Clients are presented with a wide range of options, in some cases apparently unlimited, in the form of standard pattern books or computer software. But this upfront flexibility is usually at the expense of adaptability or flexibility over the long-term. The ability to manufacture to order ever-larger prefabricated parts and, later, entirely prefabricated and factory assembled houses, seemingly provided the consumer with a huge range of short-term options, but actually limited any future change. Flexibility, in the long-term sense proposed by Walter Gropius, was no longer an inherent principle of prefabrication; whole house types could be produced but these were not necessarily broken down into, let alone expressed as, component parts that could be easily added to or replaced.

Recent developments in the use of standardised methods of production for housing appear to be repeating these mistakes. For example when the UK government commissioned a report in 1995 into how the manifestly outdated modus operandi of the UK construction industry could be brought into the twenty-first century, one of the principal themes was a turn to standardised systems of production.[39] Much has been made of the fact that the chairman of the panel that produced the report, Sir John Egan, was once Chairman of Jaguar Cars. In an echo of the early twentieth century appeals to Henry Ford, Egan promoted the 'just-in-time' and standardised techniques of the Japanese car industry as exemplars for the construction and house-building industry. Following the Egan report, prefabrication once more became the buzzword in construction. lol However, this technically determined agenda again concentrates on the immediate issues of 'efficient' construction and customer demand at the expense of longer-term issues of flexibility. Thus, Bovis Homes are cited as exemplars for the house-building sector because they have 'standardised their product by using standard plan-forms built from bulk-purchased parts... The standard house types are regularly re-engineered by the product development team in response to feedback from the sales and marketing team, and customers.'[40] The short-term



2.19 Les Marelles, Kohn and Maurios, 1975. Models showing different layouts. 072

demands of the market in terms of providing immediate client satisfaction overrides any consideration of how the customer might use their 'product' over the longer term. Here, along with some of the other examples from the twentieth century, is a clear warning that technique alone does not lead to inherent flexibility; it must be allied to a consideration of the actual use of the housing, as is demonstrated in the third episode in flexible housing, that of participation and user choice.

Episode 3: Participation and User Choice

In 1961, the Dutch Architect John Habraken published *De Dragers en de Mensen. Het einde van de massa Woningbouw*, translated ten years later into English as *Supports: an alternative to mass housing.* Over the years, this book has become a seminal text for those associated with flexible housing, in particular developing a particular emphasis on the technical approach that the book suggests (but by no means fully develops). The basic principle (which is more fully described on p.167) is one of separating out the elements of construction. Habraken argues that the 'support' or base building should be clearly defined from 'infill' or interior fit-out in residential construction and design. A support structure, he argues, was a form of construction that allowed the provision of dwellings that could be built, altered and taken down independently of each other. [41] What was original in Habraken's interpretation of a building was that the system of support / infill was not simply a technical solution but a means to an end, namely the empowerment of the user in the design and inhabitation of their dwelling. The 'radical conclusion' of this approach 'must be that the return of consultation and involvement on the part of the users, in the most literal sense, must be accepted'. [42]

2.20 Housing, Mazzorbo, Giancarlo de Carlo, 1979-86.

Habraken thus heralds a move towards user involvement in the design and later adaptation of their housing — aspects that he argues are overlooked in standard mass housing, which tends to treat dwellers as standard consumers. He was not alone in making the case for the empowerment of users through their active involvement in the planning, and sometimes building, of their own homes. In the late 1960s flexibility became an issue pursued by architects as well as sociologists who believed that every occupant should have the right of choice in terms of location and orientation, as well as a choice of personalisation with regard to the layout of a dwelling unit. (Fig 2.19) In his seminal 1969 lecture, *Architecture's People,* Giancarlo De Carlo makes a sustained critique of modernism's tendency to reduce the user to an abstraction within a universal value system, as manifested most clearly in the mass housing schemes. Against this he argues for the need to discover the 'real needs of the user', which means 'exposing and acknowledging their rights to... express themselves'. [43] De Carlo makes it clear that this leads to a new conception of the architectural object in order to allow it to change 'with the transformations which the user imposes on it', thereby acknowledging the possibility for 'growth and flexibility'. [44] (Fig 2.20)

From the late 1960s onwards there are a growing number of schemes that develop the principles of flexible housing in the context of user empowerment and participation. The solution was generally seen in the 'democratisation' as well as 'decentralisation' of the planning process — in particular in the public sector. [45] Among the leaders in this field were the French architects Luc and Xavier Arsène-Henry who stated that 'not to reckon with the originality and unique character of each person is to negate one dimension of Man and, personally, we find that unacceptable.' [46] Based on this central belief, they defined three principles:

> 1. Everyone should be able to fit out his home as he wishes, including the right to make mistakes as part of that freedom... 2. Each person ought to be able to

> express himself as a function of his choices. His home should be personalizable... 3. Each person should be able, in his home, to make a creative act by organizing his space, based on the context within which he finds himself. Even being a co-author brings a measure of satisfaction. [47]

Putting their ideas into practice, the two architects designed a large number of pioneering buildings within which the future occupants could determine the layout for their apartment. In the Arsène-Henrys' apartment block in the French city of Montereau, each occupant planned the location, type and number of rooms as well as the external elevation — restricted only by the size of their apartment, a service core and a 900mm planning module. 061 This was enabled technically by long-span concrete floors giving 40–120m² unobstructed area without cross-walls or intermediate columns. [48] In this and other participatory schemes, prospective tenants were typically given documents or brochures before their involvement in the process started. These detailed the possibilities of participation, descriptions of the building in design and technical terms, as well as potential apartment typologies and layouts. In planning sessions, the architect and occupant jointly developed floor plans, either through sketching or by means of large-scale models. This gave the occupants the choice of how they wanted to use spaces instead of architecturally predetermining their lives, or, in the words of Arsène-Henry 'to provide a private domain that will fulfil each occupant's expectations' that is not about allegedly 'good' or 'correct' layouts but day-to-day use. [49] Research conducted by Manuel Periàñez found that the plans produced by the occupants would never have been made by architects, but reflected individual and sometimes quite idiosyncratic wishes. [50]

The Arsène-Henrys were not alone in hitching flexibility and participation to a political belief system, naturally of the left, in which architects are ethically bound to work with, and not just for, others. In the UK architects such as Nabeel Hamdi, Nick Wilkinson and Walter Segal, in Austria Ottokar Uhl and Eilfried Huth, in Germany Peter Sulzer and Peter Hübner, are all explicit about the social role of a participatory architecture. [51] For Hamdi and Wilkinson the employment of flexible construction techniques is a means to an end and not an end in itself. 083 The aim is to provide housing that empowers the user to make changes both at the design stage and over the lifetime of the building. The title of Hamdi's book, *Housing without Houses: participation, flexibility, enablement,* is clear in this intent. [52] Flexibility as a mode of construction is in the service of flexibility in terms of a social and political imperative, allowing users to participate in the design process and enabling them to affirm their housing 'unit' as home. The same spirit is found in Ottokar Uhl, when he writes: 'the objective of participation by future dwellers in the planning of their homes is to make housing more democratic.' [53] Uhl was a fervent advocate in the development of flexible housing solutions in response to issues of participation. Best known for his scheme at Hollabrunn, he believed that the advancement of architecture would not come through formal developments, but through a reworked understanding of the social processes of design and occupation. [54] 077 084 In this Uhl is as clear as anyone in affirming that architects have to avoid their preoccupations with form and technique, and instead engage with wider social forces. Flexibility here is not an abstract concept but an inherent part of a social context.

This brief investigation of episodes in flexible housing suggests the issue of flexibility per se is not the primary

motivation in the design of housing, but has usually developed in response to another set of demands. [55] What is of interest is that these demands are still with us today; indeed the three main drivers that we have investigated (housing demand & limited space standards, new methods of construction, and user participation) have all come together at the forefront of the contemporary housing agenda. First, the pressure on the provision of new housing combined with the pressure to decrease space standards is a particular imperative in the United Kingdom and should lead to fresh thinking about housing design, including the consideration of flexibility. Secondly, there is intense discussion about the need to update construction techniques to reflect industrialised exemplars; again this is an opportunity for the development of flexible housing principles. Finally, the inclusion of the user in discussion about their future housing provision is, in many countries, becoming a political imperative. As we have seen, flexible housing is a direct response and solution to all these needs.

Chapter 2 Notes

1 The best attempt is a book that follows the development of flexible housing in the Netherlands. Jos van Eldonk and Helga Fassbinder, *Flexible Fixation: the paradox of Dutch housing architecture*, Assen: Van Gorcum, Eindhoven University of Technology, 1990.

2 Paul Oliver, *Dwellings: The Vernacular House Worldwide*, London: Phaidon, 2003, pp.166-7.

3 Ibid., p.158. He is referring to the typical African compound.

4 Ibid., p.167.

5 See Peter G. Rowe, *Modernity and Housing*, Cambridge, Mass: MIT Press, 1993, pp.102-13.

6 Helga Fassbinder and Jos van Eldonk, 'Flexibilität im niederländischen Wohnungsbau', *Arch+*, no.100/101, 1989, p.66.

7 Drawings in *Arch+* 100/101

8 Stam quoted in Fassbinder and Eldonk, 'Flexibilität im niederländischen Wohnungsbau', p.68.

9 Philippe Boudon, *Pessac de Le Corbusier 1927-1967: etude socio-architecturale*, Paris: Dunod, 1985, p.33. See also Rowe, Modernity and Housing, pp.56-58, for a discussion of minimum standards in housing.

10 Alan Colquhoun, 'Plateau Beaubourg', in *Essays in Architectural Criticism*, Cambridge, Mass: MIT Press, 1981, p.116.

11 As quoted in Jörg Werner, 'Alltags-Anpassungen', *Arch+*, no.100-101, 1989, p.55. Our translation.

12 Ibid., pp.53-54.

13 Hilde Heynen, *Architecture and Modernity: a critique*, Cambridge, Mass: MIT Press, 1999, p.44.

14 Ibid., p.46.

15 Marcel Breuer, 'Metallmöbel und moderne Räumlichkeit', *Das Neue Frankfurt*,1/1928. As quoted in Ibid., p.47.

16 Another example is El Lissitzky's 'Wandmobil', a wall element that accommodates 3 folding beds, working tables, and a wardrobe.

17 As quoted in Werner, 'Alltags-Anpassungen', p.55.

18 see Alice Friedman, *Women and the Making of the Modern House*, New York: Abrams, 1998, pp.64-90, for a full description of this collaboration.

19 Jannes Gerhardus Wattjes, 'Moderne bouwkunst in Utrecht', *Bowubedriif*, no.2:9, 1925, p.317.

20 Karin Kirsch, *Die Weißenhofsiedlung* Stuttgart: Deutsche Verlags-Anstalt GmbH, 1987, p.59. Mies addressed the issue of flexibility in his 1927 essay 'Bau and Wohnung'.

21 Mies van der Rohe cited in Ibid., pp.59-61.

22 Mark Stankard, 'Re-covering Mies van der Rohe's Weißenhof: The Ultimate Surface', *Journal of Architectural Education*, 55,

no.4, 2002, p.250. Stankard notes that Mies' design for the Weißenhofsiedlung is a variation on a standard German housing plan, the Zweispänner (double-loaded staircase). He compares Mies' plan with an apartment block of 1849 and with two Heinrich Tessenow designed housing units from 1913 and 1928.

23 Catherine Bauer, *Modern Housing*, Boston: Houghton Mifflin, 1934, p.202.

24 Exceptions to this are residential dwellings for the military, i.e. barracks and portable cottages, and housing designed for shipping to the colonies or to new frontiers such as California. See Colin Davies, *The Prefabricated Home*, London: Reaktion Books, 2005, pp.47-51.

25 Le Corbusier, *Towards A New Architecture*, London: The Architectural Press, 1946, p.226.

26 Gilbert Herbert, *The Dream of the Factory-Made House: Walter Gropius and Konrad Wachsmann*, Cambridge: MIT Press, 1984, p.6.

27 Gropius (1910), quoted by Matthias Ludwig, *Mobile Architektur: Geschichte und Entwicklung transportabler und modularer Bauten*, Stuttgart: Deutsche Verlags-Anstalt GmbH, 1998, p.27. See also Davies, *The Prefabricated Home*, p.132.

28 As quoted in Davies, *The Prefabricated Home*, p.132.

29 Herbert, *The Dream of the Factory-Made House*, p.234.

30 Ibid., p.236.

31 Ibid., p.3.

32 Ludwig, *Mobile Architektur: Geschichte und Entwicklung transportabler und modularer Bauten*. The competition 'Das Wachsende Haus' was announced in Berlin in October 1931 and was administered by Martin Wagner, the Stadtbaurat for the City of Berlin. Selected competition entries were shown in the Berlin Summer Exhibition of 1932.

33 Ibid., pp.41-43.

34 'The new house 194X', *Architectural Forum*, no.77, 1942, p.65. The editorial further notes that: 'it is everywhere recognised that the end of the war will bring about vast changes in our everyday lives. These changes will affect habits of consumption and methods of production, and inevitably will be reflected in the physical form of the world in which we live—and which it is the business of designers to mold [...].'

35 Victorine Homsey and Samuel Homsey, 'The new house 194X: 1. Foundation saver, prefabricated parts', *Architectural Forum*, no.77, 1942, p.72.

36 William Wurster, 'The new house 194X: 29. Flexible Space', *Architectural Forum*, no.77, 1942, p.140.

37 Louis Skidmore, Nathaniel A. Owings, and John O. Merril, 'The new house 194X: 12. Flexible Space', *Architectural Forum*, no.77, 1942, pp.100-01.

38 Davies, *The Prefabricated Home*.

39 John Egan, *Rethinking Construction: The Report of the Construction Task Force*, London: Department for Transport Local Government and the Regions, 1998.

40 Ibid., p.34.

41 John Habraken, *Supports: an alternative to mass housing*, London: Architectural Press, 1972, p.13.

42 Ibid., p.3.

43 Giancarlo De Carlo, 'Architecture's People', in *Architecture and Participation*, ed. by Blundell Jones, P., D. Petrescu, and J. Till, London: Routledge, 2005, p.18.

44 Ibid., pp.21-22.

45 Rudolf Dirisamer, Franz Kuzmich, Ottokar Uhl, and Walter Voss, 'Überbauung Wohnen morgen' in Hollabrunn', *werk-archithese*, 64, no.11/12, 1977, pp.22-23.

46 As quoted in Andrew Rabeneck, David Sheppard, and Peter Town, 'Housing flexibility?' *Architectural Design*, 43, no.11, 1973, p.703.

47 Ibid., p.702.

48 Luc Arsène-Henry and Xavier Arsène-Henry, 'La Montereau, Bordeaux le Lac', *Techniques et Architecture*, no.292, 1973, pp.94-98.

49 Rabeneck, Sheppard, and Town, 'Housing flexibility?' p.702.

50 Manuel Periàñez, *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.

51 See Peter Blundell Jones, 'Sixty-eight and after', in *Architecture and Participation*, ed. by Blundell Jones, P., D. Petrescu, and J. Till,

Chapter 2 Notes

London: Routledge, 2005, pp.127-40, for a overview of this period in terms of participation.

52 Nabeel Hamdi, *Housing Without Houses: participation, flexibility, enablement*, New York, London: Van Nostrand Reinhold, 1990.

53 Ottokar Uhl, 'Democracy in Architecture', in *The Scope of Social Architecture*, ed. by Hatch, C. R., New York: Van Nostrand Reinhold Company, 1984, p.41.

54 Helmut Hempel, 'The work of Ottakar Uhl', *Bauforum*, 15, no.90, 1982; Bernhard Steger, 'Über Partizipation. Mitbestimmung bei Ottokar Uhl', parq, 2005, <http://www.parq.at/parq/sections/research/stories/297/>[Accessed 19 July 2005].

55 The exceptions are the work of Avi Friedman and of the Open Building movement, in both of whom flexibility is a main driver. See respectively: Avi Friedman, *The Adaptable House: Designing Homes for Change*, New York: McGraw-Hill, 2002., and Stephen Kendall and Jonathan Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000.

3

THE CASE FOR

FLEXIBLE HOUSING

THE CASE FOR FLEXIBLE HOUSING

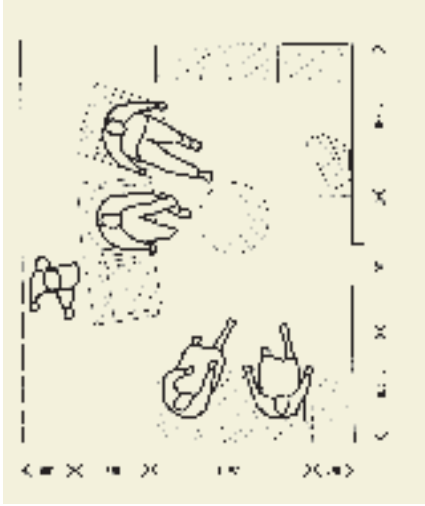
The previous chapter traced the way that flexible housing has developed as a response to external conditions and ideologies. Whilst it may be difficult to trace an ordered history of flexible housing, this does not mean that it is impossible to argue a rationale for it. This chapter makes the case as to why features of flexibility and adaptability should be included in housing design. If the first chapter looked at the 'what', the second the 'when', this one investigates the 'why' of flexible housing.

Built In Obsolescence

At a basic level the case for flexible housing is a straightforward matter of common sense. Why, to put it simply, would one *not* design for flexibility and adaptability? Housing is volatile, subject to a whole range of cyclic, non-cyclic and trend changes, and if it is not able to respond to these changes it becomes at best unsatisfactory, at worst obsolescent.[1] Yet, despite the fact that dwelling is inevitably dynamic, it is too often framed intellectually and physically as a fixity. The vast majority of housing, particularly in the UK and US private sectors, is not only not flexible, but actually builds in inflexibility, and with it obsolescence. The developed world has come to accept the built-in obsolescence of consumer products, largely persuaded by the manufacturers that it is desirable to continually upgrade our lifestyles through endless consumption. However, to apply the same argument to housing, with its vastly expanded economic, physical and social implications, is much more problematic. When a recent UK Government report notes that, at current rates of replacement, a new house built today in the UK would need to last around 1,200 years in order to meet future demand, one can understand the imperative to see housing as more than a disposable commodity.[2] [Fig 3.1] And yet, the mindset of housing provision remains short-term. The reasons are mainly economic. In the UK, market-led factors largely determine the shape of housing, even in the hugely diminished public sector, which largely follows the cycles of the private sector. In both sectors there is massive excess of demand over supply, mainly due to the scarcity of land or at least land in the right places. With almost guaranteed sales and well rehearsed profit margins, there is little incentive for developers to innovate or offer added value. This applies to both the design of homes and their construction. In both cases tried and tested solutions are rolled out regardless of social or physical context, or of changing technologies. Lack of investment in research and development has resulted in a house building industry that is unable to keep abreast of innovation in processes and technology or to cater for long term social needs.

3.1 'Typical' UK house, Sheffield, UK, 1999. According to the Barker report, a house such as this will have to last 1,200 years. The combination of tight plans and inflexible construction means that even the smallest of changes are difficult to achieve.

In the UK, houses are sold by number of rooms and designated room types instead of overall floor area. Status, and thus value, lies first in the number of rooms rather than their size. Spaces are designed down to the absolute limits of their designated function, often determined through furniture layouts. This results in what Andrew Rabeneck calls tight-fit functionalism: a room that can only be used for its preconceived purpose.[3] It is an attitude that comes out of the modernist fixation with ergonomics, typified by pamphlets such as *Space in the Home*, issued by the Ministry of Housing and Local Government, which set down spatial standards based on typical furniture layouts and circulation clearances.[4] [Fig 3.2] A good example of tight-fit functionalism is the dining room. In upmarket developments it is seen as desirable to provide a separate dining room, even though such rooms are on average used for less than 5% of the day. The dimensions of the room are established by the size of an average dining room table plus chairs and, if one is lucky, a sideboard. Circulation squeezes round the edges. The result is a long thin room, typically 3.5m by 2.2m, often with two doors, which is difficult to use for anything else, with or without the dining furniture in it. Use is thus restricted in both the short and long term. The problem is compounded when this tight-fit functionalism is applied to the whole house or apartment. Any architect who has worked with the space standard guidelines of a typical UK housing association will know that if one follows the rules to the letter, the rooms and their relationships more or less design themselves in terms of proportions and sizes. To achieve flexibility in this context requires persuasion and effort from the designer and client, accompanied by a welter of exceptions or waivers. Additionally, inherently inflexible construction techniques are the norm: internal partitions are often loadbearing and roof spaces filled with trussed rafters, both features that make future change either impossible or prohibitively expensive.



3.2 'Sitting around the fireplace and watching TV', *Space in the Home*, 1963. *Space in the Home* was a design bulletin issued by the UK Ministry of Housing in 1963 setting down the whole range of 'normal' domestic activities and their required dimensions. The very normative assumptions of how people lived their lives was then translated by countless architects and students into very normative, and very inflexible, house plans.

The situation is different, but not necessarily that much better, in North America or Japan. Both have a long established history of using prefabricated systems in order to provide the consumer with as wide a range of houses as possible.[5] Whereas in Europe, as Ole Bouman notes, housing provision remains a relic from the pre-war economy — 'you have to take the product as it is'[6] — in the USA and Japan consumer choice in housing is taken seriously. Using the latest CAD/CAM technology, purchasers can call up an almost infinite array of layouts with custom finishes in an advanced version of the nineteenth century pattern book. In Japan, advanced methods of factory production still further increase

the possibilities of customisation. [7] Whilst this gives apparent choice at the start of the process, this is not necessarily compatible with long-term adaptability; indeed, it can be argued that the more specific the design is at the start the less flexible it will be in the future since it fixes a very particular living pattern and lifestyle in perpetuity. As Stewart Brand notes in his book *How Buildings Learn,* architects as much as developers 'tend to focus on what users want now.' [8]

Increasingly, what people want now is to see housing as part of a commodified lifestyle, and developers are happy to provide this in terms of surface elements such as kitchens and bathrooms, which are often the focus of the marketing pitch. The tendency to reduce housing to the status of the consumer goods merely reinforces the view of housing as product, a disposable commodity that can be moved on from once the surface has lost its attraction. Long-term considerations, including future adaptability are almost completely lost within this very short-term view.

In effect, the housing sector is building in obsolescence through inflexibility. As one housing developer told us this is not entirely accidental. Inflexibility means that once the users' needs change, as inevitably they do, the occupants have no choice but to move. This keeps the housing market in a state of permanent demand. If flexibility were built in, occupants would be able to adapt their houses and thus stay longer in them; this would depress the housing market and limit the continuing sales on which developers depend. Housing developers actually promoting flexibility was thus referred to as like turkeys voting for Christmas. [9] However, housing provision demands a broader view of the subject than treating housing merely as a short-term investment to exploit the value of the developers' land banks. In Britain, more than half the housing stock is over fifty years old and deteriorating faster than it is being repaired, improved or replaced. The very low level of house building exacerbates this situation. [10] Yet, just providing additional houses isn't enough if in a few years time those very houses have become obsolescent. The only way to get over the supply and demand problem is to build buildings that are flexible enough to accommodate new demands on the built environment such as changing demographics, ageing users and changing working patterns. We shall see this has further benefits in terms of life cycle costing, sustainability and the incorporation of new technologies. [11] But to accept these principles, one has to move from treating housing as a short-term fix to seeing it as one of a country's most important assets.

External Demographics

One of the problems of treating housing as a static commodity with fixed design parameters is that it arrives into a world of changing demographics. A mix of units that meets immediate demand might well be inappropriate in thirty, let alone one hundred, years time. Thus over the past twenty years there has been a decrease in the number of traditional family units, a higher proportion of older people, an increase on the number of single-person households, an increased demand for shared accommodation, and a growing move towards home-working. Statistical data shows that these trends will probably continue into the next decades, but they will be overlaid with as yet unseen and uncertain demographic developments. Probably the only thing that one can say with any certainty is that housing needs at the end of the twenty-first century will be different from needs and wishes today; the argument for housing that can adapt to these changing demographics becomes

compelling. Changing demographics require new architectural solutions that incorporate flexibility into new types of housing. Cultural heterogeneity also increases the need for a variable approach to housing provision. A unified, mass-produced, housing and building policy, however, blocks this demand. The standard developer house, in its basic layout and form a remnant from the late nineteenth century, seems to be at odds with an increasingly itinerant as well as multi- and cross-cultural society.

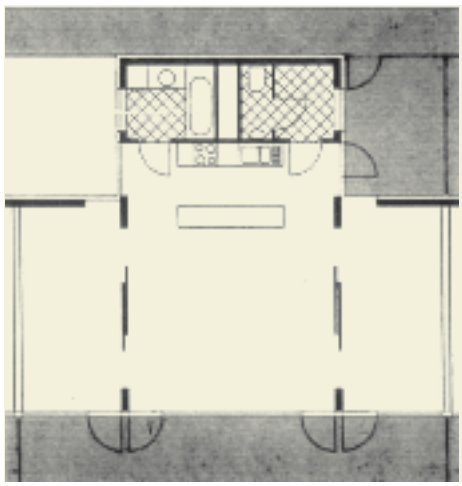
Some demographic changes can be gauged with some certainty, for instance the rise in the number of single-person households in England from around 3 million in 1971 to 6.5m in 2003, with further predicted rises to just over 10m by 2026. One can also begin to identify trends within these headline figures, such as the rise of people over the age of 65 living alone and of the young urban single. But other demographics are much more volatile. For example at a micro level, Manchester has seen a rise in its inner city population from 966 to 15,121 in the years 1991 to 2006, aided initially by the ease with which redundant warehouses (as exemplars of flexible architecture) could be converted into housing. At a macro level, it is the mass movements in migration that have always proved most unpredictable. For example, in 2003 the UK government predicted that the newly expanded European Union would result in a net inwards annual migration of between 5,000 and 13,000 people. By 2006, however, the Home Office recorded that 447,000 people from the new EU accession states had registered for work permits.[12] Add to this non-EU migration and one can begin to understand the diverse nature of housing demand over relatively short periods in the UK and in other countries. Each migrant group brings with it a certain set of cultural expectations with regard to

3.3 Microflat, Plan, Piercy Conner Architects, 2002.

living patterns and spaces, and yet are confronted with the fixed structures and prejudices of their adopted country's housing. There is mounting evidence that first and second generation immigrants find this spatial restriction at best uncomfortable at worst unacceptable.[13]

The issue of a changing demographic in relation to housing stock is nothing new. As early as 1961, the seminal Parker Morris report, produced for the UK Government, argued that 'with the greatly increased rate of social and economic change, the adaptable house was becoming a national necessity... as it would allow much easier and perhaps more satisfactory adaptation to the changing general needs.'[14] Despite the urgent tone, nothing much has happened in the interim, although government agencies and researchers still note the need for more flexible housing to cope with changing demographics. Thus in the UK, a recent report on the future of housing from the Commission of the Built Environment (CABE) and the Royal Institute of British Architects (RIBA) identified 'Culture, Flexibility and Choice' as one of the key emerging themes over the next twenty years, stating that: 'the nature of the individual households is forecast to continue changing. Viewed in tandem with the diverse modes of living, working and leisure time, it can be seen that our future housing needs to be flexible.'[15]

It is easy enough to say that housing should be designed with changing demographics in mind, less easy to actually do it. One response is to cherry-pick just one of the emerging trends and provide for it in the immediate term. This approach is apparent in the recent interest in microflats, a 'small, efficiently designed, high quality, compact dwelling that is around two thirds the size of a conventional inner-city one bedroom apartment'.[16] [Fig 3.3] Designed against the background that by 2011 40% of London's households will comprise of only one person, these apartments offer accommodation for so called 'key workers' and 'young professionals' falling within a pre-determined salary bracket. Fabricated as self-contained units with a purpose-built, prefabricated utility pod for the shower room and kitchen, these microflats can be configured into several massing options depending on site conditions. Whilst the clever design packs a lot into not much space, there are no options for horizontal or vertical additions, it is difficult to sensibly knock through walls to two units together, nor can the unit be used for any other purpose than dwelling. Predicated on short-term economic and social pressures, the microflats in their very particular response to a very specific demographic shut down future options.



3.5 Wohnregal Koppstrasse, Helmut Wimmer, 1999. Typical of an approach where the designer provides an open structure for others to fill in as they wish. 135

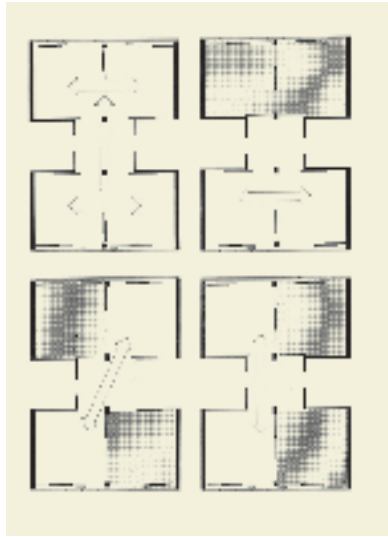
3.4 Quartiers Modernes Frugès, Pessac, Le Corbusier, 1926. 'All buildings are predictions. All predictions are wrong.' Le Corbusier's purist housing at Pessac was famously overtaken by the impurities of occupation. 011

The challenge therefore is not just to respond to immediate pressures, but to accept the uncertainty of what might happen in future demographic trends. Steward Brand's provocation is useful here: 'all buildings are predictions. All predictions are wrong.'[17] [Fig 3.4] The only way out of this conundrum is to accept that the best one can do is to anticipate change rather than predict certainty. This calls for an openness from both the client and designer. One can identify two, apparently contradictory, approaches to providing this open future: the idea of base structures and the idea of a polyvalent organisation. In the first, faced with the volatility and diversity of potential occupancy, the reaction is to provide a frame and within it empty generic space that can be infilled and adapted over time. [Fig 3.5]

The seminal example is Le Corbusier's Dom-ino house of 1914, which is based on the principle of floor slabs supported by columns and infilled with blockwork walls and standard windows and doors, to make 'cheap, flexible dwellings'. [18] It is also the solution consistent with the basic tenets of the Open Building approach, in which 'the infill may be determined or altered for each individual household or tenant without affecting the Support or base building, which is the building's shared infrastructure.' [19]

The second approach to providing for the uncertainty of demographic change acts in apparent opposition to the first. Rather than the provision of open space, it starts with a cellular structure. [Fig 3.6] Flexibility over time is provided in two ways. First, the rooms are indeterminate in their function. Secondly, the divisions are laid out and structured so as to allow them to be connected together in a variety of configurations; often they will incorporate predetermined openings that can be filled or knocked through. Historically it is the terraced (row) house that has demonstrated these principles; although initially designed for a very specific purpose (housing the bourgeois family unit), they have proved remarkably accommodating to change. More recent schemes, such as Hellmutstrasse and Kraftwerk both in Zürich, have consciously adopted a repetitive cellular structure which, when in combination with the location of the staircase and service zones, allows multiple configurations of the units together with the ability to contract or grow over time: they hold within their plans the sense of being able to accept change over the long term. 109 146

What both these schemes also give is a diversity in the initial mix of units, with the potential for that diversity to be maintained over time. This is in contrast to much



3.6 Grieshofgasse, Helmut Wimmer, 1996. Typical of an approach that provides a cellular layout with undesignated uses. Extra flexibility is given in this case by the connections across the central hall. 119

contemporary housing, particularly in the UK, which tends to provide a single type of unit with the result that large swathes of British inner cities are being covered with one-person apartments or student housing with few, if any, public, family or community facilities. The demands of both the market and planning system thus divides society into income groups and builds differently for each group — on discrete territories with disparate management regimes and financial mechanisms. 'The result', as Habraken noted, 'is artificial segregation'. and with it inflexible configurations of communities separated by economic and social barriers. For Habraken mixing and interdependency are social necessities. [20] In this light flexible housing not only meets the demands of changing demographics but also has the potential to contribute to the diversity and viability of urban life, something that is recognised in recent discussions about sustainable communities which stress the importance of providing a social mix and mixed use within new developments.

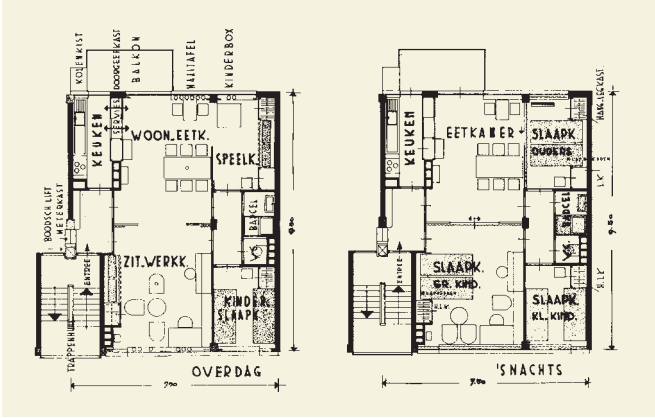
Internal Dynamics

Demographics describe the external environment for housing: change here works at a macro level and consideration of how one might accommodate it generally starts at the scale of the building rather than through the design of the individual unit. Housing also needs to respond to the internal changes during the lifetime of its occupants. These internal micro changes arise at the level of the individual house or unit. If it cannot adapt then the users will have to move on, which is both socially and financially disruptive. Housing here has to be flexible enough to deal with two conditions. The first is the need to adapt to the changing needs of individuals as they grow old or less physically able. The second is housing that can respond to the changing constitution of a family as it grows and then contracts.

The first of these categories is known in the UK as Lifetime Homes, and is subject to increasing regulation (through the Building Regulations [21]) and also to increasing research. [22] The provision of housing that can be used, or easily adapted for use, by everyone, regardless of age or disability has a clear social logic. This is supported by a financial argument. In the UK, retrofitting homes for people who become disabled already costs £350 million per year. [23] With an ageing population, this figure is set to rise dramatically unless standards are adopted that make houses more adaptable from the start. As Richard Best, former Director of the Joseph Rowntree Foundation notes, 'with an ageing population, investment in good design will save heavy expenditure in the years ahead.' [24] The Rowntree recommendations are all relatively straightforward, including level access to front and back doors, wider halls and doors, windows with low sills and enough turning space for a wheelchair.

However, the recommendations for Lifetime Homes, whilst absolutely sensible in their own right, do not go far enough to provide truly adaptable housing. They mainly deal with modifications to discrete elements of design (socket heights, door widths and so on) rather than taking a more holistic view of the potential of adaptation. These aspects are covered in the second approach to design for the lifetime of a home, namely recognising the demands of changing sizes and/or ages of family or individual groups. This ability to react to changing household circumstances is clearly not incompatible with the tenets of Lifetime Homes, but takes on board a wider set of parameters. Flexible housing as envisaged here sets the aspiration that housing in general should be designed to be potentially inhabitable by everyone regardless of circumstances. For example, if a house becomes too big and therefore expensive to run, the designed-in possibility of division and letting out sections would mean that people do not have to move elsewhere. If somebody becomes physically less able through age or illness to navigate their existing dwelling, an adaptable house could provide the continued interdependence to the dweller. If economic or family circumstances change, an adaptable house should provide the possibility of re-designating existing rooms or use patterns. Whilst it might take some extra effort to design housing to cope with changing family size and structure, changing lifestyles, and ageing or disability, the flip side is that those projects incapable of growth and change will, as Habraken notes, become failures. [25]

Historically the vernacular house typically provided a living environment that could accommodate these changes; however, since the late nineteenth and twentieth centuries these issues have become architectural tasks. Some of the very first examples

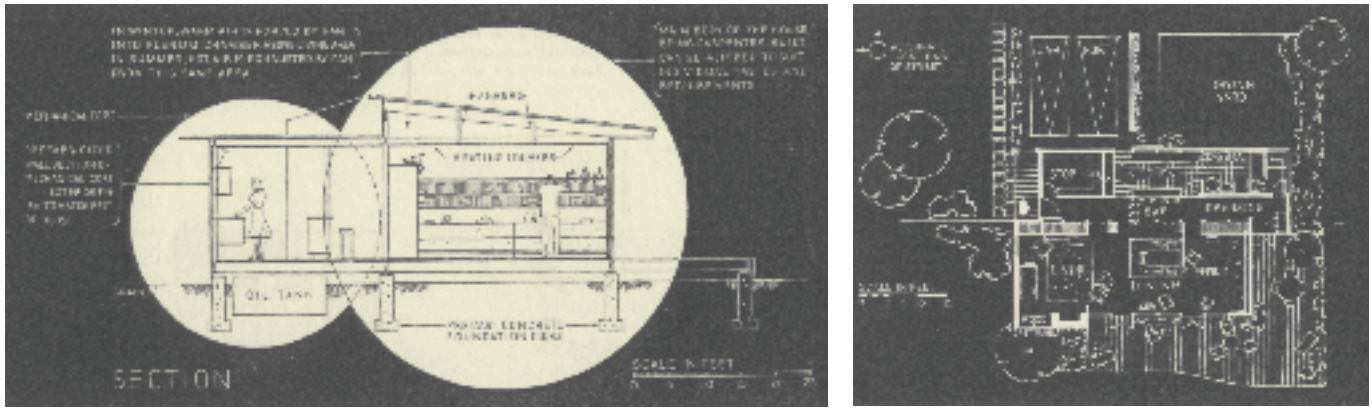


3.7 Woningenkomplex Vroesenlaan, Van den Broek, 1934.
Original plans drawn by Bakema.

of specific considerations for buildings to adapt to changing family circumstances were developed in the early 1930s. *Das Wachsende Haus* was a competition that invited submissions dealing with issues such as growth, or the expandability of the house, horizontally as well as vertically and the generation of a range of house types by using standardised components (see p.24). As we have seen, probably the most sustained investigation into the effects of changing living patterns, both on a daily and long-term basis, was the work of the German architect and researcher Heinrich Leppla whose collaboration with Van den Broek resulted in the pioneering Vroesenlaan project. [Fig 3.7] 022 On his own account, Leppla conducted a series of systematic studies in the early 1930s. These 'combined... day and night studies with studies of the life cycles of the various family members and the changing customs and requirements that resulted from them'. [26] [Fig 2.5] He then evolved a series of plans that accommodate the changes thrown up by these studies. Leppla, and Mart Stam, apply a semi-scientific approach to the analysis of internal dynamics. This is both their strength and weakness: strength because of the rigorous attention that they draw to the issue, but weakness because of the essential instability of living patterns. The problem is that the uncertainty of dwelling cannot be framed within a positivist framework. The more that Leppla and Stam attempt to pin those patterns down, the more exceptions come to the surface. Even if the functions that they are mapping are now understood as flexible (as opposed to the orthodoxy of fixed uses), theirs is at heart a functionalist approach. Early experiments such as Vroesenlaan are important in breaking the hold of mono-functionalism, and the plan choreographs the potential for different ways of using it, but they still exert the control of the architect.

The idea of a house being capable of adaptation by its user became a recurrent preoccupation with architects. A common approach was to provide a neutral frame that could be divided up or added to at will. For example, in the 1940s, the American architects Edward Stone, Stanley Sharp and Cope Walbridge designed a house the central part of which was planned for maximum flexibility of use during the lifetime of an average family. [27] [Fig 3.8] The primary plan consists of a 4 metre by 10 metre space, divided into a living/dining area and a sleeping area, which could be separated by a folding partition. If the original family grouping changed, say with the arrival of a child or a tenant, a bedroom wing could be added by using the same type of construction. The addition of space, achievable through the single-storey house on a large plot, could be continued in any of the four directions. William Wurster's project of the same date shows the same approach of combining lifetime concerns with standardised systems of construction. 029

More recently projects such as the Banner Building in Seattle as well as the Kölner Brett in Cologne offer raw space that can be partitioned according to the needs of the respective tenants — but can equally well be returned to its original 'blank canvas' state. 113 129



3.8 Planning for Economy and Flexibility, Edward Stone, Stanley Sharp and Cope Walbridge, 1944. Section and Plan

The same principle of adaptability of the individual unit lies behind the Convertible House, a project developed by the Canadian Mortgage and Housing Corporation. 107 This dwelling, which from the outside looks like a standard single house, can be divided into two dwelling units. The scenario starts with a young couple occupying one unit and renting out the other. As the needs of the homeowners change, they take over the second unit, with the second floor containing additional bedrooms for an expanded family. Once these become redundant again as children move out, the upper storey can be converted into a rental space thereby generating monthly income as the original homeowners grow old in their original home. [28]

Instead of transferring a planner's or architect's behaviour patterns and conceptions of living values onto the subsequent occupants, the better adaptable projects convey a plan that is as adjustable as possible to any future situation. This adaptability either comes through possible modifications in plan through movable partition walls or a general use-neutrality of a plan with regard to equipment and size. Building in this capacity for change does not dramatically increase cost [29] but, as the Canadian study on the Convertible House shows, is more likely save money over the long term either for the individual owners in the private sector or the housing associations in the public sector. It is these financial arguments in support of flexible housing that are addressed in the next section.

Financial Arguments

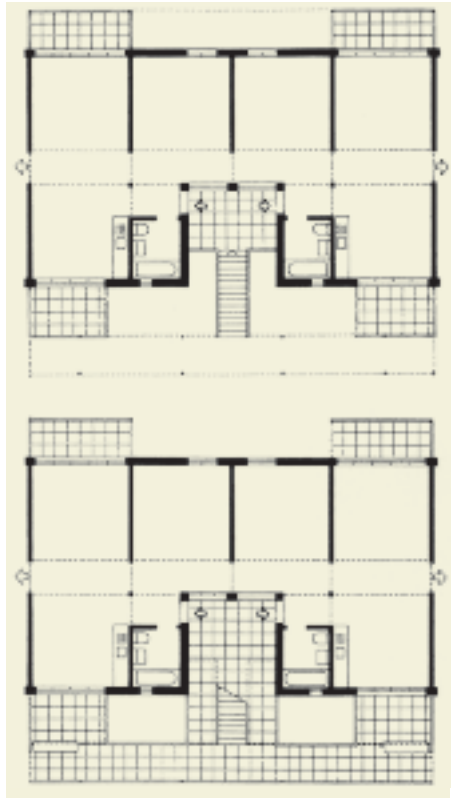
Sense tells us that flexibility is more economic in the long term because it limits obsolescence in the housing stock. Many have argued that flexible and adaptable housing can avoid considerable long-term capital cost through building-in the capacity to adjust to different circumstances. [30] All our qualitative research indicates that if technological systems, servicing strategies and spatial principles are employed that enable the flexible use of a building, these buildings in turn will last longer, and they will be cheaper in the long run because they reduce the need and frequency for wholesale refurbishment. However, there is surprisingly little quantitative data to substantiate this argument. Market research in the Netherlands has shown that people are more likely to stay in their homes if they can adapt them, and by corollary a high percentage want to move because they cannot adjust their dwellings to their needs, but the financial implications of this have not been quantified.[31] However, there is almost nothing in terms of hard-nosed financial assessments of flexible housing.

Part of the problem in understanding the financial implications of flexible housing lies in the way that the products of the housing and construction industry are costed. Everything is done on the basis of immediate expenditure, and the notion of long-term or whole life costing is rarely discussed. Although it is generally acknowledged that buildings which can be easily adapted over time will reduce running costs (to a housing association, public landlord, or home owners) whole life costing or the 'systematic consideration of all relevant costs and revenues associated with the acquisition and ownership of an asset', [32] is seldom taken fully into consideration. The whole life cost of a development includes the initial capital costs, the finance costs, repairs and maintenance, demolition and disposal, as well as running costs such as energy, water and waste. [33] One can thus see that flexibility is not the only principle to suffer under the regime of short-term expediency: so too do issues of sustainability. The difference is that sustainable items are beginning to be declared in terms of pay-back period, so that the relationship between up-front expense and long-term benefit becomes more transparent.

As Henz notes, 'any upfront additional investment (which anyway is not always necessary) can be set off against long-term economic calculations such as a higher appreciation of the dwelling on the part of the user, less occupant fluctuation, and the ability to react quickly to changing needs or wants of the existing or potential inhabitants and the market.' [34] Such whole life costing calculations have yet to be applied to the elements of flexible housing. This is a particular loss in the public sector, where dwellings need to be upgraded on a regular basis and the cost of management and refurbishment exceeds the initial capital cost. [35] Maintaining properties for the future is no longer grant assisted in the UK. Whereas a few years ago housing associations could get government grants for improvements, today, long-term maintenance of properties has to come out of a 'sinking fund' for each scheme. [36] Even a relatively simple problem such as trying to fit modern kitchen equipment into the space of a 1970s apartment has knock-on effects. Because modern kitchens generally have larger space standards to accommodate washing machines and other equipment, plans have to be rearranged — an exercise through which other rooms might be 'lost'. This in turn results in lower rents as the rent for an apartment is determined not by its floor area but by the number of bedrooms. [37] The example of the kitchen is but a small part of the general problem of updating services that faces all of the managers of public sector housing in their cyclical refurbishment programmes. By designing buildings whose services can easily be upgraded and whose parts changed without too much expenditure (for example by following the principle of layering and separation of elements) costly disruption and premature obsolescence could be avoided. The implications are not just technical but also cover the human and actual cost of rehousing tenants who have either outgrown their original accommodation or else find it too big or not suitable for their physical state; again these costs, whilst real, are not considered in the initial funding of new project. If whole life costing were applied rigorously and included in the initial cost of housing, then building-in flexibility would be clearly an economic and sustainable benefit. Flexible housing in this context presents clear advantages to housing associations and local authorities, and yet within the present funding structure, and as long as whole life costing is not a compulsory part of the costing process of a building, many clients are reluctant to spend extra money up front.

If present models of housing finance, based on either direct sale or direct rent, do not encourage long-term thinking, then alternatives need to be considered for flexible housing to become economically viable. A possible model is one in which the developer is responsible not only for the construction, but also the maintenance and management of housing over an extended period. [38] In this way the long-term issues that flexible housing inherently addresses would, for financial reasons alone, have to be dealt with in the design. Under such a system no developer would intentionally build in non-adaptable or non-maintainable elements. Another financial model is the 'Buyrent' system developed by Hel Oosten, one of the largest Dutch Housing Corporations. In this the ownership of the base shell of the building is separate from that of the infill, with the latter being purchased by the individual while the former remains in corporate ownership. The Buyrenter has control over their space, and can upgrade it to their needs, receiving the enhanced value when they move on. As Kendall and Teicher note, this system only works when there is a clear design separation between the base building and the infill, and when the housing is designed specifically to allow the Buyrenters to adapt their dwellings to their needs, adaptations which under the financial incentive of the system go far beyond simple decoration or the addition of the odd kitchen appliance. [39] In this case, a system of housing finance thus effectively leads to the design of housing that is inherently flexible.

The general perception is that building-in flexibility costs more money; it is likely that this prejudice arises because flexible housing is associated with one-off experiments, which are almost by definition more expensive since they often involve the investment in bespoke building systems. [40] Whether flexibility really is more expensive is difficult to measure. At the most basic level, that of designing out inflexibility, the skill lies in designing sensibly rather than throwing money at the problem. For example, the inclusion of rooms with indeterminate functions or avoiding tight-fit functionalism does not imply extra costs, just a redistribution of space. [Fig 3.9] The next stage up is the inclusion of elements that allow lifetime adaptation for age or disability. A recent study of lifetime homes found that the extra cost of providing flexibility to all dwellings in a project was estimated to be less than one



3.9 Überbauung Brahmshof, Kuhn und Fischer und Partner, 1991. Each apartment is made up of a series of indeterminate rooms, and can be joined horizontally and vertically in a variety of ways. 108

per cent of total construction costs. [41] Another study of a flexible housing scheme that involved extensive user consultation indicated that there were marginal increases owing to the cost of the participatory process, but quite substantial reductions (up to 15%) in the profit margins of the contractors owing to the way that the decisions arising out of the participation interrupted the construction critical path. [42] The most extensive cost benefit analysis is that of Kendall and Teicher who base their arguments on the experience of over one hundred built projects, and conclude that 'residential Open Building's cost benefits have proved to be substantial.' [43]

Less easy to evaluate are the financial benefits of the intangible elements such as user satisfaction. Again, this is an important area to research, because it is the argument of user satisfaction [44] that could be the selling point for spatial adaptability and flexibility in the private sector where, as we have seen, arguments about whole life costing by and large fall on the deaf ears of the developers. Whilst the excess of demand over supply means that UK housebuilders do not need to deliver a good product or high levels of customer service in order to win market share, issues of user choice and satisfaction are clear drivers in other consumer areas. As argued in a UK Government report, the house building industry must start paying attention to issues of consumer-led demand if it is to move on from its present position of working to the lowest common denominator. [45] There are indications that some developers are taking this on board. For example at the Millennium Village scheme by Proctor Matthews the developer was prepared to cover the extra cost of sliding walls that provided flexibility because the units with them were seen to be more desirable by potential purchasers and thus sold faster than expected. 143 In the same way, consumer feedback on the private development at St James Urban village indicated that the purchasers valued the choice they were being offered and so the scheme sold quicker than a non-flexible one. [46] 150

Overall, the financial argument for flexible housing is compelling. In market terms, it leads to higher consumer satisfaction at point of purchase or occupation, and with it increased value. In technical terms, flexible housing reduces maintenance costs, allowing as it does retrofitting and upgrading of services, thereby future-proofing buildings. In physical terms, potential obsolescence is reduced significantly, with the ability to adapt and upgrade buildings rather than pulling them down. In social terms, it limits the need for users to relocate. The point is best made by Habraken when talking about support structures with their inherent flexibility: 'the question is not whether we can afford the support town, but whether we can afford to do without it.' [47] However, the real financial benefits of flexible housing will only be realised once the consideration of whole life costing is taken into account, demanding a move from short-term financial expediency to long-term economic sense. Housing, as a primary asset of any nation, deserves this.

The User

The user choice, and hence satisfaction, that flexible housing provides has far more than financial benefits: it also has social and political benefits. We have seen how John Habraken's seminal book, *Supports,* started out with a critique of mass housing. Habraken argued that mass housing suppressed the ability of the user to claim their housing unit as their own home. Instead he proposed an approach in which the dwelling should be 'an instrument for self-affirmation.' [48] A flexible housing

design opens opportunities to the user in three specific ways. The first is through the ability to customise, which gives the future resident a degree of choice over their future home. The second is the potential to adapt designs prior to occupation not so much as a means of customisation (which tends towards treating housing as a commodity) but as a means of involving future tenants in a participative capacity, as well as giving housing providers the freedom to change the housing mix. The third way that flexible housing empowers the user is post-completion, when a flexible design enables users to make adjustments on their own terms.

Customisation

Customisation of housing concentrates on the front end of the process through providing consumer choice. At a basic level this might be in terms of finishes of floors or kitchen cabinets but also in terms of the type and size of windows, position of internal walls and preferred location within a building. At a more advanced level, it involves more complete control over the size, layout and aesthetic of housing unit. As we have seen in Chapter 2, there is a long tradition in the USA and Japan of customising housing to the user's wishes. In Japan housebuilders can typically produce 50,000 units a year using a combination of factory and site processes, with each unit customised to the purchaser's requirements. In the UK, a small but growing number of architectural firms are catering for identified consumer needs and wants through the use of government favoured construction techniques of prefabrication. Modern Methods of Construction (MMC) are seen as a tool for providing highly customised dwellings. The London based architecture firm HTA sees the future of housing as a process of mass-customisation. This will involve the final user at the heart of a process involving the designer, developer, regulatory bodies and manufacturers — following the model of computer and car industries — in an integrated way. HTA developed a choice-based sales system for a housing scheme in Central Oakridge, England. 161 This demonstrated the potential for involving the purchaser in making choices in the design using a simple web-based interface, allowing the user to preview different results based on their choices. Later the model was expanded to include wider choices based on family size, location in the development, room arrangement and finishes. The steel-framed construction and standard service pods allowed plan types to be changed up to quite late in the construction process and alternative treatments to be incorporated. At Suzhou, for a Chinese client, user involvement started at the largest scale — where would you like to live (beside a canal, with a river view, near a shopping street)? — and moved down to the level of the building or block or street, to the layout and type of unit, and the fit-out of the unit. The selections would then go to the factory to be prefabricated; the user could watch their unit being constructed and finalised. The drawback of upfront customisation is that it often (but not necessarily) comes at the expense of the potential for later adaptation. Flexible modes of construction and a more flexible construction process can certainly mean more user choice, but if the systems employed are over complex they become inaccessible to the future user and for this reason will not be altered. The ability to customise housing upfront also tends to foreground the use of technology in housing production. The interrelationship of user control and technological processes is a message received from Habraken, and one that he has subsequently been criticised for, probably unfairly, as 'one of those libertarians whose proposals to tackle the inadequacies of mass housing usually focus on in the first place reorganising the product and the

technology of the product.' [49] The subsequent history of Open Building, which evolves out of Habraken's principles, does indeed suggest the dangers of allowing technical issues to over-determine the design of housing at the expense of an original intent to create housing that empowers the user to claim their house as their own over time. Finally, customisation privileges the notion of housing as commodity; the user is offered choice in the same way as they are offered choice in the marketplace of consumer goods.

The user as participant

Many of the key figures in flexible housing in the 1970s were politically motivated against exactly this commodification of architecture and housing. For them the involvement of the user was a necessary act in the democratisation of housing, and the provision of flexibility was an essential part of this. Thus Ottokar Uhl argued that: 'Users must have the right to participate in design with architects and planners and to abandon the role of mere consumers.' [50] The use of flexible design here allows the user to make changes work through all stages of the housing process, from the initial design and through to occupation. One of the best documented schemes in terms of user involvement in the design process is the PSSHAK (Primary Support Structures Housing Assembly Kit) project at Adelaide Road in London. 083 The design not only allowed future tenants to be involved in the design of their homes in an informed manner, but also allowed the client to change the mix of units late in design process. [Fig 3.10] 'Suddenly, when the housing scheme is well advanced on the drawing board, the brief is changed: the director of housing...wants many more smaller units on the site plus two eight-person houses. One of the many flexibilities in the PSSHAK process means that a change such as this simply causes

3.10 Adelaide Road Estate, Hamdi and Wilkinson for GLC, 1978. Each apartment is made up of a series of indeterminate rooms, and can be joined horizontally and vertically in a variety of ways. 083

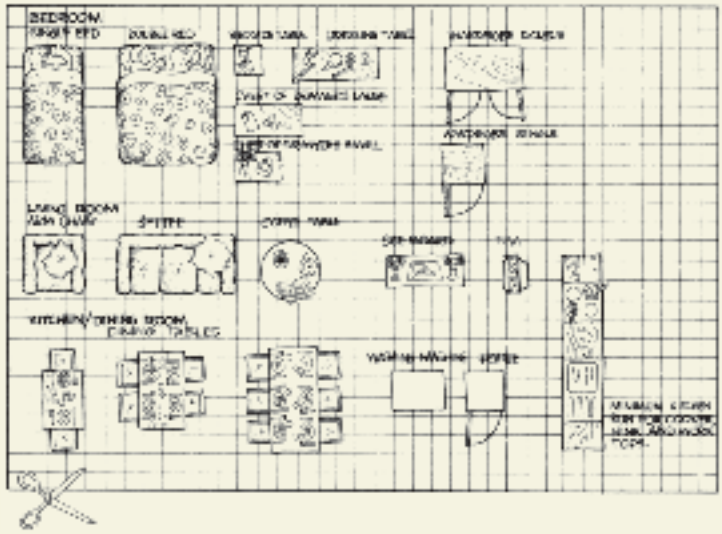
Nabs Hamdi (the architect)... to smile.' [51] Support and infill are separated and the basic structure allowed for larger units, including two- and three-storey houses and maisonettes. The potential for user involvement did not stop with the completion of the building but was intended to continue after occupation. [52] This is typical of the better approaches to participation in which the design allows intervention before and throughout the building's life.

In the 1960s and 1970s participation was seen as a social experiment and it was usual for sociologists to accompany the process, and also to follow up with post-occupancy studies that looked at the same building again after a five or ten year period of occupation. Thus, Molenvliet, one of the early Open Building projects in the Netherlands, was monitored by sociologists who interviewed both those who had engaged in the participatory design process and those who had not. 078 They found that there was a greater likelihood that those who had not participated wanted new floor plans (43% versus 14% of those who had participated), and a greater likelihood that those who had not participated wanted to leave the scheme (42% versus 15% of those who had participated). [53] All the research indicates that people who have had some choice in the design of their homes

are more satisfied in the long term, which is maybe why current Dutch housing policy seeks to ensure that ⅓ of new housing construction is based on the initiative of its future occupants.

This satisfaction is not simply down to the physicality of the design; it is also a human issue to do with identification and emotional ownership. Some of the plans thrown up by the pioneering participatory schemes would not pass muster in the first year of an architecture school, and certainly defy the touchstones of design elegance, but nonetheless provide for the users' needs. [Fig 3.11] This is an example of how some of these participatory schemes challenge the norms of architectural practice. In handing over some control to users prior to occupation, the architect relinquishes the sense of authorship that is so crucial to the profession. In accepting plans that are clumsy in a designer's eye, the schemes challenge the notions of efficiency and functionalism that still underpin architectural production. Finally, in encouraging changes to be made after occupation according to the users' rather than the architects' ends, they upset any assumptions that architecture should always be judged on the basis of refinement and static object. Architects such as Herman Hertzberger and the late Otto Steidle welcome this revised value system through working with the principle of 'incomplete' space — a space and/or structure that anticipates change through infill or other appropriation. 059 060 In both cases additional space can either be added on the outside by building within the non-filled parts of the frame construction or by filling in the initially double height spaces. The case studies show many other examples of how flexible housing allows users, to a greater or lesser extent, to become decision makers in the formation and adaptation of their homes.

Whatever the motivation — commercial, political, social or simply goodwill — these schemes clearly distinguish themselves from the vast majority of current housing, in which the plan is offered up as a fait accompli that then prescribes future occupation. Ask of the typical house whether the user can adapt it, and the answer is generally no; one of the great advantages of flexible housing is that the answer is yes.



3.11 Adelaide Road Estate, Hamdi and Wilkinson for GLC, 1978. Aids for tenants to plan their dwellings. 083

Sustainability

Jon Broome argues convincingly that: 'involving people in the housing process is a necessary pre-condition for a sustainable housing process.' In this context he regards flexibility as an inherent part of a sustainable system, a basic and fundamental premise to do with buildings having a long-term future, being capable of changing, and being capable of responding to changing aspirations and needs.[54] But it is not just in regard to

user involvement that flexible housing embeds itself into the heart of any sustainable approach to housing design. As we have seen in this chapter, flexible housing works across and integrates social, environmental and economic fields. Much contemporary sustainable design tends to concentrate on environmental issues — mainly because they are quantifiable and easier to address technically — and in doing this they miss out on the social and economic aspects. As described above flexible housing directly addresses issues of social and economic sustainability. The social aspects are not only covered through user involvement, but also in the capacity of flexible housing to accept demographic change and thus stabilise communities. The economic aspects are addressed through the long-term vision that flexible housing engenders through future-proofing and avoiding obsolescence.

The beauty of flexible housing is that if one follows through the principles, and combines them with a response to climate change, one almost inevitably arrives at a sustainable solution that integrates the complete range of sustainable issues; however, the green rhetoric is a quiet one that eschews the superficial gestures of some sustainable architecture. Flexible housing potentially exceeds the accepted definition of sustainability — providing for the needs of the present without compromising the ability of future generations to meet their own needs — inasmuch as it is not about the avoidance of future compromise but the encouragement of coming change. There is a broader lesson to be learnt here. In the face of climate change, social fluidity and global economic change, the temptation is to pick off each as a 'problem' to be solved. What flexible housing shows us is that the best approach to sustainable design is not one of problem solving, because that just addresses limited aspects of the here and now, but of attitude forming across the spectrum. Flexible housing provides space for a degree of uncertainty in relation to the development of demographics, social needs and technological progress. By acknowledging change as an underlying parameter but accepting the level and extent of change as unknown, flexible housing is inherently sustainable.

Chapter 3 Notes

1 H. Priemus, 'Flexible housing: fundamentals and background', *Open House International*, 18, no.4, 1993, p.19.

2 Kate Barker, *Review of Housing Supply: Delivering Stability, Securing our Future Housing Needs*, London: Her Majesty's Stationery Office, 2004, p.23.

3 Andrew Rabeneck, David Sheppard, and Peter Town, 'Housing flexibility?' *Architectural Design*, 43, no.11, 1973.

4 'Ministry for Housing and Local Government', *Space in the Home*. Vol.6, Design Bulletins, London: HMSO, 1968.

5 Colin Davies, *The Prefabricated Home*, London: Reaktion Books, 2005, pp.127-29.

6 As quoted in: Javier Mozas, 'Concerning the life of houses. Another way of being flexible', *a+t*, no.13, 1999, p.11.

7 Davies, *The Prefabricated Home*, p.189.

8 Stewart Brand, *How Buildings Learn: what happens after they're built*, New York, NY: Viking, 1994.

9 This was from one of the many interviews that we carried out in the course of the research project. For obvious reasons, this particular developer wants to remain anonymous.

10 Between 1985 and 1996, average investment as percentage of

Chapter 3 Notes

GDP in UK housing was 3.5% compared with 6.3% in Germany, 5.9% in Canada or 5% in Australia and France. The Government-commissioned Barker report identified an actual need for around 250,000 new residential units per year over the next ten years in the south of England alone, but in 2003 only 170,000 units were actually being built nationwide. As demand exceeds supply, and will continue to do so according to recent projections, Barker argued that the UK is moving towards a society facing increasing problems of homelessness, affordability and social division. Barker, *Review of Housing Supply*.

11 David Gann's work is influential in arguing for the consideration of new technologies and their benefits for flexibility. See: David Gann et al., *Flexibility and Choice in Housing*, Bristol: Policy Press, 1999.

12 For a summary of the situation in the USA see Isaac Megbolugbe and Patrick Simmons, 'Housing Needs and Demand in the light of demographic trends to 2010: the US position', in *Meeting the Needs of the Future: the housing implications of demographic economic and social trends*, Liverpool: Housing Corporation, 1996, pp.9-25.

13 Penoyre and Prasad, *Accommodating diversity: the design of housing for minority ethnic, religious and cultural groups*, London: National Association of Housing Associations, 1993; Sarah Hollingworth, '*Domestic Diaspora*', MArch Thesis, University of Sheffield, 2007.

14 Ministry for Housing and Local Government, *Homes for Today & Tomorrow* (also known as the *Parker Morris Report*), London: Her Majesty's Stationery Office, 1961, p.9.

15 CABE and RIBA, *Housing Futures 2024: A Provocative Look at Future Trends in Housing*, London: Building Futures, 2004, pp.14-15. At a 1996 conference organised by the Housing Corporation, speaker after speaker called for flexibility to be taken into account in housing design. Housing Corporation, *Meeting the Needs of the Future: the housing implications of demographic economic and social trends*, Liverpool, 1996.

16 The Microflat Company, 'What is a Microflat?' 2002, <http://www.themicroflatcompany.com/HTML/main_fset.htm> [Accessed 22 March 2006].

17 Brand, *How Buildings Learn: what happens after they're built*, p.178.

18 Davies, *The Prefabricated Home*, p.11.

19 Stephen Kendall and Jonathan Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000, p.4.

20 John Habraken, 'Interventions: professional and user inputs. Design for adaptability, change and user participation', *Openhouse*, 5, no.4, 1980, p.18.

21 Caitriona Carroll, Julie Cowans, and David Darton, eds., *Meeting Part M and Designing Lifetime Homes*, York: Joseph Rowntree Foundations, 1999.

22 Julie Brewerton and David Darton, *Designing lifetime homes*, York: Joseph Rowntree Foundations, 1997, Joseph Rowntree Foundation; 'Lifetime Homes' <http://www.jrf.org.uk/housingandcare/lifetimehomes/> [Accessed 28 April 2005], Christian Woetmann Nielsen and Ivor Ambrose, 'Lifetime adaptable housing in Europe', *Technology and Disability*, 10, no.1, 1999.

23 'Adaptable housing could save millions', *Building Design*, no.1297, 1997, p.4.

24 Ibid. The Rowntree Foundation argue that to adopt their sixteen basic standards in new housing would only add between £100 and £300 to the cost of a three-bedroom house. This is probably an underestimate given another report that estimates it adds approximately 1% to the overall costs. See footnote 40 below.

25 Habraken, 'Interventions: professional and user inputs. Design for adaptability, change and user participation', p.17.

26 Jos van Eldonk and Helga Fassbinder, *Flexible Fixation: the paradox of Dutch housing architecture*, Assen: Van Gorcum, Eindhoven University of Technology, 1990, p.31. This excellent book also reproduces four pages of Leppla's diagrams.

27 Edward D. Stone, Stanley Sharp, and Cope B. Walbridge, 'The new house 194X: Planning for Economy and Flexibility', *Architectural Forum*, no.77, 1942, p.119.

28 CMHC, 'The Convertible House – Vancouver, British Columbia'

Chapter 3 Notes

<http://www.cmhc-schl.gc.ca/en/imquaf/afho/afadv/cohode/deflho/case2.cfm> [Accessed 20 December 2004].

29 Rudolf Dirisamer et al., 'Überbauung "Wohnen morgen" in Hollabrunn', *werk-archithese*, 64, no.11/12, 1977, p.22.

30 Priemus, 'Flexible housing: fundamentals and background', p.19. His argument arises from the situation in the Netherlands where 'housing lasts for over one hundred years', but is universal in its application.

31 Elma Durmisevic, 'Towards flexible infill systems', *Open House International*, 26, no.3, 2001, p.63.

32 BRE, 'Whole Life Costing' 2005, <http://www.bre.co.uk/service.jsp?id=48> [Accessed 4 May 2005].

33 Beyond Green and Housing Corporation, 'Seven Principles of Sustainable Regeneration and Development', Beyond Green, 2004, <http://housingcorplibrary.org.uk/housingcorp.nsf/AllDocuments/2798B2CA9F4E22A980256E61003FBC75/$FILE/7PRINCd.pdf> [Accessed 22 March 2006].

34 Alexander Henz and Hannes Henz, *Anpassbare Wohnungen*, Zürich: ETH Wohnforum, 1997, p.4.

35 Simon Allford, 'Interview with Simon Allford, AHMM', 2005.

36 Sue Belk, 'Interview with Sue Belk of Warden Housing', London, 2005.

37 Dickon Robinson, 'Interview with Dickon Robinson, Peabody', London, 2005.

38 This is essentially the same as the PFI (Private Finance Initiative) scheme developed by the UK Government to fund new public facilities, with the private sector responsible for the design, build and maintenance of the facilities, generally for a 30 year period. Thus far PFI has mainly dealt with the provision of new health, education and office facilities, with its use in the housing sector limited to refurbishment. It should be noted that PFI in general has been severely criticised both at the level of design and service, but also because of the real concern of handing over public buildings, with all their social complexities and responsibilities, to the private sector.

39 Kendall and Teicher, *Residential Open Building*, pp.227-31.

40 Bundesamt für Wohnungswesen Bern, 'Anpassungsfähigkeit = Nutzungsneutralität', *werk·archithese*, 64, no.11/12, 1977, p.30.

41 Edward Steinfeld, 'Designing adaptable housing to meet barrier-free goals.' *Architectural Record*, 167, no.3, 1980, p.57.

42 Herbert Prader, *Partizipation im Sozialen Wohnhausbau*, Wien: Selbstverlag der Architekten Prader Fehringer Ott, 1977.

43 Kendall and Teicher, *Residential Open Building*, p.221.

44 Ottokar Uhl, 'Ablesbare Partizipation', *Bauwelt*, 72, no.38, 1981, Nur Esin Altas and Ahsen Özsoy, 'Spatial adaptability and flexibility as parameters of user satisfaction for quality housing', *Building and Environment*, 33, no.5, 1998.

45 Barker, *Review of Housing Supply*, p.111.

46 John Weir, 'Interview with John Weir, Haute Future', Banbury, 2005.

47 John Habraken, *Supports: an alternative to mass housing*, London: Architectural Press, 1972, p.82.

48 Ibid., p.15.

49 Nabeel Hamdi, *Housing Without Houses: participation, flexibility, enablement*, New York: Van Nostrand Reinhold, 1990, p.45. Hamdi is summarising, rather than endorsing, this criticism of Habraken.

50 Ottokar Uhl, 'Democracy in Architecture', in *The Scope of Social Architecture*, ed. by Hatch, C. R., New York: Van Nostrand Reinhold Company, 1984, p.41.

51 'PSSHAK Mark 2: Flexible GLC housing takes a step forward', *Architects' Journal*, 161, no.21, 1975, p.1071.

52 The fact that later studies have shown that the project has not been altered much is down more to the simple fact that later tenants and managers were not briefed on the potential for change, than it is down to inherent design faults. See Rebecca Pike and Christopher Powell, 'Housing Flexibility Revisited', *MADE*, no.1, 2004.

53 C. Richard Hatch, ed., *The Scope of Social Architecture*, New York: Van Nostrand Reinhold Company, 1984, pp.38-39.

54 Jon Broome, 'Mass housing cannot be sustained', in *Architecture and Participation*, ed. Blundell Jones, London, Spon 2005. p.65.

4

CASE STUDIES IN FLEXIBLE HOUSING

Traditional Japanese House

001

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1850/1995	Japan	Kazuhiko + Kaoru Obayashi	Single-detached house

This house is representative of the traditional Japanese house that is organised as a series of interconnected spaces that can be joined or divided by means of sliding partition walls. The individual rooms are only separated by lightweight walls and can never really be fully (acoustically) isolated. The flexibility that derives from this principle, is one of indeterminacy. The openness of the plan as well as the frame construction suggest that functional and social changes can be dealt with easily — both on a daily as well as on a periodic or even longer term basis. Connections between rooms can be opened or closed through sliding screens, which make it possible to change the size and the function of a space in a matter of seconds: two individual rooms can be joined by simply opening up two large screens so that two small spaces become one large room that can be used for a specific festivity or family gathering. The actual flexibility and adaptability of the house is thereby completely dependent upon the active participation of the users (as well as a specific type of furniture): by pulling out futons from a storage cupboard, a room that was used as a dining or sitting room can be transformed into a bedroom; the minimal approach to furnishings, and the relative lack of other clutter, demands a discipline to achieve flexibility that may be beyond normal living patterns, but nonetheless the principle remains and has fascinated generations of architects. Flexibility is also enabled through a modular approach to design. The size of the rooms is based on the standard measure of tatami mats, with rooms made up of a set of these mats. i.e. 6 or 8; these and other building components are thus interchangeable.

Ground Floor Plan

Plan Drawing Scale 1:200

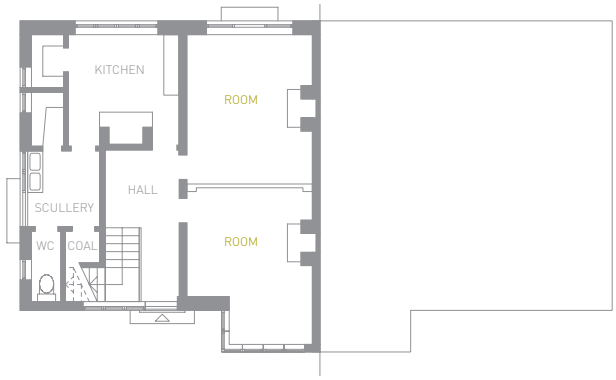
Cottages

004

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1901	Britain	N/A	Semi-detached house

The design of this cottage for a town southwest of London is determined by its date and the people it was built for. The plan allows each principal room to be accessed from a central hall — and so not by inter-communicating suites. Whilst the plan assigns a particular use to each room, i.e. bedroom, drawing room and dining room, there is no obvious hierarchy, with each room a plain rectangular shape. This cottage thus exemplifies the inherent flexibility of generic space, which can be adapted according to changing social needs. Thus, in the ground floors, the separately accessible rooms that were originally designated as drawing room and dining room, can now serve a number of functions, i.e. a guest bedroom or a study space. On the first floor, there is no master bedroom with an en-suite bathroom but 3 equally sized rooms that use one shared bathroom. The house can be occupied by different mixes of people, from a family to three to four independent persons sharing. Built over 100 years ago, the dwelling is still generous by contemporary British standards with rooms between around 10 and 15m^2. The positioning of the staircase toward the front of the house means that the 2-storey house could be easily divided into two apartments, as has often happened in the intervening years.

First floor



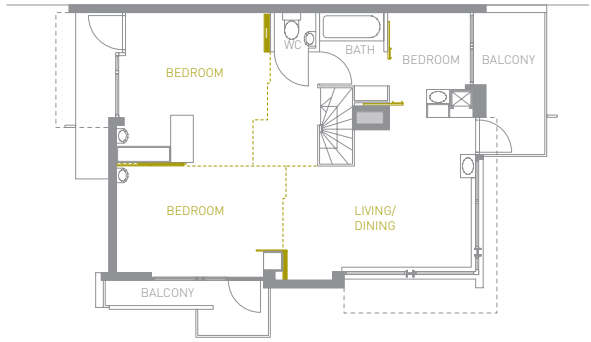
Ground floor

Plan Drawing Scale 1:200

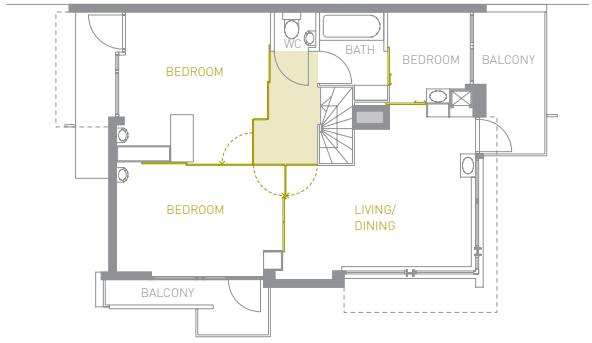
Schröder Huis

009

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1924	The Netherlands	Gerrit Thomas Rietveld	End of terrace



First floor, day use



First floor, night use

Of all the seminal houses of the twentieth century, it is the Schröder Huis that has most fascinated architects as an exemplar of flexibility. However, some of this interest is misplaced, since the house is a highly tuned response to a very particular set of requirements, and therefore it is problematic to extrapolate generic principles from it. The house is organised on two storeys around a central core that contains the staircase. Whilst the ground floor plan is subdivided in a conventional way into separate rooms: kitchen / dining, a reading room, a studio room (plus adjacent dark room) and a bedroom — the hinged sectional moveable screens of the first floor allow for the creation of one single continuous open space.

The design of the Schröder Huis joins the spatial concepts of De Stijl with Mrs Schröder's aims to overcome the socio-spatial hierarchy of the normal house whilst also maintaining some privacy. As in the traditional Japanese house, the flexibility of the Schröder Huis relies on the participation of the user, who is constantly employed to create enclosure and then dissolve it again. During the day, the hinged screens are pushed towards the outer walls of the building and either kept in storage cupboards or gathered behind short fin walls. When closed again, the screen in the centre doubles up as a door, so that each room can be accessed separately from the hall: two rooms for sleeping and one living / dining room.

Plan Drawing Scale 1:200

Hufeisensiedlung

010

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1925-31	Germany	Bruno Taut and Martin Wagner	Multi-storey apartment block [1072]

Typical apartment

The Hufeisensiedlung was one of many large-scale housing estates built in the 1920s and early 1930s to ease an overall shortage of around 100,000 dwellings in Greater Berlin alone. The client was GEHAG (Gemeinnützige Heimstätten-, Spar- und Bau-Aktiengesellschaft), one of the largest of the co-operative housing societies, housing groups, and other public housing associations that were formed in that period. Bruno Taut, their chief architect, designed and built over 10,000 dwellings between 1924 and 1931 in Berlin, amongst them the Waldsiedlung Zehlendorf (1926) and the Wohnstadt Carl Legien (1929).

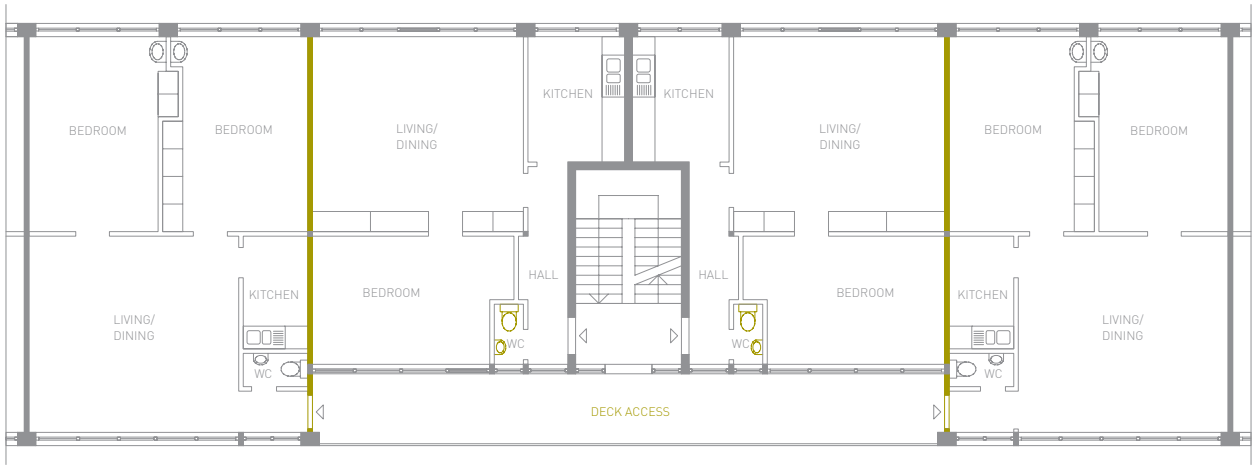
The Hufeisensiedlung consists of 1,072 dwellings, 600 of which are accommodated in 3-storey apartment blocks and 472 in row houses. Overall, only four different plan typologies were applied. The central part of the estate, the horse-shoe-shaped apartment block, contains predominantly two apartments per flight of stairs, each apartment having 3½ rooms, one kitchen and a bathroom; two rooms also have an adjacent loggia space. In order to accommodate a wide range of occupants and different mixes of users, the distribution of space within each apartment was kept as 'neutral' or indeterminate as possible. Rooms, with no designated use, are of a similar size and all are accessible from a central corridor. Whilst the apartment size is on the small side at 49m^2, the arrangement of rooms allows different modes of occupation: the user decides which of the rooms should be a living, a dining or a bedroom or whether, for example, all rooms should be bedrooms with the kitchen doubling up as a living room.

Plan Drawing Scale 1:200

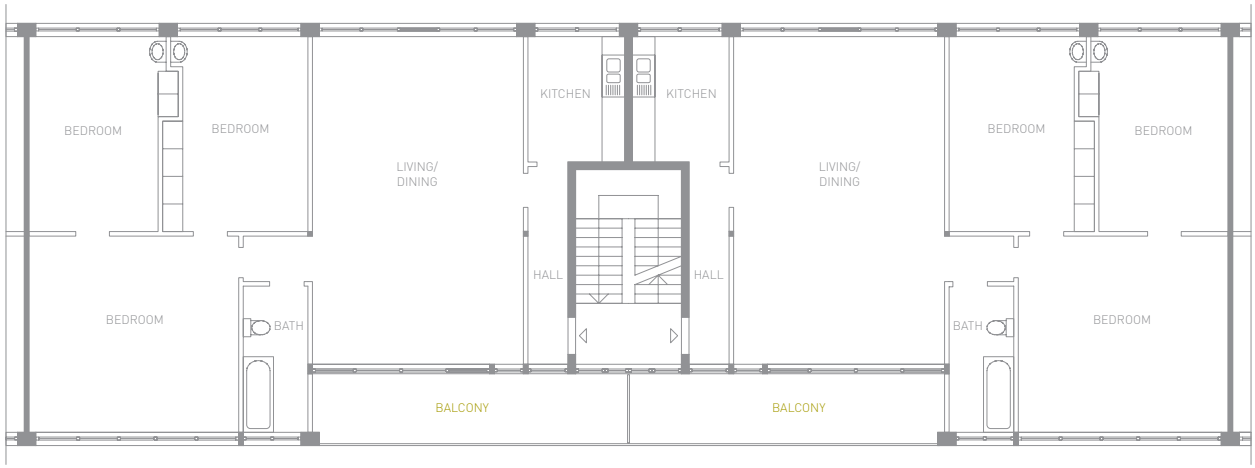
Verwandelbare Wohnung

012

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1927	Germany	Karl Schneider	Unrealised



Option 1
4 apartments with deck access



Option 2
2 apartments with balcony

This project for an apartment block in Hamburg-Duhlsberg was submitted to a competition for Kleinstwohnungen (very small apartments). The plan shows four apartments, which can be combined into two units, the first such intentional use of this device. The services in the enlarged unit remain in the same location: one of the wet spaces that used to be a kitchen is slightly enlarged and the other former kitchen space becomes a bathroom.

Whilst this project is still based on a conventional constructional system, it hints at the method of construction later used by Mies van der Rohe in the Weißenhofsiedlung Wohnzeile. Schneider's plan shows a regular grid of loadbearing columns integrated into the layer of the external envelope against which the internal partition walls can be built. Schneider differentiates between the loadbearing column and non-loadbearing wall, which can be removed or added according to a user's needs.

The deck access in this project illustrates a skilful way of dealing with circulation space. In the example with four apartments, access to the two apartments adjacent to the staircase is directly from within the enclosure of the staircase, whilst the two outer apartments are reached by stepping out onto the deck. The deck is not closed off by means of a door or shutter, but is left open and thereby allows its use by the occupants of all four apartments. When the four apartments are transformed into two units, access to the apartment to the right and to the left of the staircase is provided straight from the staircase landing. The deck becomes a private space — divided by a screen into two equal parts — with access either through a door from the staircase or from within the apartment.

Plan Drawing Scale 1:200

Wohnzeile, Weißenhofsiedlung

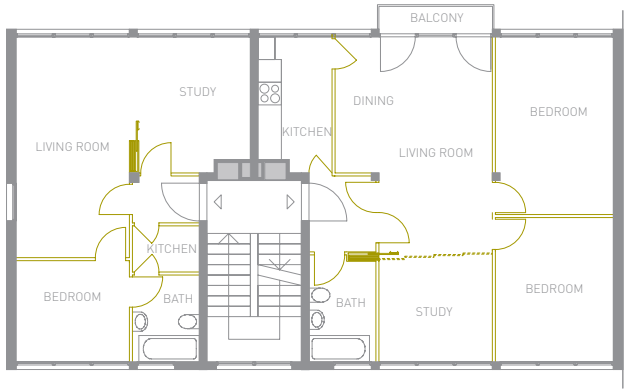
014

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1927	Germany	Ludwig Mies van der Rohe	Multi-storey apartment block [24]

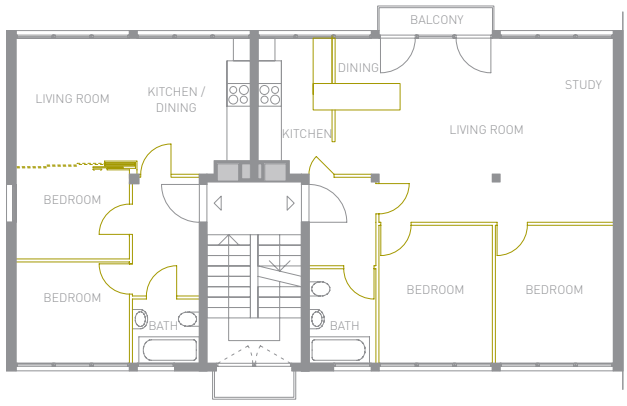
In Mies van der Rohe's apartment block for the Weißenhofsiedlung, the initial floor plans are completely open plan apart from one or two internal structural columns. To one side of the stairs is a smaller apartment of 45m^2 and to the other side a larger one of 72m^2. Bathrooms and kitchens are pushed against the party wall and stair enclosure. Four identical of these units, staircase plus small and large apartment, are set repetitively next to each other (Haus 1, Haus 2, Haus 3 and Haus 4) into one long Zeile or row. The combination of open plan spaces and services arranged around a core is similar to the flexible principles of the speculative office block, where generic space is provided for the client to fit out as they wish.

Mies van der Rohe then called on others to finish these raw spaces with internal partition walls, demonstrating both the ideological basis and the real practicality of his approach to flexibility.

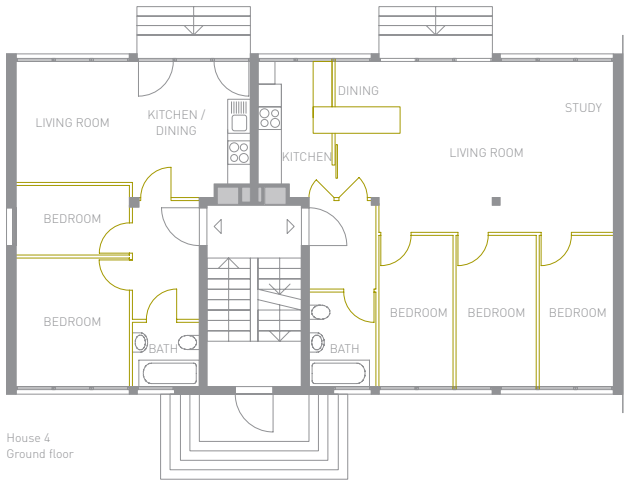
The large apartment on the ground floor of Haus 1, designed by Lilly Reich, features two living rooms, one bedroom, a kitchen and one bathroom. On the first floor of Haus 3, the Austrian architect Franz Schuster planned an apartment for a childless couple: one bedroom, living room, a large kitchen and a bathroom. On the second floor of Haus 4, the Schweizer Werkbundkollektiv proposed a bachelor apartment with a room for a piano and a small study separated from that room by a moveable partition wall. Next door, the larger apartment is fitted out by the same architects to accommodate two bedrooms (one with a double bed and the other one with two single beds), a small dining / living room and a study. Other architects engaged in Mies van der Rohe's project included Adolf Meyer, Rudolf Frank, Richard Lisker, Arthur Korn, Brüder Rasch, and Adolf Schneck.



House 4
Second floor



House 4
First floor



House 4
Ground floor

Plan Drawing Scale 1:200

Maisons Loucheur

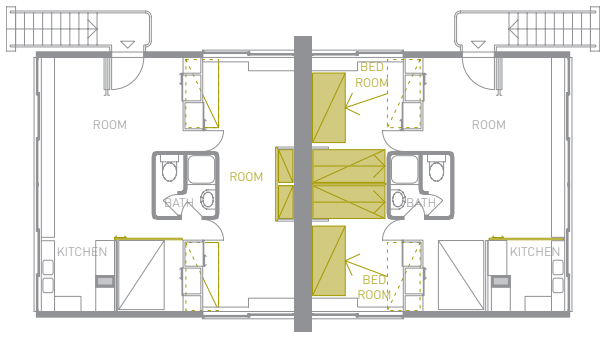
016

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1928/9	France	Le Corbusier	Semi-detached

Le Corbusier's Maisons Loucheur were developed as one response to the Loi Loucheur, a government programme under which a total of 200,000 dwellings for sale and 60,000 for rent were built within 5 years (a number well below the 1 million dwellings needed). The architect, who had been working on the idea of the adaptable floor plan since his Maison Dom-ino project (1914), proposed a small raised building of 46m^2 within which moveable and fold down furniture makes the best use of the tightly planned area through the course of the day. The doubling of uses within each area expands the house, according to Le Corbusier's calculations, to give the equivalent of 71m^2.

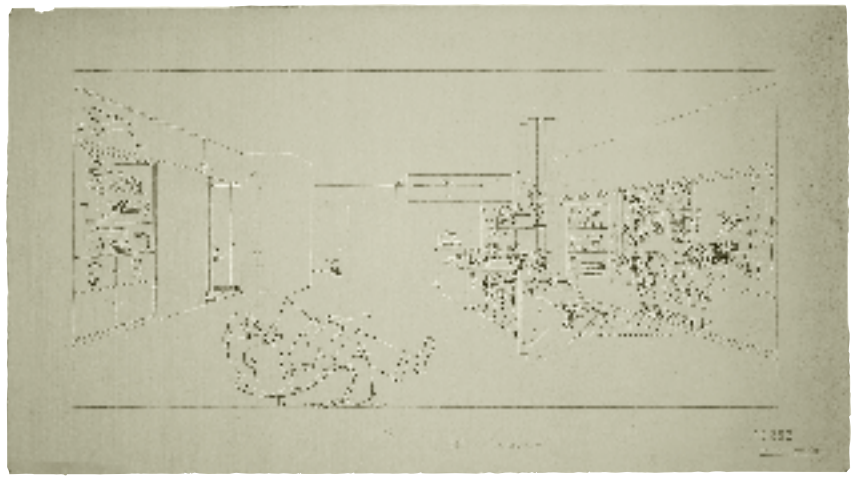
Le Corbusier had already explored this idea in his buildings for the Weißenhofsiedlung, which have a central living area that is one large space during the day and turns into a diversified series of spaces at night. For the Maisons Loucheur, however, the moveability is taken to its extreme with complex systems of moveable walls, and folding and moveable beds allowing multi-usage of the same space.

A thick stone wall provides the backbone for two units, one attached to either side of the wall. The units themselves were envisaged as entirely prefabricated: they would leave the factory on the back of a lorry complete with interior finishes and could be put up within a matter of days. The house was designed for a family with up to four children: a large room or salle for dining and other daytime activities, a kitchen that can be shut away by means of a sliding screen, beds that disappear beneath built-in wardrobe elements and thereby make space for a work or study table — all arranged around the central freestanding bathroom element. The area under the building, as in later American examples, can be appropriated by the user for their own needs, from simple storage to adaptation as a workshop.



First floor plan
Day use

First floor plan
Night use



Plan Drawing Scale 1:200

Housing Block Erasmuslaan

017

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1931	The Netherlands	Gerrit Rietveld	Terrace [4]

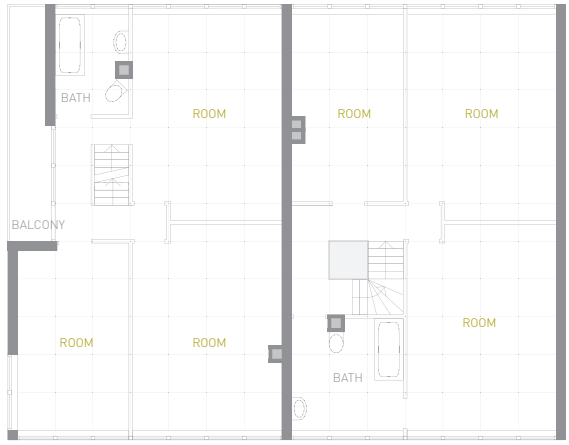
The houses on Erasmuslaan, Utrecht, simplify some of the principles that Rietveld first developed in the Schröder Huis. The plans are based on a one-metre module and a structural system that allows the free subdivision of the open space. On the ground floor, space can be adjusted and subdivided by means of folding concertina walls, which are guided on floor and ceiling tracks. The upper storeys are divided more conventionally by partition walls, whose positions follow the underlying grid, with all rooms separately accessible off the vertical circulation core.

In each of the four houses, staircase, kitchen and bathroom are grouped together and are placed to one side of the space of each living unit. On the ground floor, the walls enclosing this core are the only fixed elements in plan. The concertina walls divide or open up the remaining space. If these wall panels are pushed to one side against the fixed wall, the openness of the large space (11 metres in length and between 4 and 7 metres in width) emerges to its full extent. If pulled out, the panels divide the space into up to three smaller spaces of 15m^2, 20m^2 and 24m^2 (though it should be noted that one of these 'rooms' does not have its own access from the central core, thus potentially limiting its usage).

Unlike Mies van der Rohe's Weißenhofsiedlung project, the façade is not interrupted with structural elements, nor are there any loadbearing columns in the centre of the space. At Erasmuslaan, the crosswalls are a double skin of loadbearing brick which support I-beams that span the width of the each house. In theory, therefore, each of the internal walls could be placed somewhere else or could be removed altogether.

This structural principle enables a continuous band of steel framed windows on the façade. Yet, in order to provide possible connection points for the establishment of internal partition walls, slightly wider window profiles are placed at two-metre intervals.

Ground floor



First floor

Plan Drawing Scale 1:200

Kleinwohnung

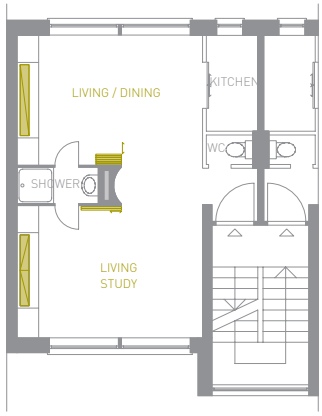
018

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1931	Germany	Carl Fieger	Study

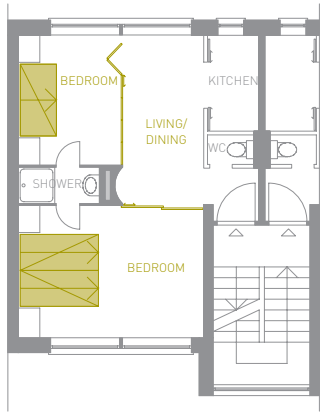
Built as a prototype of a minimal apartment of 40m² for the Berlin building exhibition in 1931, Carl Fieger's Kleinwohnung can be transformed from a two bedroom apartment at night into living and dining room plus study space during the day.

The main mechanisms with which this transformation is produced are foldable beds and sliding walls. By day the beds can be folded back into a wall recess with their undersides flush against the wall; they thereby more or less disappear and make space for other activities to happen. The space in front of the smaller bedroom can be used, day and night, as a small dining area and provides, together with the kitchen, a WC and the shower room, the only fixed points in this scenario.

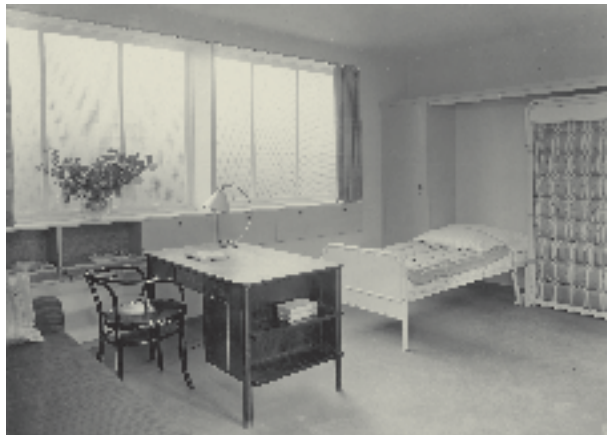
By night, the two 'bedrooms' are given privacy by folding walls that slide out from the central core. The bathroom, reduced to the size of a shower cubicle, is located in the centre of the apartment, thereby suggesting a division of the space into two equal parts. The bathroom has a door to each side, thus obviating the need for a corridor and allowing night-time access from both bedrooms without disturbing the other occupants of the apartment.



Day use



Night use

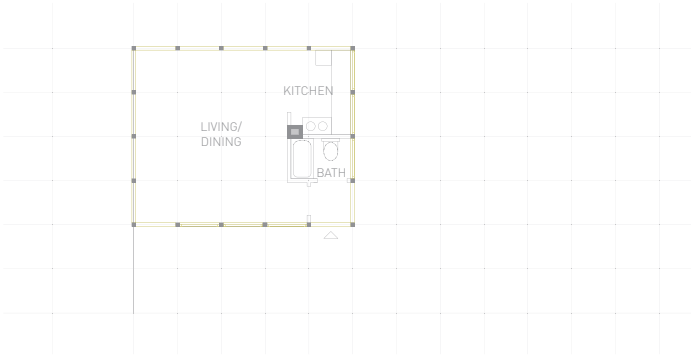


Plan Drawing Scale 1:200

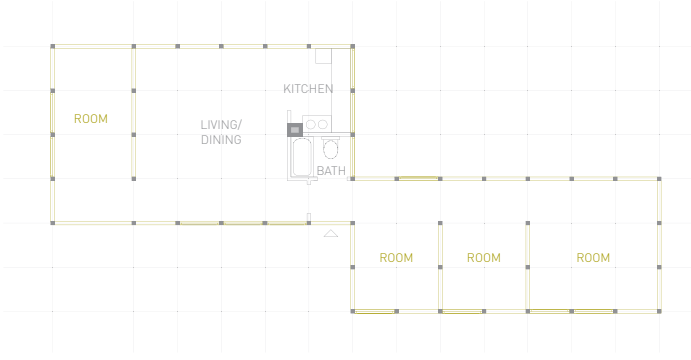
Werfthaus

021

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1932	Germany	Otto Bartning	Study



Basic module

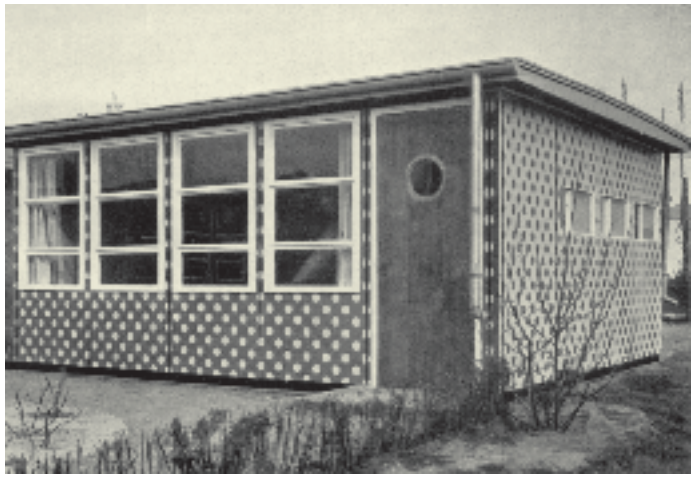


Basic module with extensions

Otto Bartning's Werfthaus was developed for the 1932 German competition entitled *Das Wachsende Haus* (The Growing House), which sought architectural solutions to the issue of the affordable and adaptable house. The competition encouraged designs that started off with a core house, which could then be extended in stages according to the financial means of its occupants. The adaptability and extendability of the house was to be designed-in from the very beginning.

Otto Bartning's submission to this competition was called Werfthaus (Shipyard House), referring to its proposed place of production. The entirely prefabricated house, which was built as a prototype for the Berlin summer show of 1932, consists of a thin steel frame filled in with panels. The core house is a 25m^2 box which provides a small hall, a bathroom, a kitchen and a combined living / sleeping space of around 18m^2. Over time, the house can be extended using the same set of elements (four different panels: 1 door panel, one solid panel, one panel with a large window and one with integrated smaller windows) up to a maximum size of 60m^2.

One of the premises for the design of the house was to provide easy and fast assembly and disassembly of its parts. The point foundations are poured in situ, onto which the frame is mounted. The frame is subsequently filled with panels that are a composite product of copper alloyed steel and cork. The interior walls are made of plywood and are, as all other parts of the building, bolted to floor and ceiling. The bolted construction allowed for quick dis- and re-assembly at another site, as well as ease of change of internal and external configurations.

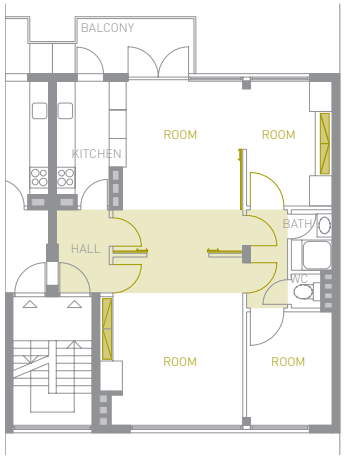


Plan Drawing Scale 1:200

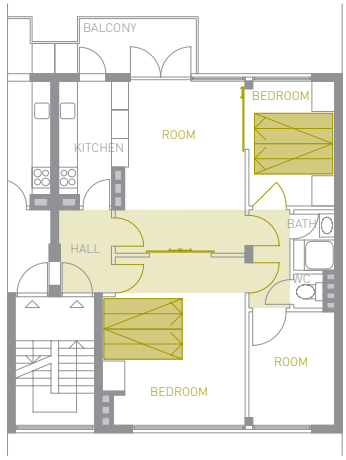
Woningenkomplex Vroesenlaan

022

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1934	The Netherlands	Johannes Van den Broek	Multi-storey apartment block



Day use



Night use

The Dutch architect, Johannes Van den Broek, was one of the pioneers of flexible design. He argued that, through a more efficient organisation of a floor plan, including the integration of sliding walls and folding beds, the mass housing apartment typology could become smaller without the sacrifice of comfort. Working in collaboration with Heinrich Leppla he investigated the use-cycles of residential space, both at the level of daily change and at the level of change over time.

The Vroesenlaan project represents such a conscious attempt to deal with the complexities and changing nature of life. The skill lies in the overprovision of doors, which anticipate but do not determine division and occupation. The hall, a small space adjacent to the entrance in the centre of the plan, has three doors. One provides access to the kitchen, which is straight ahead. The other two doors, just next to each other with a short stretch of wall in-between them, access the same long space. The central elongated space of living/dining and study room can be divided into two separate rooms by means of sliding panels. The area next to the kitchen is dedicated to living and dining, the other area is designated as a study room (though over time these uses may change). The study room can be turned into a bedroom by folding down beds that are integrated into the design.

On the other side of the this elongated space is a sequence of: sliding walls that separates the dining and living room from a small room, a door, a short stretch of wall, another door (this mirrors the set up on the opposite side of the room) and then a longer partition wall. Behind the two doors is another small corridor, which has another four doors. One door provides access to the room next to the living and dining room, the second door is the door to the bathroom, the third door accesses a WC, and the fourth door opens into the only dedicated bedroom of the entire apartment.

The overprovision of doors enables the separate accessibility of each room as well as the bathroom. How the apartment and its spaces are used is then left to the interpretation of the inhabitants. A study of the building conducted by a sociologist in 1965 found that there were 24 different ways of organising activities within the space.

Plan Drawing Scale 1:200

Letohradská

025

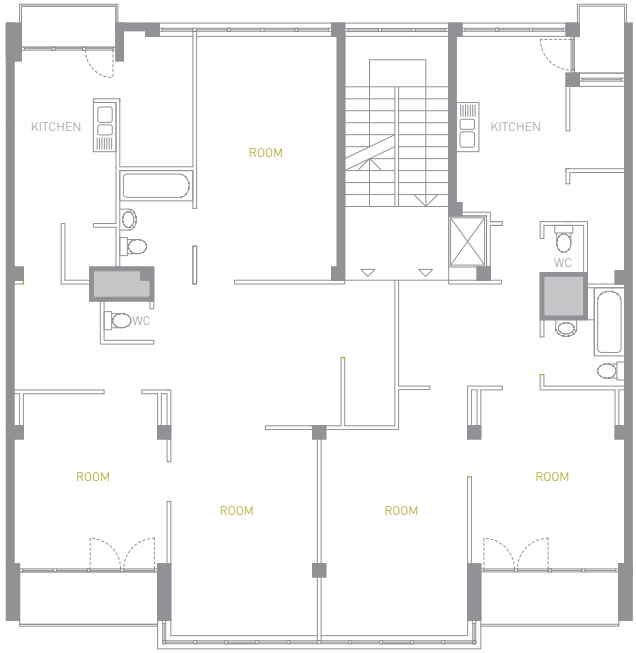
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1937	Czech Republic	Evzen Rosenberg	Multi-storey apartment house [12]

The Letohradská apartment block in Prague employs a strategy of indeterminate space, providing rooms without specific designation. In contrast to Bruno Taut's Hufeisensiedlung, where the same strategy is applied to mass housing, Rosenberg used it for inner city luxury apartment houses with generous space standards.

Each floor, apart the top and ground, has two units: one 2-room (just over 80m^2) and one 3-room apartment (around 125m^2). The individual rooms within each apartment can be accessed via a central hall. The larger apartments have added flexibility of use through additional doors or sliding walls, between two rooms.

The open column and beam construction allows for the relatively free distribution of rooms. Partition walls are non-loadbearing, which leaves the entire area of each storey indetermined as to their specific use — as can be seen in the design of the top storey apartment in the same development. The only limit in the subdivision of the plan is imposed by the number of connection points to service ducts and the relatively deep plan of the building.

Top floor



Typical floor

Plan Drawing Scale 1:200

Flexible Space

029

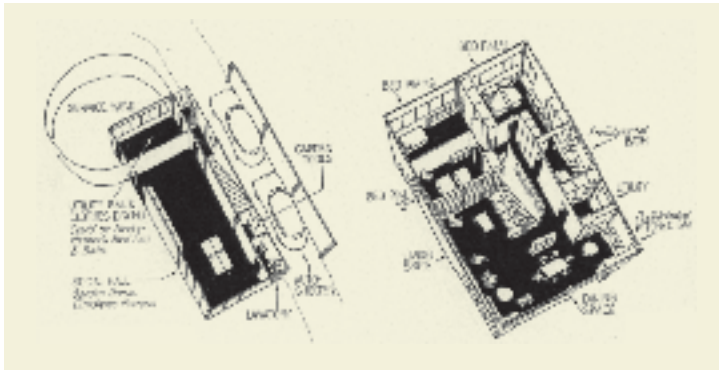
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1942	USA	William Wilson Wurster	Study

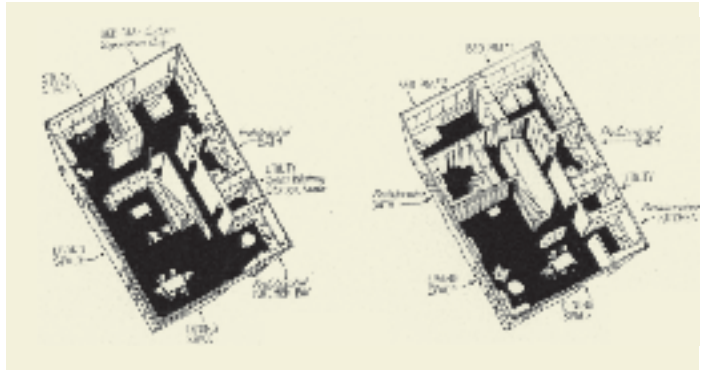
Ground floor
possible subdivision

First floor
option with 3 bedrooms

William Wurster's proposal for 'The new house 194X' competition was initiated by a short manifesto in which he lists the inherent and fixed problems of residential dwellings: unalterable areas, arrangements with permanent wall partitions, and a size that is usually limited to minimum initial needs and impossible to expand except at considerable expense. In place of these he proposes a fixed outer shell — an undivided space of 36 feet by 54 feet (a total area of almost 180m^2) which is raised one storey above ground level, with a long staircase arriving in the centre of the elongated plan. The principle here is not one of gradual expansion and addition, but of subdivision. Wurster starts with an abundance of inexpensive space that can then be adjusted over time. With this one-floor house Wurster uses the concept of excess space; space that is as simple and economical as loft construction and allows everything from maximum openness to complete division.

Initially, the completely open space would be divided only by a completely prefabricated kitchen bay, bathroom and closets. Later on, with children, it could be further subdivided into a series of smaller separated areas or rooms through the addition of closet units. These, Wurster indicates, are factory-fabricated units for space division and storage. Two standard sizes in two heights cater for all needs: as clothes closets, as shelves for books and magazines, as a sideboard, as a storage cupboard for brooms and ironing equipment and as laundry unit. As with Corbusier's Maisons Loucheur, Wurster offers additional space beneath the house for expansion: a space that can be the garage, a garden store, a social hall and /or a utility room.





Plan Drawing Scale 1:200

Prefabrication

032

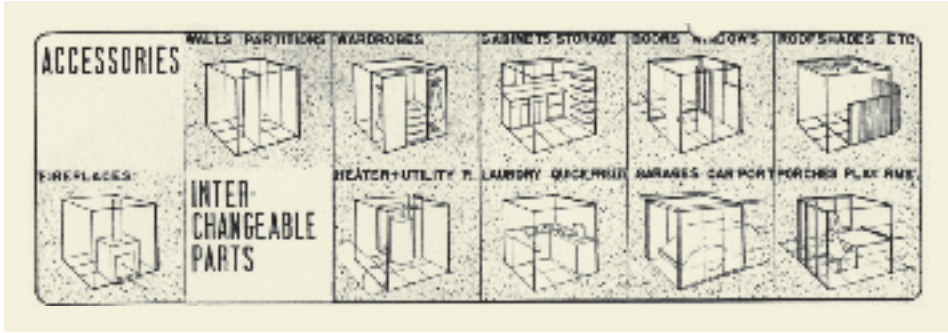
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1942	USA	Walter F. Bogner	Study

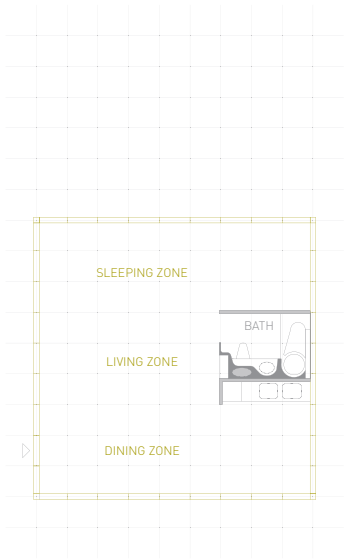
Like Wurster's Flexible Space project, Walter Bogner's proposal for this house responds to a brief set by the American journal *Architectural Forum*, which asked for a design that should be adaptable enough to accommodate the different needs resulting from changes in occupation as a family grows older.

The architect developed a concept for a house that comes in four stages: groundwork, shell assembly, installations unit and accessories, and interchangeable parts.

The shell assembly consists of the enclosing walls and a roof, based on an 8 foot grid in both horizontal and vertical dimensions; this can be further subdivided into three. Interchangeable panels are then installed into this grid. The panels can be external or internal, solid or glazed.

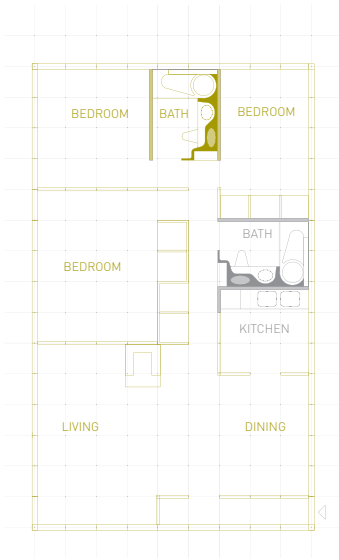
Internally these parts are considered like furniture and include wall partitions, wardrobes, cabinet storage, doors and windows, roof shades as well as a heater and utility room, a laundry and quick freeze room, a garage or car port and a porch or play room. Bogner illustrates a first step, in which the user would have a basic unit of 24 feet by 24 feet, amounting to around 53m^2. The only space-defining element in this shell is a prefabricated bathroom unit with attached kitchen. By adding partitions, still within the same shell, the plan can be subdivided to form up to two bedrooms, an enclosed kitchen and a living and dining room. By adding further 8 by 8 feet modules, the basic plan can be enlarged for greater comfort or changes in the composition of its users.





Basic shell

Basic shell, divided into rooms



Extended basic shell

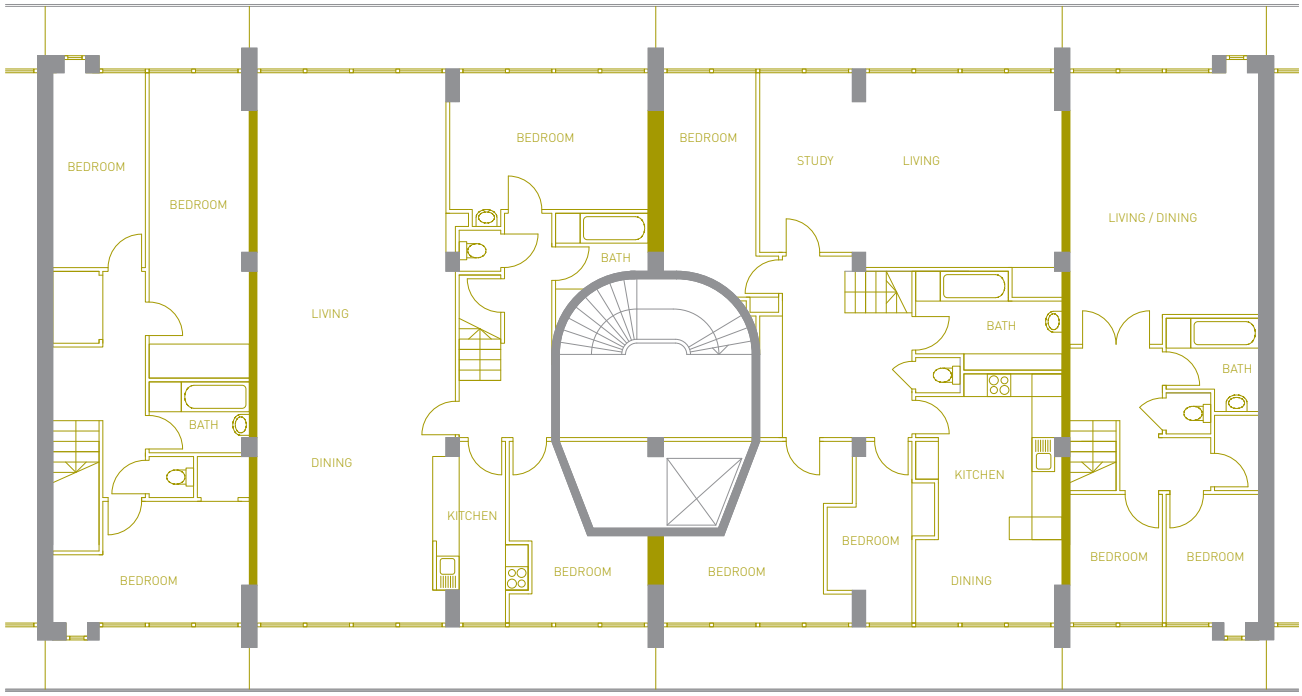
Plan Drawing Scale 1:200

Kristalbouw

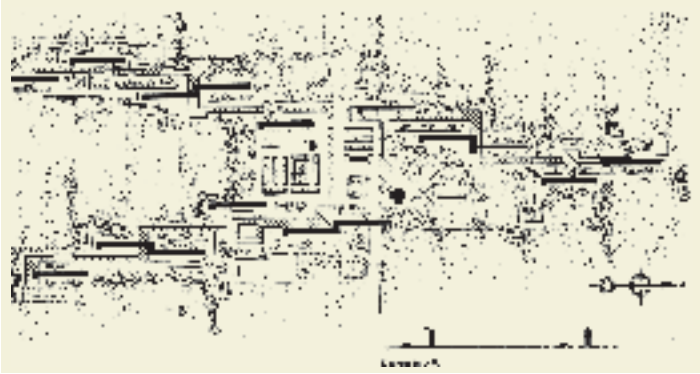
036

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1952	The Netherlands	Jan Trapman	Study

Trapman's Kristalbouw project has been described as a precedent for the development of John Habraken's approach of 'supports' and 'infill'. The proposed building was to be built as a concrete frame structure supporting lightweight floors. A layer along the outer edge of the structure can either be used as a balcony for apartments that are accessed via an internal corridor, or as an open gallery access. Apart from the placing of staircase and lift cores at regular intervals in the centre of the plan, the use and design of the buildings is left open within the support structure. In a series of drawings illustrating the feasibility of the project Trapman shows a range of alternatives: different ways of subdivision, internal and external access, one-storey apartments as well as maisonettes (made possible by the light floor construction that allows the location of stairs within individual units) and residential use as well as the use of the structure as a hotel. He also proposed that apartments could be extended sideways or upwards over time, though this degree of flexibility would be dependent on, and in all probability limited by, mutual cooperation with neighbours.



First, fourth and seventh floor



Plan Drawing Scale 1:200

Järnbrott Experimental Housing

037

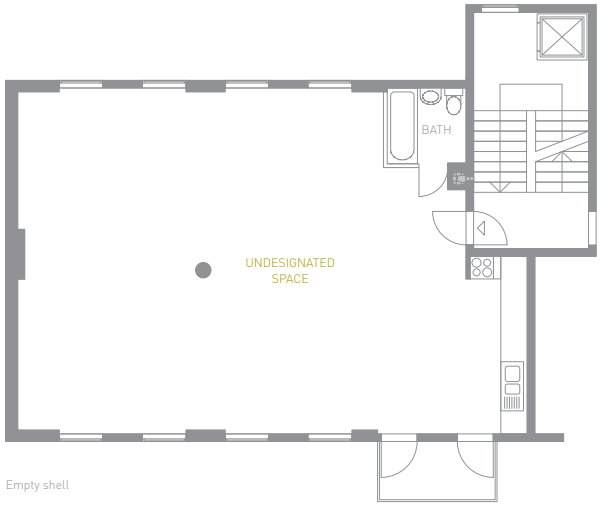
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1953	Sweden	Tage + Anders William-Olsson	Multi-storey apartment block [20]

This experimental housing project was the winner of an ideas competition for new housing types arranged by the Göteborg municipal housing company Bostadsbolaget in 1950-51. The building has 20 apartments on five storeys: two apartments of 42m^2, eight apartments of 54m^2, five apartments of 68m^2 and five apartments of 83m^2, all arranged around two staircase cores.

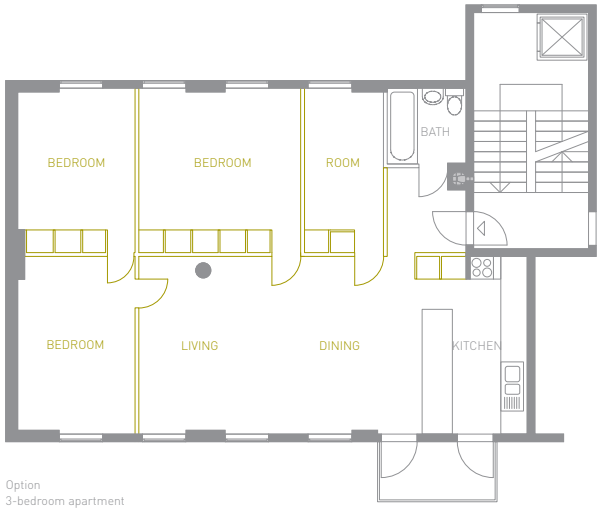
Tage and Anders William-Olsson's project has two main features: an open plan and modular infill. The fixed elements of the plan were reduced to a bathroom on the side of the staircase and a kitchen unit along the party wall. There was then just a single column in the middle of an otherwise open space. All partitions were made with a modular system of demountable panels, either 20 or 60cm wide (and 80cm wide elements for doors), with open joints.

Prospective occupants were shown suggestions for interior layout, which they could determine before they moved in. Published plans show the variety of arrangements for each apartment. The modular partitioning also enabled tenants to continue to change the layout over time. A subsequent study showed a wide range of developed layouts, with living rooms from 18m^2 to 37m^2 (where initially they had been 18m^2) and other rooms down to a minimum of 5m^2.

The building still stands, but for number of reasons the demountable walls have been replaced. There were problems with acoustic transmission between rooms and with the visible joints, which residents disliked and wallpapered over. The housing association that managed the apartments also lost interest in the flexible aspects of the scheme and ceased the supply of spare parts.



Empty shell



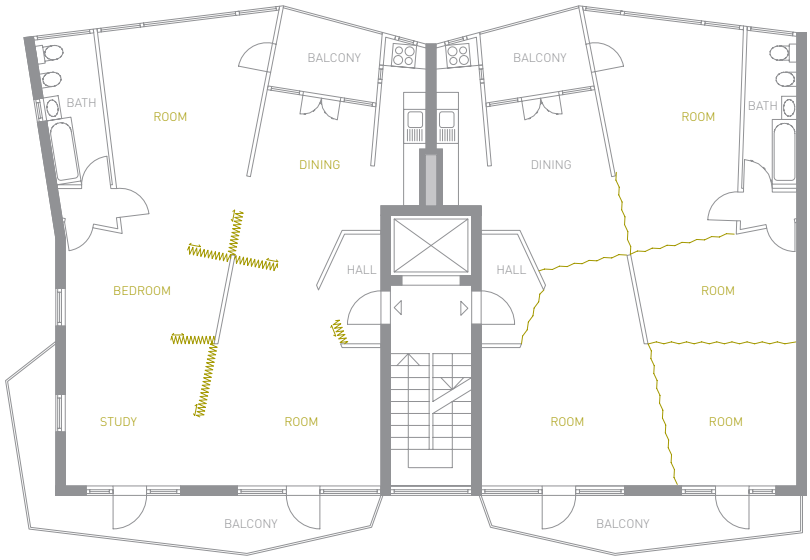
Option
3-bedroom apartment

Plan Drawing Scale 1:200

Single-space House for Four People

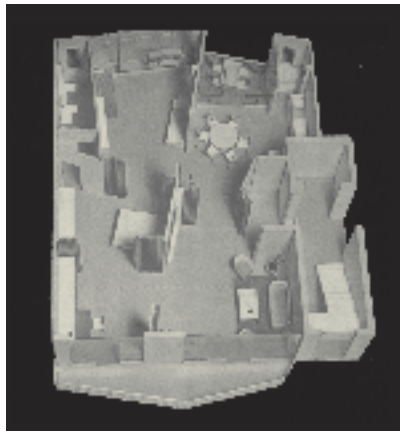
039

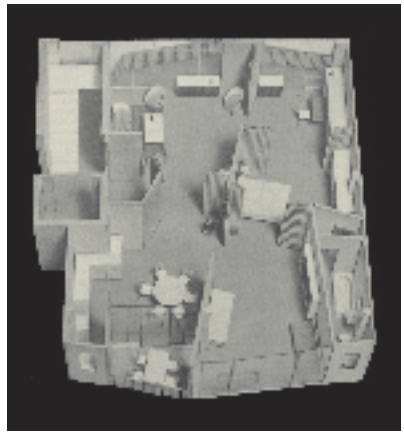
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1957	Italy	Gio Ponti	Study



Typical floor plan
open and closed partition walls

This project develops the idea of a single space that is surrounded by the essential minimum of services, with kitchens and bathrooms pushed to opposite sides of a single large space. A series of angled sections of wall provide the connecting point for concertina panels. The various permutations of the opening and closing of these panels gives a wide variety of potential spaces and use patterns. Areas can be connected with each other as well as isolated, though never acoustically. In the end, the occupation of the house, whilst suggestive of flexible use, is actually over-determined by the design. To live in these spaces with their interconnections and rooms opening off one another would demand a real commitment to the ideals of flexibility.





Plan Drawing Scale 1:200

Kallebäck Experimental Housing

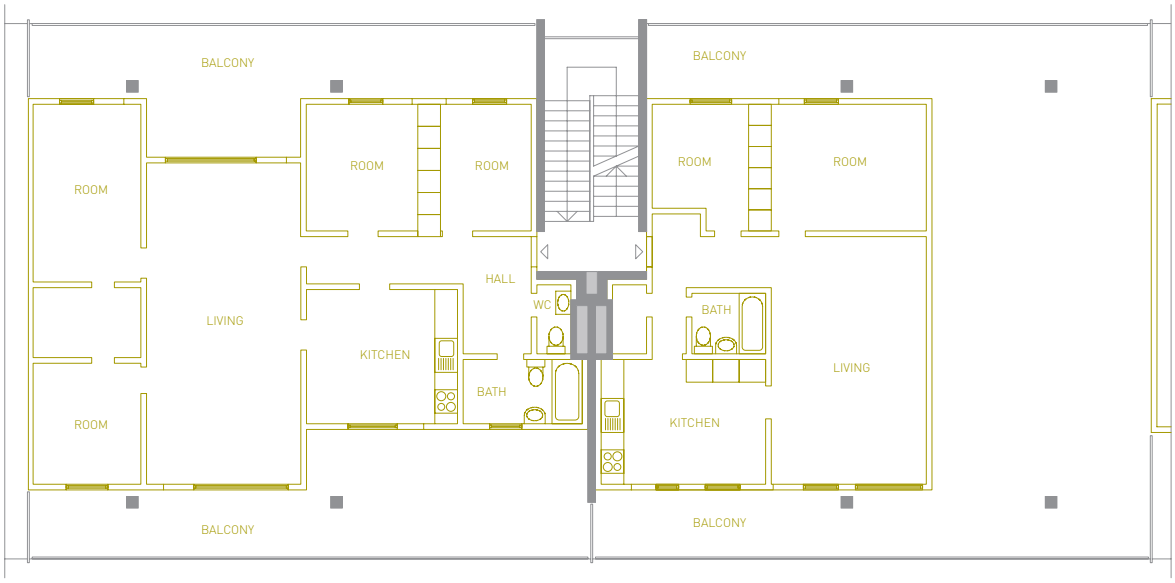
042

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1960	Sweden	Erik Friberger	Multi-storey apartment block [18]

Built at the urban periphery of Göteborg, the Kallebäck housing development can best be described as a shelving unit that provides individual sites for single detached houses. It takes the concept of support structure to its logical conclusion, stripped down to the provision of the floor of the shelf, vertical circulation and a few service connections. Each house is set on a concrete floor plate, and can have its own façade treatment, floor plan and (surprisingly) roof. The front of the 'shelf' forms the edge of a balcony for each house. The design of the house is then based around a system of demountable partition walls, wall cupboards and doors, all fixed to the concrete floor plate. 2 people are needed for changing parts: one to hold the element, another one to fix it.

The initial idea was that the shelves would be filled up over time. However, such was the popularity of the scheme that all the plots were taken from the start and each of the houses designed more or less to their full extent. Whilst this might have been against the wishes of the architect, the scheme still retains a playful sense of a set of mobile homes perched in the air, exuding a sense of past and future change. However, some critics have dismissed the scheme as a one-off oddity with few wider lessons.

Two studies, one after two years of inhabitation, the other after eleven, found that changes continued to be made by the inhabitants. The first study found that the majority of the occupants had chosen to buy into the project specifically for its potential to change and therefore had an active commitment to the possibilities of flexible design.



Varied infill

Plan Drawing Scale 1:200

The Adaptable House

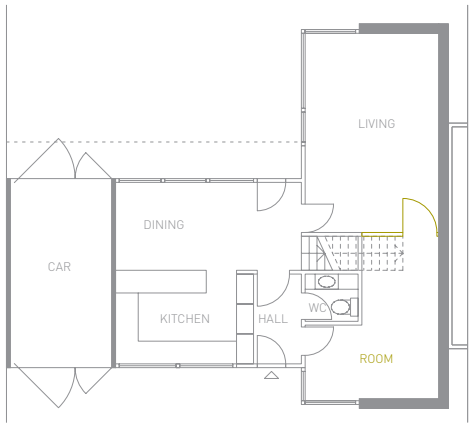
044

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1962	Britain	Development Group of the MHLG	Study

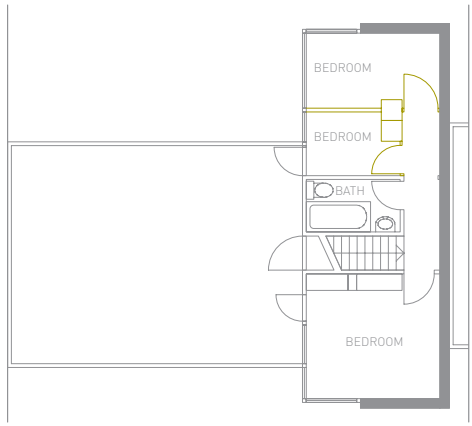
The Adaptable House, developed by the British Ministry of Housing and Local Government (MHLG) in 1962, emphasises the changeability of the plan as a means for providing flexibility. The design for the development of this house was based on findings and recommendations published in the seminal *Parker Morris Report* in 1961. Parker Morris stressed the importance of a building's adaptability to future needs. Whilst the consideration of the stages in a family's life cycle and their expression in space had already played an important role in the 1930s (i.e. Vroesenlaan by Van den Broek), it became a central focus again in the 1960s and 1970s.

The architects at MHLG illustrated this concept with a diagram that differentiated between seven stages in a family's cycle over a period of fifty years starting with marriage, the arrival of two children within five years, another child within the next 5 years, the growing up of all children, their leaving the house gradually, up until the final stage from year 35 when the couple is on their own again.

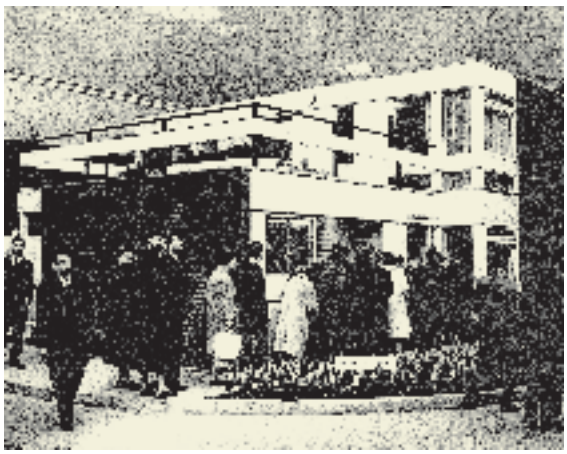
Architecturally, this programme is accommodated in a two storey L-shaped house with kitchen, dining room / playspace, WC and one additional room on the ground floor. The additional room is accessible both from the entrance hall as well as via a door to the living room and can be used as a hobbies room, bed-sitting or guest room. The large living rooms on ground floor can be used for different functions and activities, and subdivided as necessary. Depending on the number of occupants in the house a large space to one side of the staircase on the first floor can be divided into two rooms.

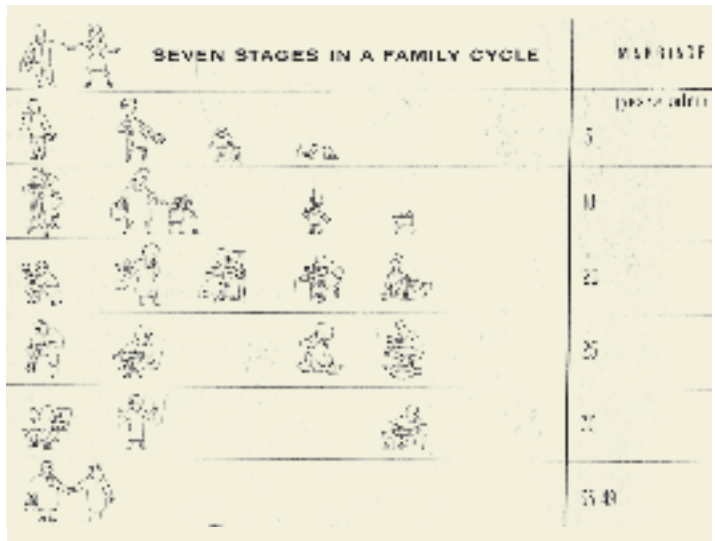


Ground floor



First floor





Plan Drawing Scale 1:200

Neuwil

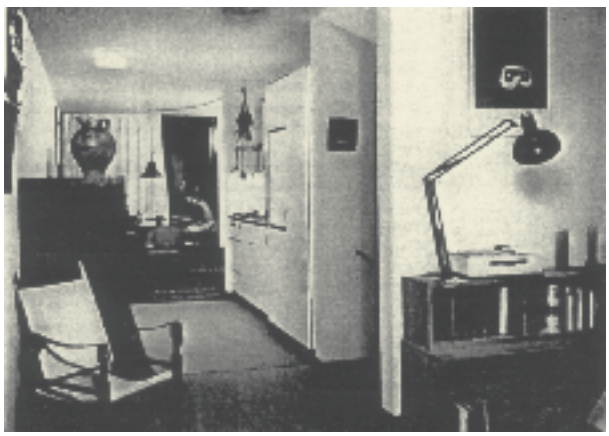
046

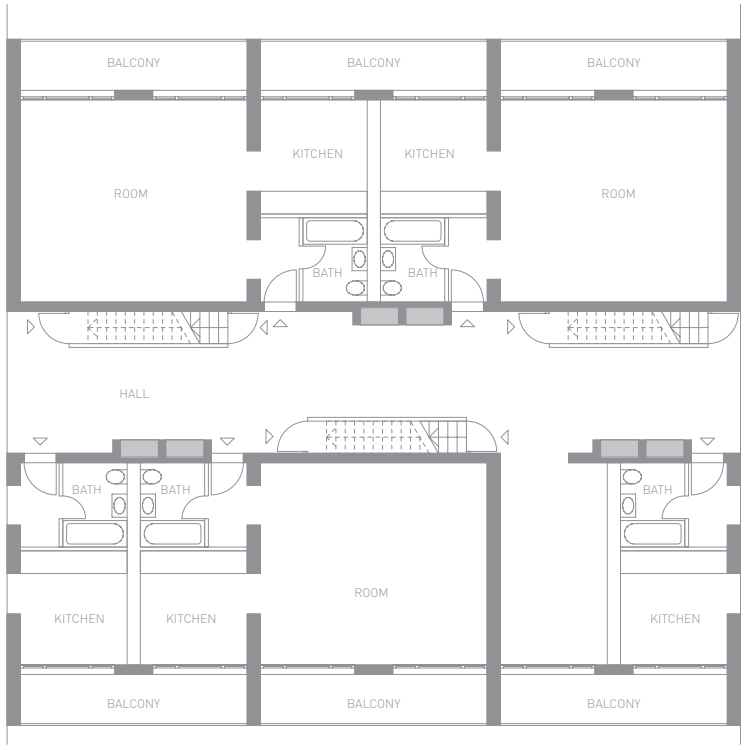
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1962-65	Switzerland	Metron	Multi-storey apartment block [49]

Over the years Metron's work has been concerned with buildings that can be adapted to users' needs over time as not only the demands of an occupant change over time, but also those of the market (see also Röthenbach).

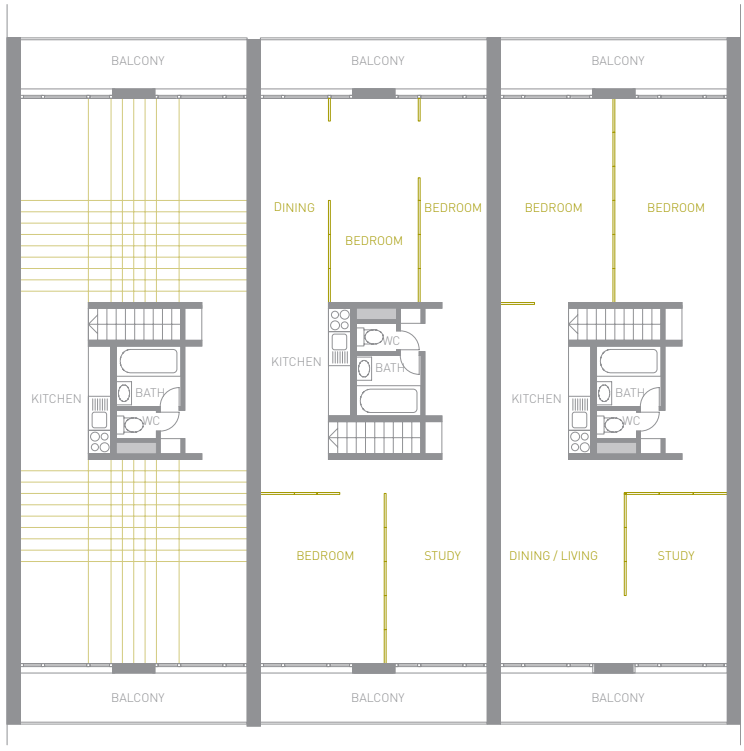
The building in Wohlen is an eight-storey concrete slab and column construction. Apartments are accessed via a 'rue intérieure' on every third storey. There are single room apartments on the 'rue intérieure' level, as well as the entrances to staircases that leads up or down one storey to larger apartments. One enters these apartments in the centre of the plan. The staircase is part of a freestanding core that also contains the bathroom and a kitchen. To each side of this core spaces of just over 30m^2 can be freely subdivided within the constraints of a 30 by 30cm grid, using any of five types of ready-made wall panels (all five types, 60 or 90cm wide, are stored in a common room in the building). A users' manual entitled 'Meine Wohnung ist mein Schloß' ('My apartment is my castle') was prepared to assist tenants in the process of dividing their spaces. This manual depicted life-cycle scenarios and their spatial implications, together with instructions to assemble wall panels.

The façade consists of one centrally placed fixed wall element and a 60cm, 120cm and another 60cm window panel to either side. The ready-made interior panels can be connected to the window frames and the fixed wall panel, thereby creating room widths between 1.80 metres up to 4.20 metres. The depth of each room is determined by the number of ready-made wall panels used. Whilst the overall size of the apartment can't be changed, the sizes and number of rooms can be changed with great ease, as has happened over the years.





Access floor



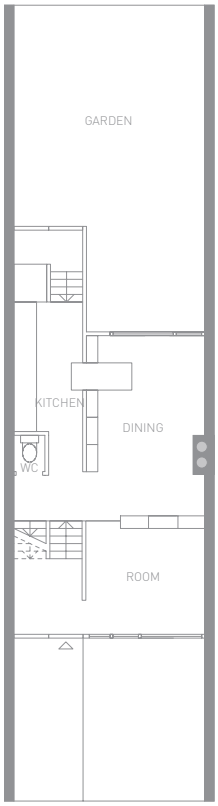
Floor above access level

Plan Drawing Scale 1:200

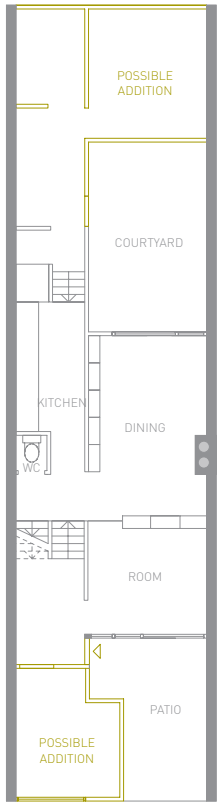
Extendible houses ‘t Hool

047

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1963	The Netherlands	Johannes Van den Broek, Jacob Bakema	Study / terrace

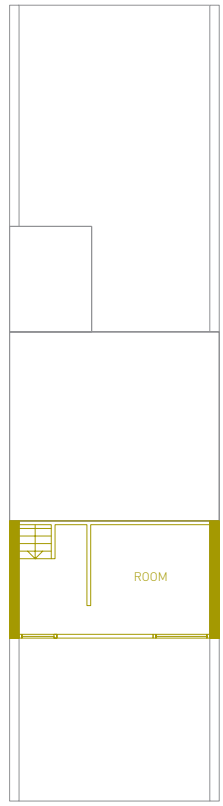


Ground floor
(minimum size)



Ground floor
(maximum size)

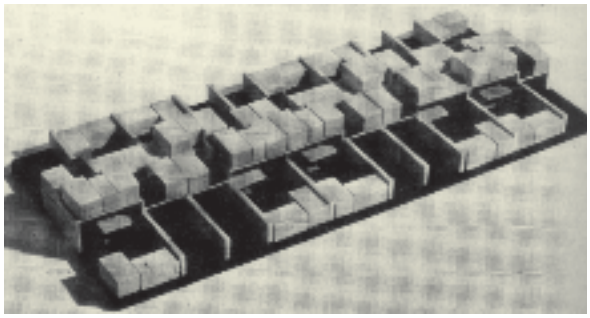
First floor
(minimum size)

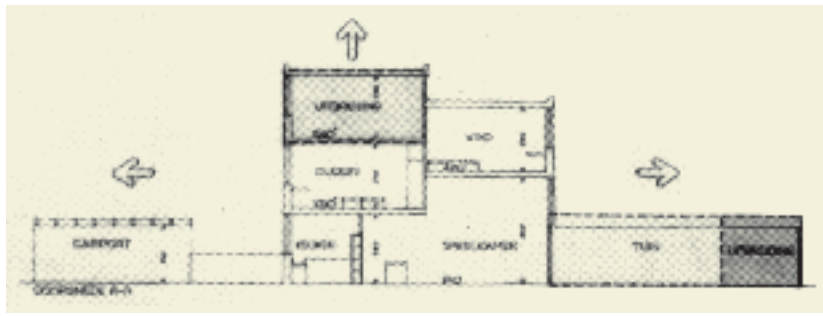


SECOND FLOOR

Van den Broek and Bakema's project for extendible houses is an example of intentionally planning for future expansion, something often overlooked in normal housing design. On an elongated plot of land, the architects proposed a narrow house not unlike a nineteenth century British terraced house. This core house contains a small front yard; it has a kitchen with direct access to the back garden, and a combined dining and living room on the ground floor. The core house in its smallest state also has a second storey, which houses three rooms: a larger room to the front and two smaller rooms towards the back of the house.

This smallest functional unit is designed to be expanded by pushing out horizontally to the front and back, and vertically upwards. Towards the front, on the site of the front yard, an additional room can be built, which might be a garage, a small shop or a guest room. Towards the back, the entire rear garden can be transformed into a series of rooms that are organised around a courtyard — which almost doubles the useable space on the ground floor. Finally, planning permission allows for an additional room to be built on top of the first floor flat roof. Together these changes allow for the initial house of 85m^2 to be transformed into one of 130m^2.





Plan Drawing Scale 1:200

Square L-Type System

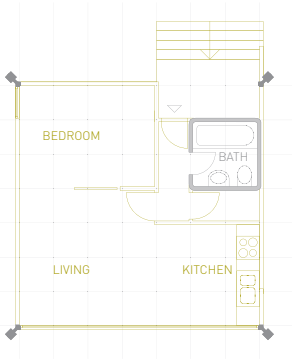
050

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1967	The Netherlands	Johannes Van den Broek, Jacob Bakema	Urban block [study]

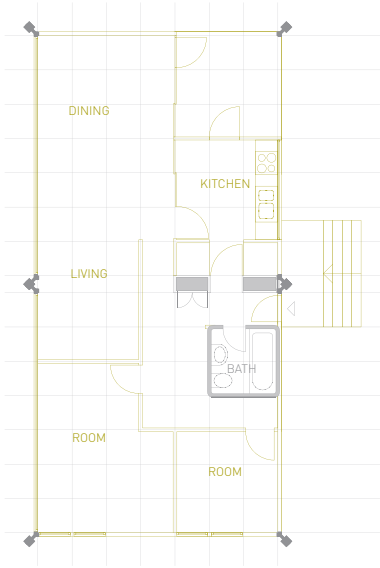
Van den Broek and Bakema's Square L-Type system was developed as a response to an international competition, tendered by the European Community for Coal and Steel for a housing group executed with industrialised building elements. Their solution combines prefabricated systems with a repetitive module that can be deployed both initially and then over time in a number of configurations.

The competition entry shows an urban block ranging in height from one storey to sixteen storeys. The entire project is a multiple of a basic module of 6.30 by 6.30 metres, which can be stacked vertically and added onto horizontally. The basic module can either be self-sufficient, i.e. it can be a single room apartment, or can be combined with other modules to fulfil the needs for larger apartments. Any number of modules can be used to form a detached house; they can form terraced houses; or can be stacked for use in more urban environments.

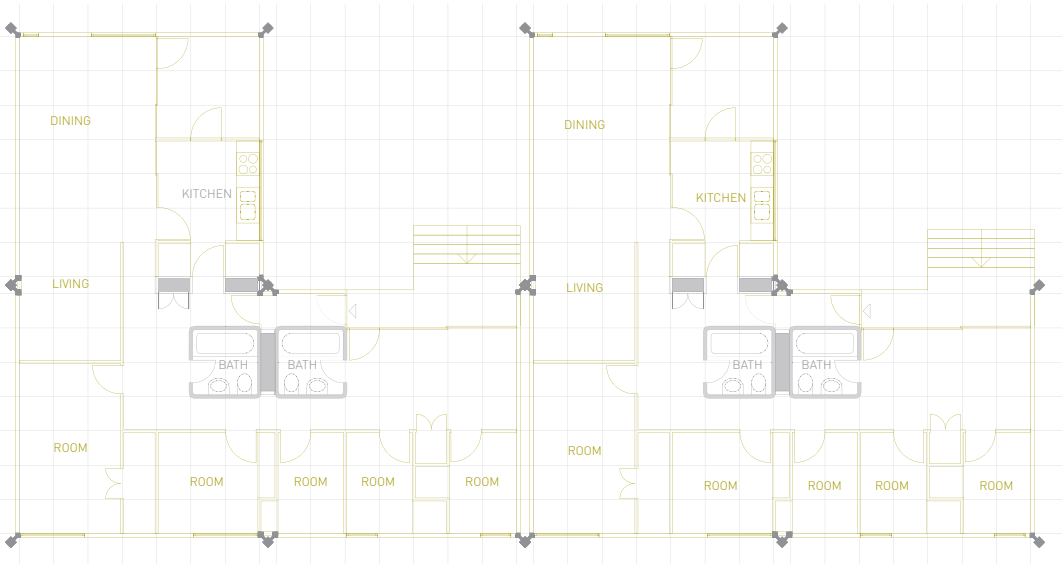
The primary construction of repetitive modules enables the system to adapt to different urban planning situations. It is then filled in with a secondary system that consists of floor and ceiling panels, a series of differently sized wall and window elements (both internal as well as external), prefabricated bathroom pods, cupboards and kitchen units.



Option 1 - one square unit
detached one family house



Option 2 - two square units
one family house



Option 3 (L-Type)
terraced houses

Plan Drawing Scale 1:200

Eastfields

052

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1968	Britain	London Borough of Merton	Urban block

This design for the local authority housing estate develops an elaborate system of interlocking apartments and maisonettes. Flexibility is achieved through a split-level design with a central stair giving access to identically sized rooms at each level.

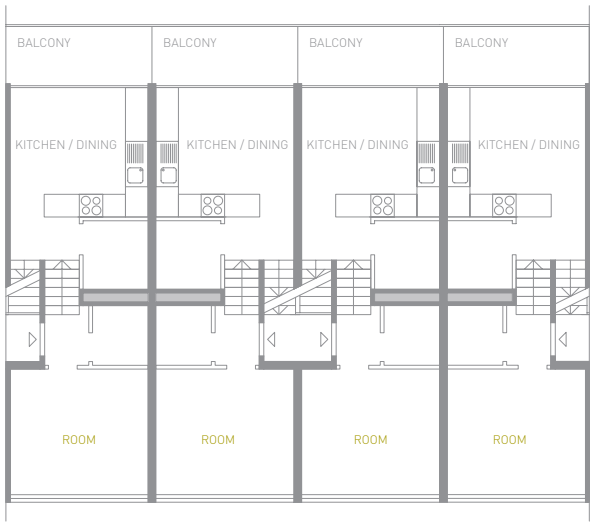
The main access is an elevated platform on level 1.5, located on the inner side of the block. The entrances to the apartments are half a staircase down on level 1, which has a bedroom with attached balcony and bathroom. A further half storey down gives on to a living and dining room with adjacent kitchen as well as access to a garden space.

Moving up from the elevated platform, level 2 contains the entrances to larger apartments that develop across two bays of the rigid reinforced concrete structure. On level 2 itself is a bedroom, a WC and a living room, whilst on level 2.5 there is a bathroom, a storage room, another bedroom and a combined kitchen and dining room. The entire length of level 2.5 also has a balcony.

Moving a further storey up from the main staircase, level 3 accesses two units — one to either side of the staircase — that develop over 5 split-levels. Level 3 contains a living room and a WC. The kitchen and a storage room are on level 3.5. Level 4 and 4.5 have WC, a bathroom and 2 bedrooms. Level 5 finally gives access to a small room that opens onto a roof terrace.

Because all rooms throughout the entire development are identical in size, functions and their location in plan can be changed. The apartment on level 2 and 2.5 could, for example, have the living room and kitchen on one level and both bedrooms on the other level, or indeed use the various spaces in a different way. The same goes for the units on level 3 to 5, where functions can be distributed according to needs and wishes of the inhabitants.

Level 3.5

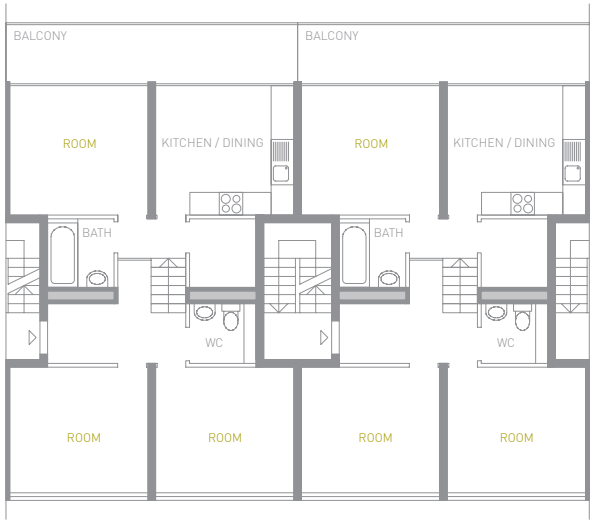


Level 3

Level 4.5

Level 4

Level 2.5



Level 2

Plan Drawing Scale 1:200

Sutton Dwellings

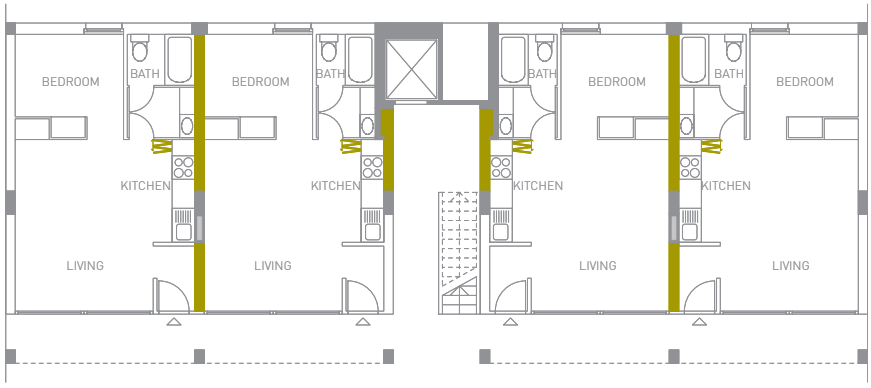
054

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1968	Britain	Frederick MacManus & Partners	Multi-storey apartment block [48]

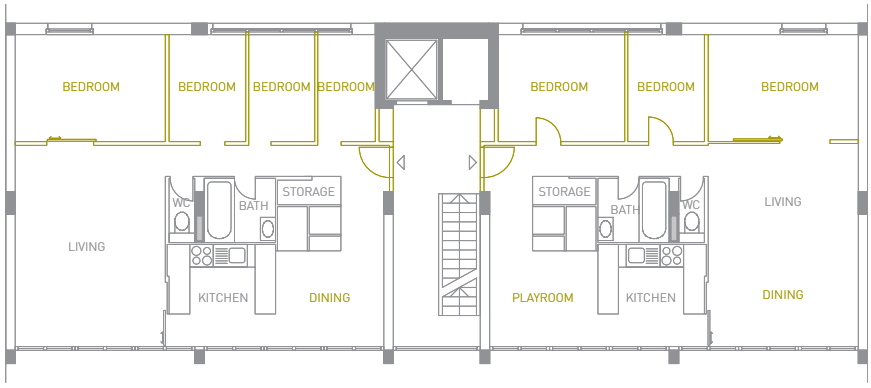
The Sutton Dwellings by Frederick MacManus & Partners were commissioned by the Sutton Dwellings Housing Trust (now William Sutton Housing Association) and built according to Parker Morris standards. The new dwellings extend an existing 1915 estate, which also belongs to the Trust.

The client brief required accommodation for singles (bed sitting room apartments), disabled people (two-roomed apartments) and families (five-person apartments). The entire development has forty-eight dwellings on five storeys, with four staircases serving two units each on floors one to four; the apartments on the ground floor are accessed straight from the pedestrian access on the rear of the block. The ground floor accommodates the single person apartments; the first, second and third floor accommodates family apartments; and the top floor contains the two-person apartments.

The entire programme, from residential and down to the garages, is accommodated within the same structural grid within a reinforced concrete frame construction. The loadbearing elements are contained within the external skin, with one additional row of columns on the inside of the building. Apart from these few structural elements, only the staircase core is fixed in plan. This allows considerable flexibility in the internal planning, as is shown in the original drawings that show a variety of layouts within the same shell. Each of the family apartments has a condensed central core that contains a bathroom, separate WC, a number of storage cabinets and the kitchen. The remaining space can be divided according to the needs of a particular occupant.



Single person flats, ground floor



Family flats, upper floor

Plan Drawing Scale 1:200

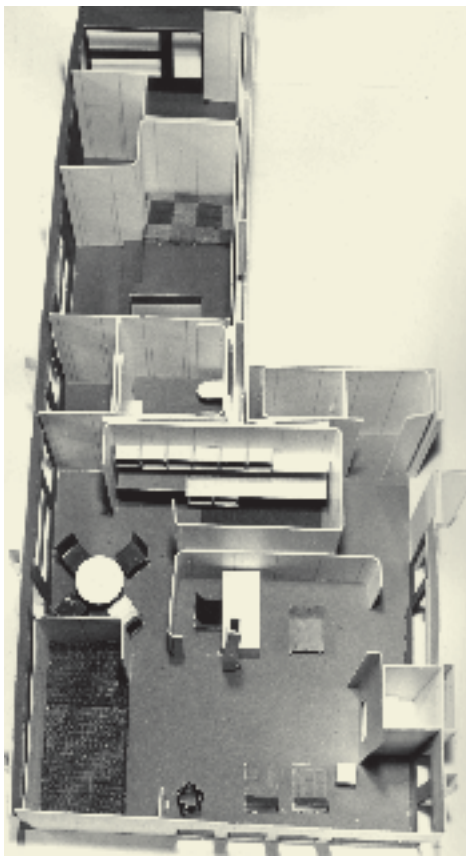
Kronsberger Strasse

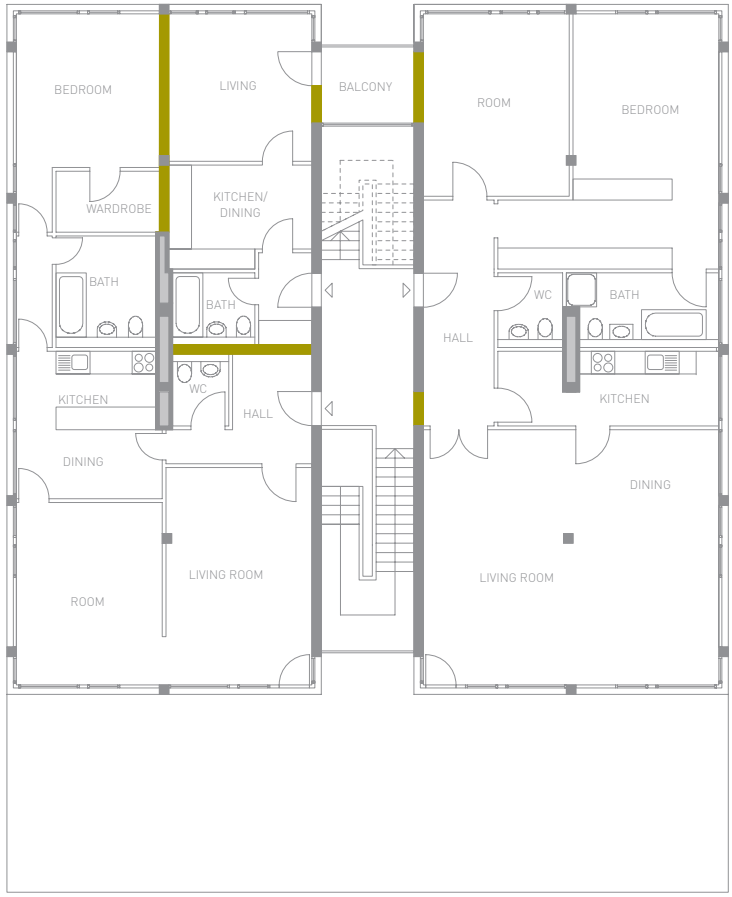
055

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1969	Germany	Bernhard Binder + Stefan Polónyi	Multi-storey apartment house [10]

This three-storey apartment building in Berlin provides the capacity for change through its form of construction, which allows the expansion and contraction of individual dwellings within the same structure. The building is designed on a grid using a reinforced concrete frame. A central staircase divides the building into two halves, each of which is unobstructed apart from a few columns and a service duct. The size of one 'half' and design of the common hallway with its multiple doors allows each floor to have two, three or four differently sized apartments. The architects show a variety of possible layouts, testing their design for long-term flexibility. The plans indicate the spatial division into ten units, but the number of apartments could be as low as six or as high as twelve.

At a later stage, two adjoining units could be merged into one large unit (with one of the entrance doors blocked up) or a smaller unit could be enlarged by taking space off another, though the latter adaptation would depend on tenancies. The advantages in this form of flexibility lie not only in its potential to respond to its user's periodic changing requirements but also in the long-term adaptability offered by the dwelling within a changing market situation.





Second floor

Plan Drawing Scale 1:200

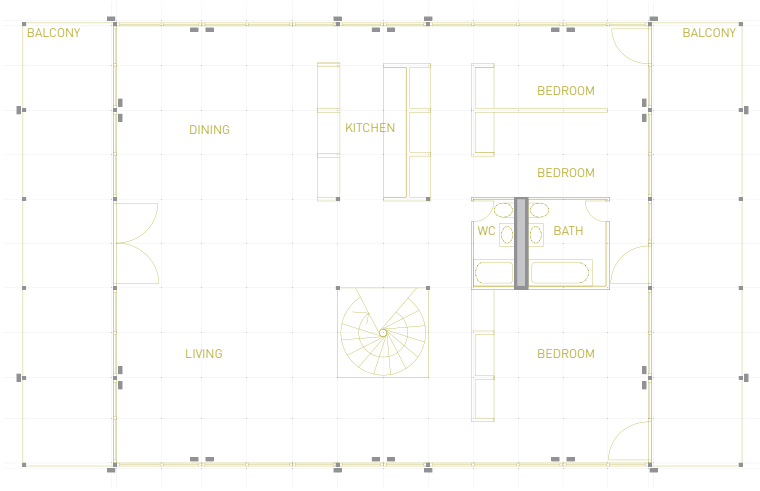
Wohnhaus Schärer

057

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1969	Switzerland	Fritz Haller	Single-detached

Haller's so-called Maxi architecture was predicated on flexibility: exterior and interior features like windows and doors could be dismantled and moved within a steel framework whose elements were based on a modular measurement of 120/60cm.

Haller went on to conceive Midi and Mini systems that were used widely for smaller-scale projects, such as the Schärer family's house, which overlooks the Haller's Münsingen factory.



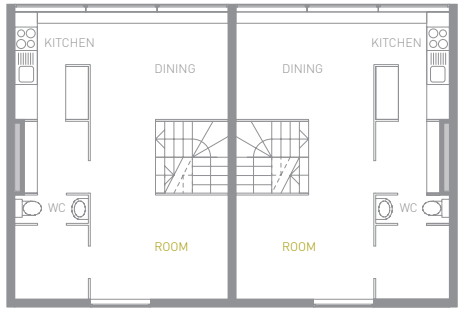
First floor plan

Plan Drawing Scale 1:200

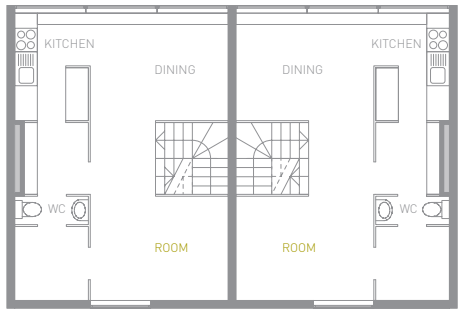
Alexandra Road

058

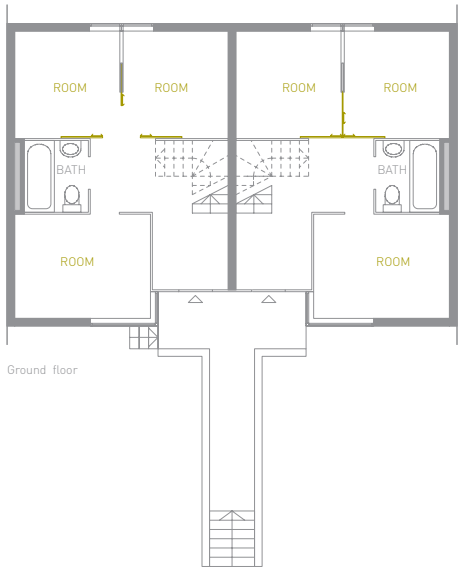
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1969-78	Britain	Neave Brown for GLC	Urban block



First floor



First floor



Ground floor

Alexandra Road exemplifies Neave Brown's notion of flexibility. As opposed to the many proponents of flexible housing who engender flexibility through open space or loose planning, flexibility for Brown is the opposite of free space. Free space may be one way of achieving flexibility but it demands a lot of space, and in public housing this is not available. Instead Brown argues for a developed understanding of how people may use a house over time, and then designs for those scenarios. Flexibility here is about explicitness, a freedom achieved through prescription. Brown's buildings develop specific solutions that can nevertheless be adapted to changing social use.

Alexandra Road, as well as his housing on Winscombe Street in London, are examples for this way of thinking. Both projects are based around the notion of zones, and both develop the concept of a ground floor that can be cut off, either through plan or a separate entrance, and handed over to a different use or user. Bedrooms are downstairs and living rooms upstairs, which decreases the space needed for circulation. Over time the ground floor has been variously used for granny flats, workplaces, or separate rented accomodation.

Plan Drawing Scale 1:200

Diagoon Houses

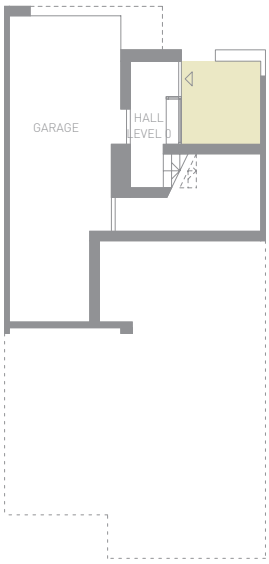
059

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1971	The Netherlands	Herman Hertzberger	Terrace [8]

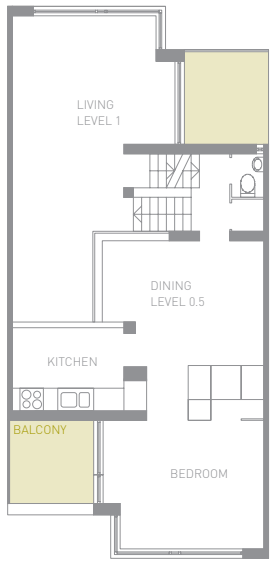
The principle behind these houses is based on the idea of the 'incomplete building', meaning that a basic frame leaves space for the personalised interpretation of the user in terms of number of rooms, positioning and functional uses. The houses are designed to provide an alternative to how dwellings are typically conceived, handing over the power of design to the occupant. The occupants themselves are able to decide how to divide the space and live in it, where they will sleep and where eat. If the composition of the family changes, the house can be adjusted, and to a certain extent enlarged.

Hertzberger calls the structural skeleton used in this design a half-product, something that everyone can complete according to his own needs and desires. There are two fixed cores, one contains the staircase and the other one kitchen and bathroom on different levels, with several half-storey levels attached. Indicating the inherent possibilities of the house, Hertzberger illustrates the opportunities for the spaces through diagrams. A typical plan shows the building sectioned into 3 planes. The first one can contain the entrance to the house, a workroom, storage and a smaller or larger garage. Moving up a half storey, the kitchen is the focus point but leaves the space around it for interpretation: where and how big a dining room is, how the living room constitutes itself and how the relationship to a balcony is made use of. The third level is grouped around a bathroom around which space can be divided into individual bedrooms or be left open.

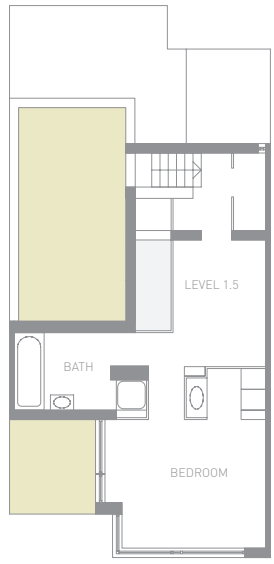
The principle of incompleteness, also expressed in the relatively raw appearance of the blockwork that is used as infill material of the skeleton, is continued on the outside of the buildings: is there a fence, or not, how can the small space underneath the terrace be used, what to do with the roof terrace or the tiny yard next to the entrance? Over time these slack spaces have indeed been appropriated. Despite their openness, the Diagoon Houses are not just neutral buildings that offer an infinite number of options. They provide a framework and give indications as to the possibilities of spatial arrangement. There is a tension here between architectural intent and user control.



Ground floor



First floor



Second floor

Plan Drawing Scale 1:200

Montereau

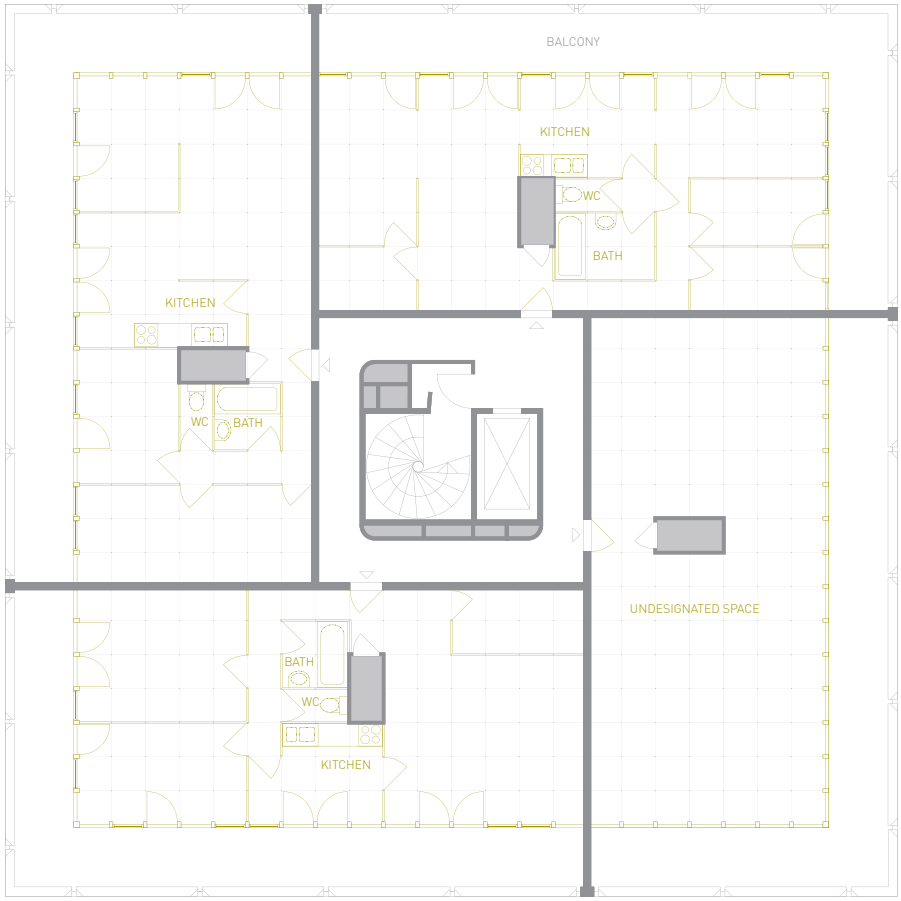
061

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1971	France	Les Frères Arsène-Henry	Multi-storey apartment house [37]

The project for a residential ten-storey tower uses some of the principles of the speculative office block to achieve flexibility in housing. It is also one of the pioneering participatory schemes. Long-span concrete floors create an unobstructed area so that each dwelling unit is without cross-walls or intermediate columns. Four units are grouped around a central core containing communal staircase and lift. Each unit of 13.5 by 6.3 metres is divided into a planning module of 90cm. The only defining element in the otherwise open space is a core of 0.9 by 1.8 metres, just opposite the entrance door, within which all service functions rise and drop. A balcony wraps around the full perimeter of each unit, providing external space for every room.

Occupants, as far as they were known when the planning process began, were involved in the design of their apartment. Within the standard shell, each occupant could choose how their respective space would be subdivided, as well as the appearance of the façade by being able to determine the position of standardised external panels.

The limitation within which the occupants had to work was the dimension of the planning module, which gave typical room widths of 90cm (a corridor or store), 180cm (a bathroom or small bedroom) 270cm (a bedroom or small living space) and 360cm (living spaces). The internal room partitions were made from hollow core chipboard, 2.5 metres high and 35mm thick. These panels are held in place with friction screws. Whilst the architects initially prepared ten hypothetical apartment plans to illustrate the inherent possibilities of the system to prospective occupants, no family adopted any of the plans shown. Instead they quickly mastered the design of their own layouts on squared paper, particularly when the exercise was done in the actual spaces. In the end, no two plans were the same.



Typical floor plan

Plan Drawing Scale 1:200

Asemwald

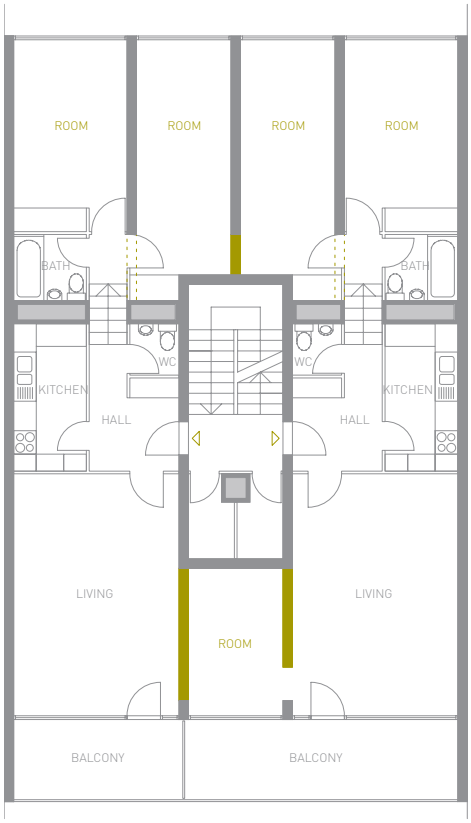
064

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1972	Germany	O. Jäger, W. Müller + H. Papst, H. Wirth	Multi-storey apartment house [l143]

The Asemwald development near Stuttgart accommodates 1143 apartments in three slab blocks. The scheme was proposed as a viable alternative to a single detached house, offering large apartments, high quality fittings, and inherent flexibility. The mix of apartments ranges from one-room apartments to six-room maisonettes. The size of these units ranges from 41m^2 to 154m^2, with a typical three-room apartment of between 80m^2 and 105m^2.

Flexibility is achieved through a crosswall system with a series of preformed openings that allow rooms to be easily connected or separated. The intent was that this would allow prospective purchasers to determine their ideal layout, as well as to facilitate change over time. Thirty percent of those who moved into the scheme immediately after it had been completed made use of the possibility to influence the design of their dwelling plan.

The plan here illustrates one of these potential variations in layout. By connecting through the crosswall, a two-room apartment can gain or lose rooms. A two-room unit can be enlarged from an initial 85m^2 to a three-room unit of 95m^2 (by adding the smaller room) or a three-room unit of 100m^2 (by adding the bigger room) or to a four-room apartment of 120m^2 (by adding both rooms). Often however, this is not done on a room-to-room level, but by buying an adjacent apartment in its entirety.



Typical apartments

Plan Drawing Scale 1:200

Wohnanlage Genter Strasse

067

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1972	Germany	Otto Steidle and Partners	Terrace [7]

First floor

Second floor

The houses on Genter Strasse (photographs below), Peter-Paul Althaus Strasse and Osterwaldstrasse (plans above) were built in three phases in the early 1970s, and show the development, and technical refinement, of a single principle of flexibility based around the idea of support and infill. The first phase, a row of seven houses on Genter Strasse, uses a prefabricated reinforced concrete skeleton with corbels on every half storey onto which cross beams can be placed; these provide a visual anticipation of the possibility of change. A purpose made system of glazing and solid panels infills the frame, and can be changed at will, though in practice the tenants have remained faithful to the original aesthetic and colour. The second phase again of seven units uses the 'Elementa' system, a simplified reinforced concrete skeleton of columns with longitudinal downstand beams and ceiling panels. Prefabricated wet cores provide the necessary structural integrity. Phase 3 uses a reinforced concrete skeleton system and a more refined proprietary infill cladding. Apart from the structural differences, there are also differences in the way the structure is expressed, open as in the Genter Strasse or completely encased in the buildings of the two later phases, as well as differences in span.

The buildings illustrate a principle of flexibility that can also be found in Hertzberger's Diagoon Houses. Steidle provides an excess of space from the very beginning, which can then be claimed over time, either on the outside through building into the non-filled parts of the expressed frame or on the inside by filling in the initially one-and-a-half or two-storey spaces. The provision of structural connections at every half-level increases the options for adaptation, allowing a complex spatiality to develop in the interior. Because of the clarity in distinction between load-bearing and non-loadbearing construction, walls within the frame can be altered easily according to users' needs and wants. Over the last 30 years, volumes, interiors, and uses have changed considerably.

Plan Drawing Scale 1:200

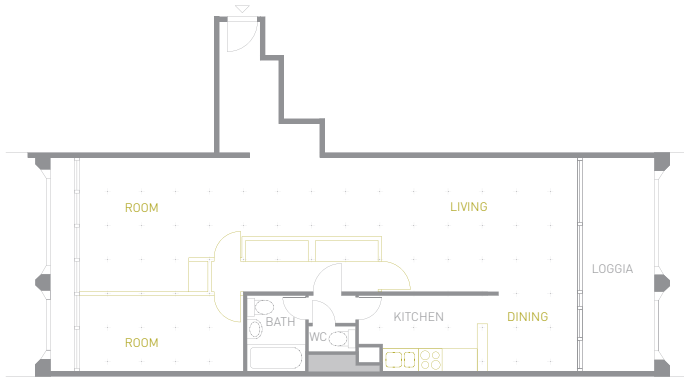
Les Anticonformes

071

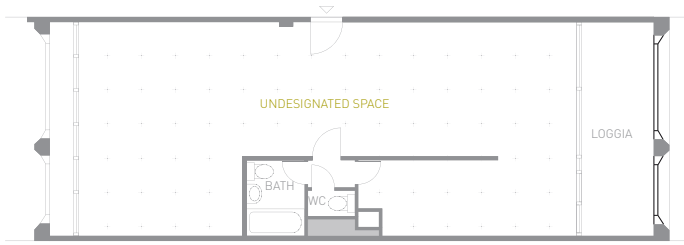
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1975	France	Les Frères Arsène-Henry	Multi-storey apartment block [256]

'256 apartments where you place the walls where you want,' stated the publicity for this private sector scheme of apartments and maisonettes in two buildings on Rue des Pyrénées in Paris. Buyers were offered open plan units that can subsequently be subdivided on a 90cm grid with a given system of partition walls (as in the scheme at Montereau by the same architects). The sale price was fixed on an area basis, irrespective of the quantities of partitions, doors or cupboards selected by purchaser. Most apartments are double aspect and have a balcony at each end. A typical apartment of around 13.5 metres by 5.73 metres has the entrance in the centre of the long side and can be divided as needed: open plan; a private zone to one side and a more public zone to the other side; or a series of rooms accessed via a corridor. Only the bathroom and kitchen are fixed in plan.

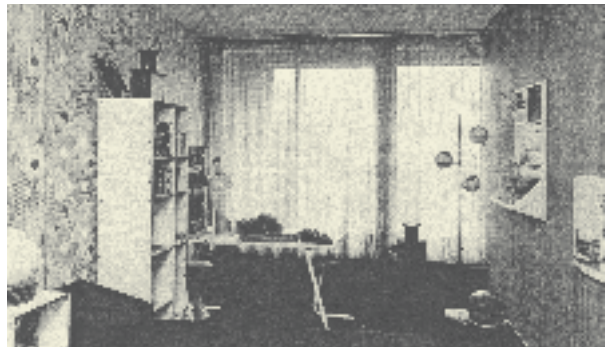
The position of electrical sockets, set as a grid in the floor, is also changeable, so each alteration in layout or movement of a partition wall does not require a complete re-wiring of the apartment. As at Montereau, where the architects had set a precedent for an elaborate waiver procedure to get around planning and building regulations, construction of the apartment block in Paris was allowed to start even though internal layouts and elevations were not yet fixed.



Typical apartment



Empty shell



Plan Drawing Scale 1:200

Les Marelles

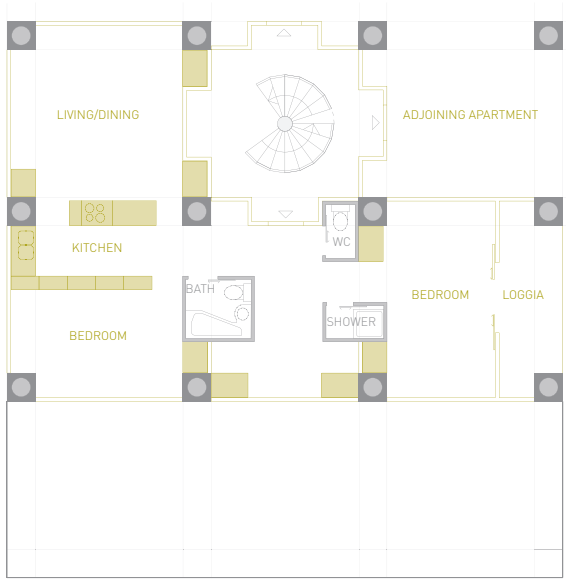
072

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1975	France	Bernard Kohn, Georges Maurios	Multi-storey apartment block [100]

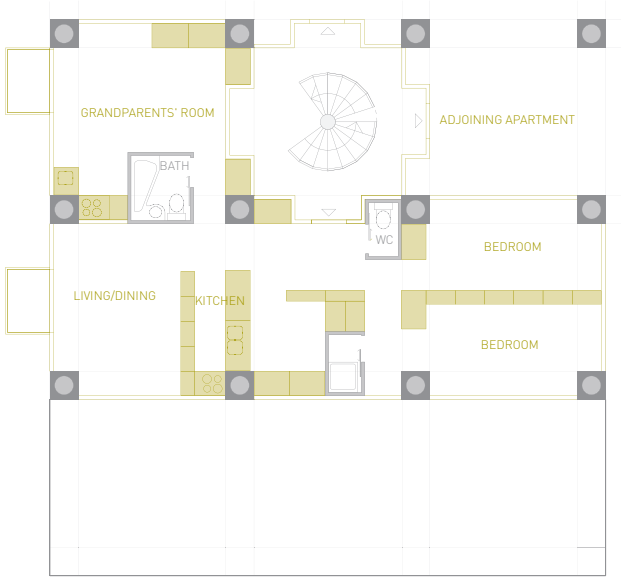
Les Marelles was developed as an experimental housing project of 100 dwellings. Built with the intention to provide a genuinely flexible habitat, the inhabitants were involved in the process of the design of their apartments through the use of 1:10 scale models.

The construction consists of a repetitive square frame of 4.65 by 4.65 metres. The U-shaped beams collect and distribute horizontal services which rise or drop in massive hollow columns of 0.75 by 0.75 metres. This three-dimensional network allows for kitchens and bathrooms to be located anywhere along the ducts. Kitchens, bathrooms, partitions and façades can be chosen from a catalogue and are designed for interchangeability.

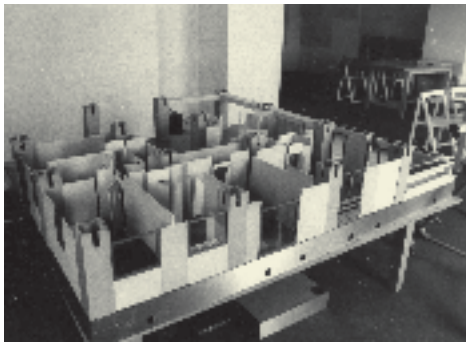
Within this set-up prospective occupants could design their own apartments, the boundaries of which were determined by the number of serviced and unserviced space parcels they bought. The central staircase of any of the nine buildings can serve up to four apartments. Thus not only the size of the individual apartments is open but also the internal layouts. Apart from the column and beam construction system and the vertical circulation system, nothing is fixed. There is no typical plan either: each apartment is different not only through differences in layout but also through the location of its perimeter walls. The only common elements are the use of the same partitions, window panels, kitchen and bathroom units, but they are never in the same place twice.



Option 1



Option 2



Plan Drawing Scale 1:200

Flexibo

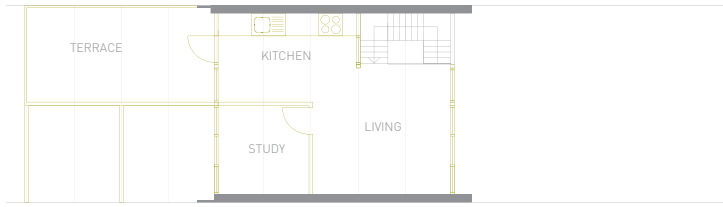
074

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1976	Denmark	Fællestegnestuen	Terrace [68]

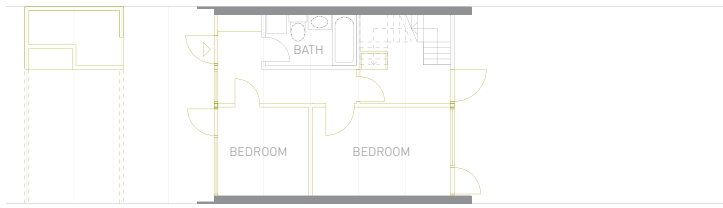
The 68 one- and two-storey dwellings, designed by Fællestegnestuen for Copenhagen's Public Housing Association (KAB), were partially designed and often also partially built by the residents. Whilst the basic frame of the building, which consists of prefabricated components of concrete and laminated timber, cannot be altered (apart from adding smaller parts such as a pergola), the interior is based on a modular wall system, which can be changed, adjusted or reconfigured by a building's inhabitants.

The architect's drawings clearly show the principle of layers in the design. Parallel walls of concrete provide the dividing perimeters of each house. After these walls are placed, flooring elements are laid on concrete joists and roof and deck elements on timber beams. The façades are closed with light elements. Bathrooms and kitchens are placed along one of the partitions as the only fixed elements. Subsequently, internal partition walls can be laid out. These partitions consist of two types of wall elements of 1 metre and 0.45 metre, a door element of 1 metre, cover board, guide strips, and assembly fittings. Within the given modular grid system, determined by the rhythm of the laminated timber beams as well as some further guides, rooms can be formed at will. Additional pieces of wall can be acquired from a central depot.

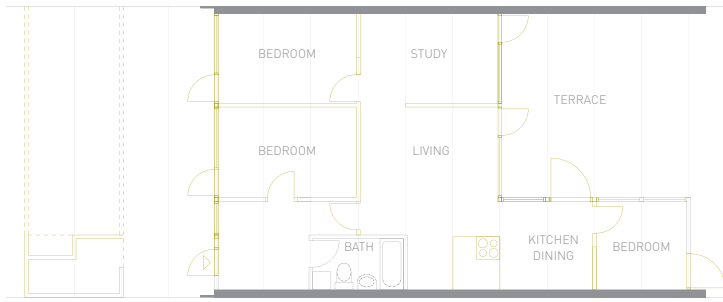
Whilst flexibility in the Flexibo scheme is implemented at the project stage, it is also possible after occupation and when somebody else moves into the house. The construction system allows walls to be moved around very easily, so any layout can be adapted to different needs and requirements at any point in time. A study after 3 years of completion showed that various residents had changed the position of doors, added additional rooms and altered room sizes.



First floor
2-storey terraced house



Ground floor
2-storey terraced house



1-storey terraced house

Plan Drawing Scale 1:200

Housing group in Purkersdorf

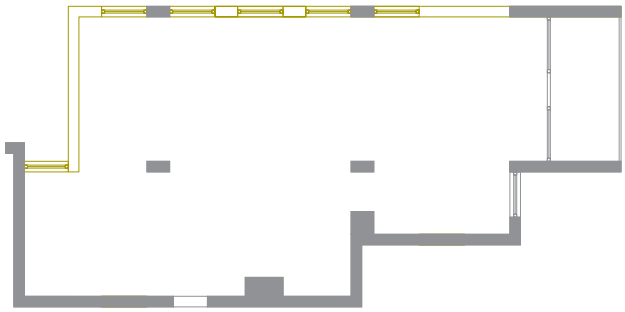
075

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1976	Austria	Atelier P + F	Multi-storey apartment house [72]

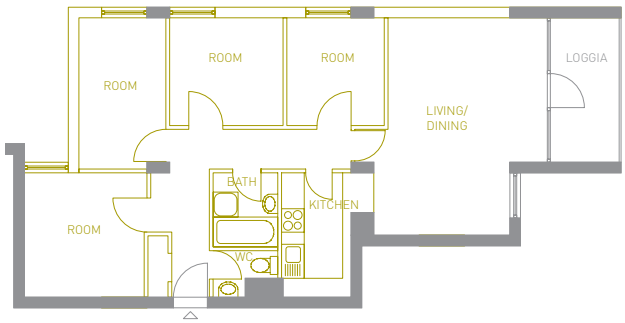
The development of the 72 dwellings in Purkersdorf is first and foremost an experiment in participatory design in social housing, accompanied and analysed throughout by a group of sociologists. When selling of the units started in 1973, interested people were offered a number of possibilities: decisions over size and way in which units were to be subdivided; enlargement or reduction of unit size — in agreement with their neighbour; position and size of wet areas; and choice of position, number and size of windows. Potential occupants were shown a catalogue of ten options per layout type, from which they could either choose the one most appropriate for them or else develop their own ideas. The architects had meetings with each of the future inhabitants and subsequently prepared detailed plans for every unit.

Overall apartment sizes range from 41m^2 to 125m^2, but with an inherent potential to hand over larger parts of one storey to one user. The drawings show unit type A with a total of 106m^2 as an empty shell and then with two of the possible subdivisions as proposed by the architects.

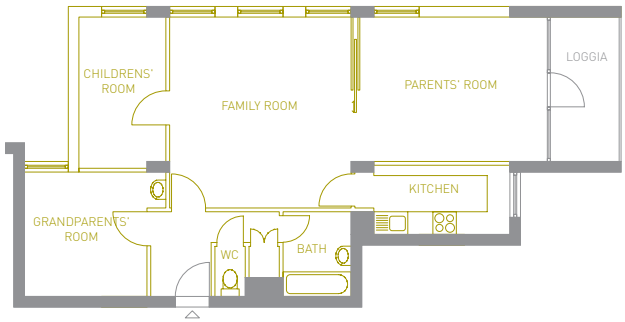
A retrospective analysis of the project found that the possibility to create or co-design one's dwelling resulted in a high level of user satisfaction, as well as the achievement of a higher level of identification with the housing scheme. This confirms the architects' belief that participation is more than just about moving walls, but a process of social interaction, communication and constant reiteration between public, planner, designer, developer and the occupant. The actual cost of the participatory process was put at 1.11% of total costs, made up of increased design time and additional construction work. However, the capital costs of the scheme were more problematic. The initial flexibility depended on investment in excess space in the primary structure, which was prohibitively expensive to write off over time.



Empty shell



Option 1: 4 bedroom apartment



Option 2: 3 bedroom apartment

Plan Drawing Scale 1:200

Hollabrunn

077

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1976	Austria	Ottokar Uhl and Josef Weber	Terrace [70]

Based on an entry to the 1971 'Wohnen Morgen' or Living / Housing competition, run by the Austrian government department for building and technology, the scheme deals with the problem of building for the unknown future user. The project takes as its starting point the SAR method of support and infill developed by Habraken and his collaborators. Firstly, primary and secondary structure were separated. Secondly, a modular dimensional system was adopted to coordinate all elements. Thirdly, the system was designed to be open to accommodate any materials and forms of technology. Finally, zones were defined to accommodate different functions.

The planning application itself was submitted with the comment that the exact number and types of apartments would only finally be determined once the future occupants had designed their respective units, and so the indicated layouts only showed one possible form of subdivision.

The loadbearing structure consists of prefabricated Lecca concrete columns and beams, with a dimension between centre lines of 5.1 and 9.6 metres, and in-situ reinforced concrete ceilings. The only fixed element in plan is the staircase whose enclosing walls double up as service cores. Within these limitations, party and partition walls can be placed freely.

In the end, only half of the 70 dwelling units were designed by their future occupants themselves as only 34 people had expressed interest in buying a unit when detailed planning began. The occupants, aided by the architects as well as sociologists, were able to choose: the arrangement of walls within the support structure of the dwelling units; the size of the dwellings, by determining the position of the façade elements; the subdivision of the dwelling into rooms, which also included kitchens and bathrooms; the number, type and position of windows and doors; and the finishing of the dwellings. It was estimated that this participatory process added 5% to the budget, a cost covered by the Ministry of Housing.

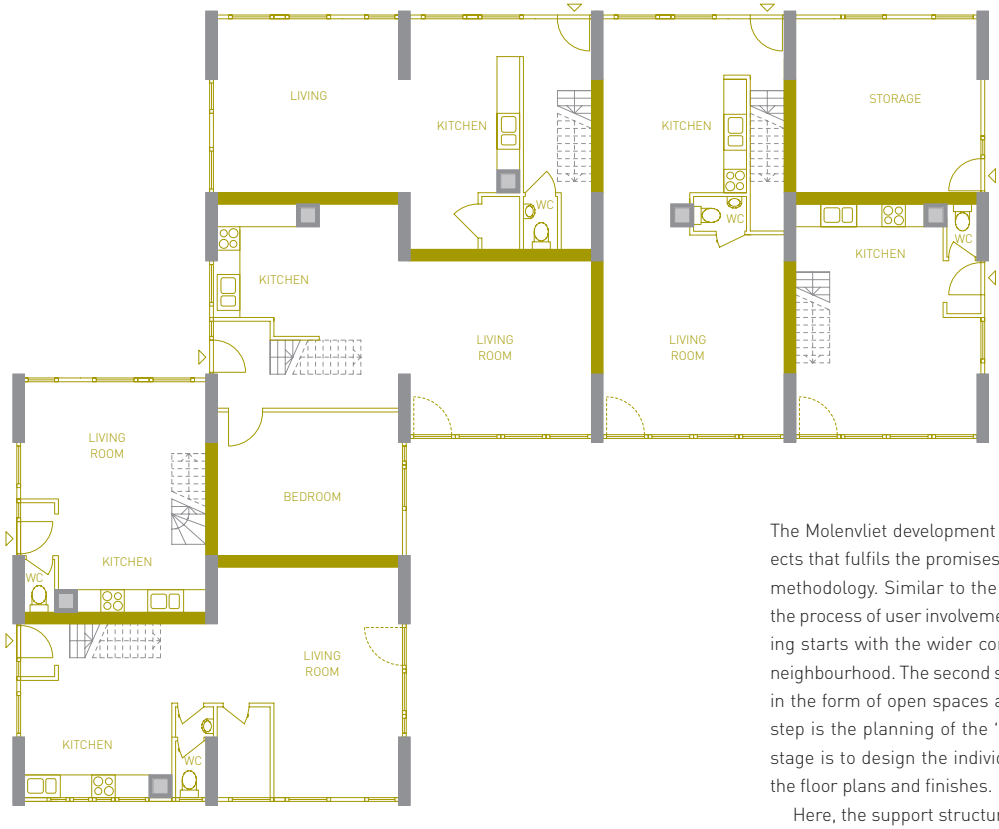
Support structure and infill

Plan Drawing Scale 1:200

Molenvliet

078

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1977	The Netherlands	Werkgroep KOKON	Urban block [124]



Ground floor plan

The Molenvliet development is one of the key Dutch projects that fulfils the promises of the SAR support and infill methodology. Similar to the development in Hollabrunn, the process of user involvement in terms of decision-making starts with the wider context of the overall plan of a neighbourhood. The second step is to negotiate built areas in the form of open spaces and building zones. The third step is the planning of the 'support' structure. The final stage is to design the individual infills, which determine the floor plans and finishes.

Here, the support structure, an in situ concrete framework with openings in the slabs, is a combination of seven components: floor decks, with openings for vertical mechanical chases and stairs; in situ concrete piers placed parallel to each other on a 4.8 metre square grid; pitched roofs sloped at 45° to provide a habitable attic; wooden frames which act as an armature for specific façade elements; roof terraces located on the flat roof space of the ground floor dwellings; open galleries for upper level access; and large vertical service ducts containing all wiring and piping for gas and water as well as television and telephone connections.

The principle of support and infill allowed the free subdivision of the structure into a complex of apartments ranging in size from one- to six-room units. The wall piers, using a version of the Dutch 'tunnel' system allow apartments to straddle across two or three bays, a principle further developed in the same architects' Keyenburg project of 1984. Initial decisions about the placement of partition walls were made in conjunction with the future users, who met twice with the architect and a representative of the Housing Association. Contrary to some other developments where tenants were shown possibilities of subdivision, at Molenvliet they were presented with an empty support plan, which was then laid out through discussions between architects and tenants.

Plan Drawing Scale 1:200

Adelaide Road Estate

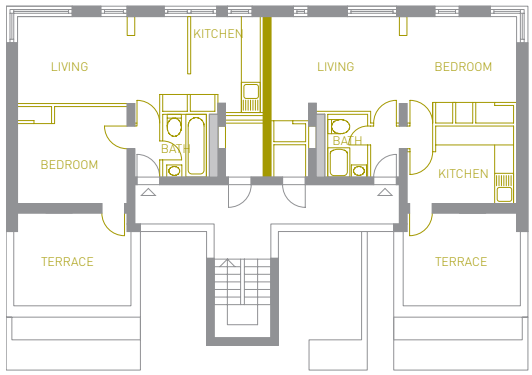
083

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1979	Britain	Hamdi and Wilkinson for GLC	Multi-storey apartment block [44]

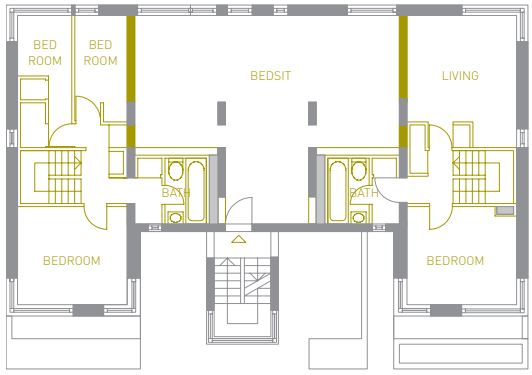
PSSHAK (Primary Support Structures and Housing Assembly Kits) was developed by Nabeel Hamdi and Nick Wilkinson as a thesis project at the Architectural Association in a practical interpretation of John Habraken's theories of support and infill. Working for the Greater London Council, Hamdi and Wilkinson's deployed their system in the design of the Adelaide Road Estate, comprising eight small three-storey blocks. PSSHAK was a good solution to a local authority's need of having to respond quickly to changing housing requirements. Using PSSHAK meant that, even though the housing scheme was well advanced on the drawing board, the mix of accommodation could be altered to suit specific demands. It also aimed to demonstrate the feasibility and benefits of participatory design methods in the public sector, the designer acting as 'skilled enabler' instead of the 'expert architect', approaches that Hamdi and Wilkinson have pursued ever since.

The PSSHAK process firstly involves the construction of a basic structural shell, which consists here of loadbearing brick crosswalls and cast-in-place concrete floors as well as primary electrical and mechanical service points. At strategic positions, these walls and floors have 'soft zones', which can be opened up to allow both vertical and horizontal combination between floors or bays. The infill kits consist of vertical ducts, partitions, doors, cupboards, bathrooms and WCs. The kit was supplied by the Dutch company Brunyzeel and installed in a dry process without the need for interior brick or plaster work.

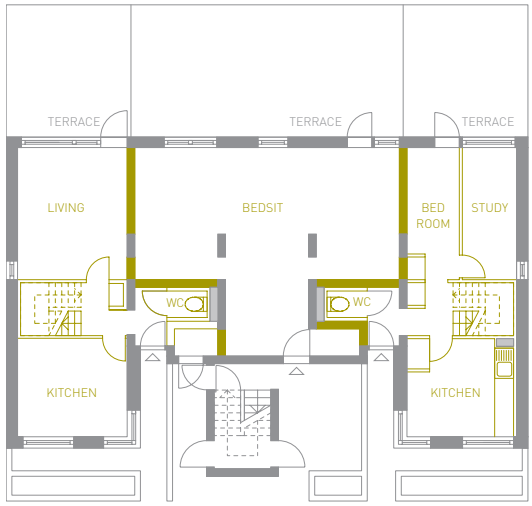
Tenants, working in small consultation groups, were given 2 weeks to design their own interiors. Architects refined these designs and advised on amenities and costs. Prospective tenants were then able to visit empty shells and review models before making their final decision on the subdivision of spaces. Whilst the initial plans show a wide range of sometimes idiosyncratic layouts, the potential for later change was never fully realised, maybe for the simple reason that the local authority failed to pass on the instruction manual.



Second floor



First floor



Ground floor

Plan Drawing Scale 1:200

Feßtgasse Housing

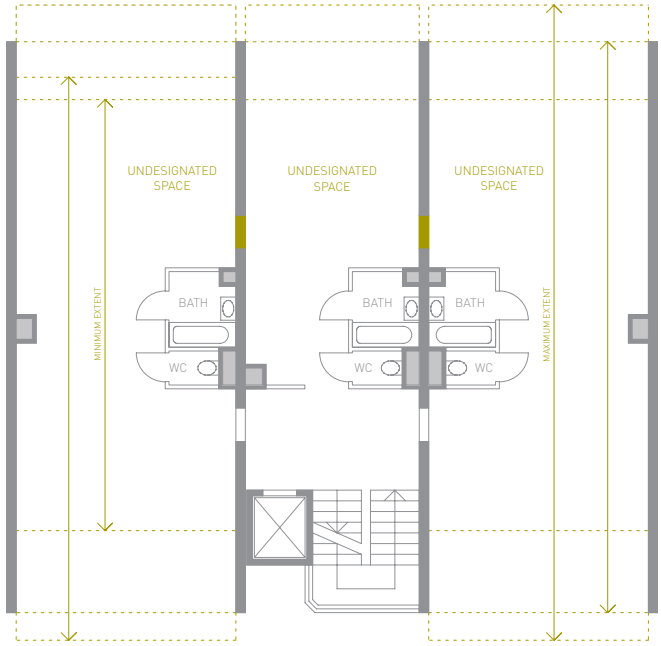
084

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1979	Britain	Ottakar Uhl	Multi-storey apartment block [44]

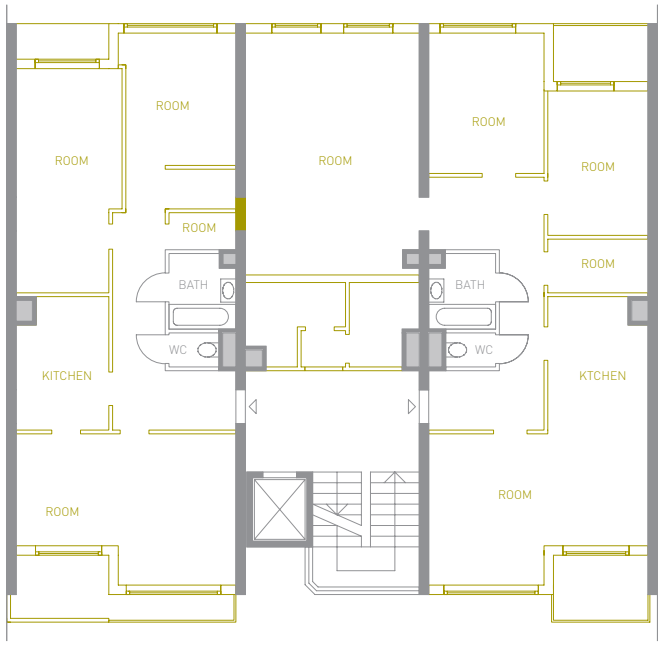
Like Uhl's earlier Hollabrunn project, this building exploits flexible design with the aim of generating maximum participation of tenants in the design process. Indeed, it was the first project in the history of Viennese public housing were tenants could determine their apartments.

The building consists of a basic three-bay structure of loadbearing crosswalls with a central staircase that serves up to three apartments per storey. The only fixed elements within an otherwise empty shell are toilets and bathrooms, which are located against the crosswalls, and a service duct on the opposite side of the wall, which indicates the position of the kitchen, without determining its final layout. Openings in the loadbearing concrete walls serve as access doors or as connection between various rooms in dwellings occupying more than one bay. Thus the space in the central bay can either be a small self-contained apartment, or else an extension to one of the apartments in the side bays.

The positions of the façades on the front or the rear were not fixed to start with, allowing the size of the apartments to be varied. By placing the façade at the most inward possible point, an apartment unit can be as small as 11.4 by 5.8 metres or, by placing the façade as far out as possible, as big as 15 by 5.8 metres, In practice the majority of tenants chose the largest possible option, though there is some variation in the addition of external balconies to some units.



structural frame and possible infill



tenant designed flats

Plan Drawing Scale 1:200

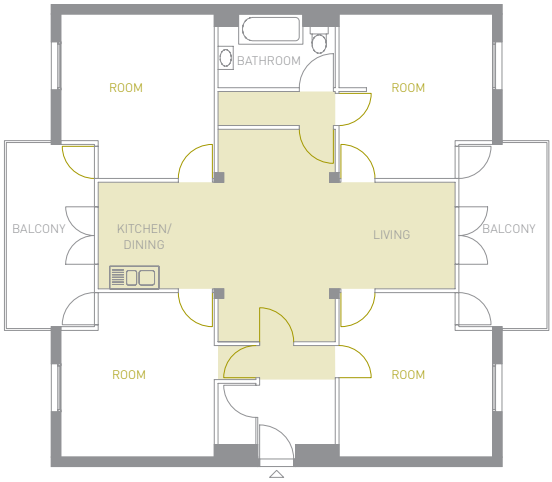
Wohnhaus

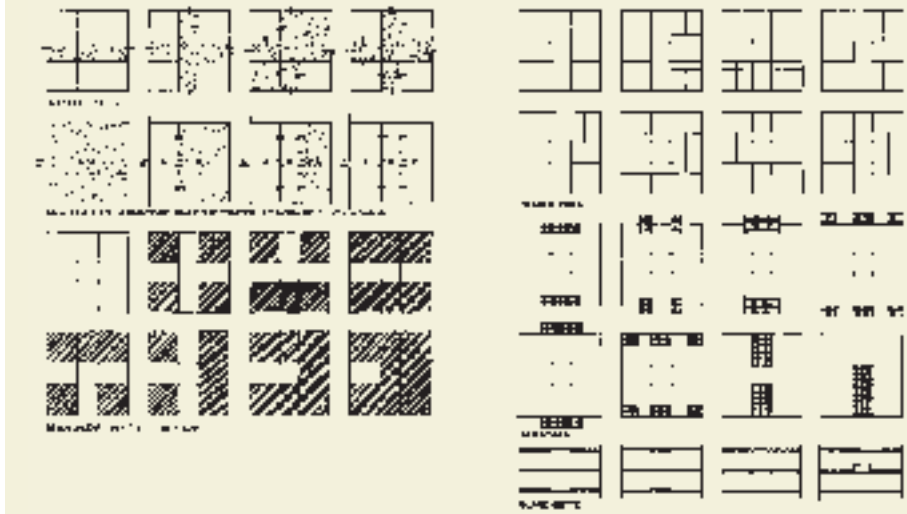
085

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1982		Anton Schweighofer	Study

The apartment consists of four identically sized rooms which are accessed individually from a central space that contains entrance hall, bathroom, kitchen and one more unspecified area. Each room has at least one point of access, most have two doors. Both the private and public rooms have access to a balcony on each side of the plan.

The flexibility of the plan comes through its indeterminacy, both socially and functionally. The rooms in themselves are multifunctional; their use is not predetermined through specific dimensions or location within the unit. The unit might be inhabited by four strangers or a family. It might be a residential unit but could equally well be an office space or small workshop. The large size of the hallway further increases flexibility in use, allowing a variety of functions to unfold in this central space, parts of which can be temporarily divided off from the others.



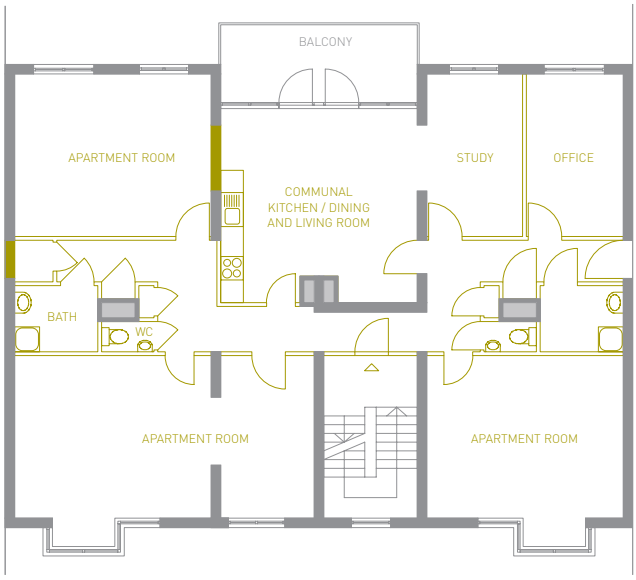


Plan Drawing Scale 1:200

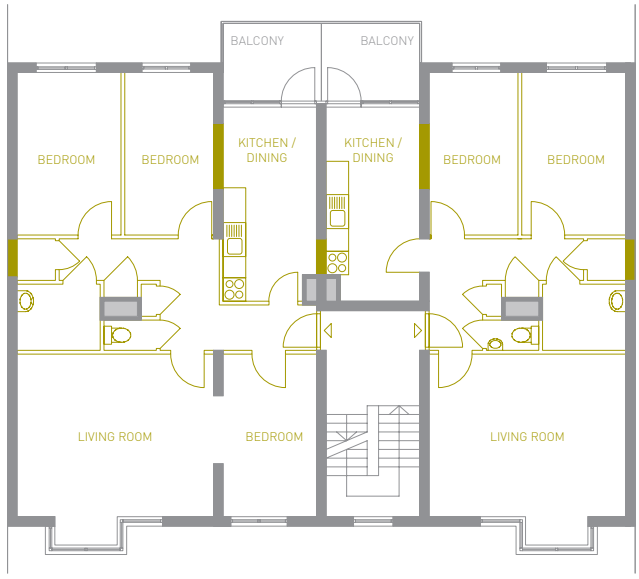
Flexibele Woningbouw

087

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1984	The Netherlands	Volkshuisvesting Rotterdam	Multi-storey apartment block

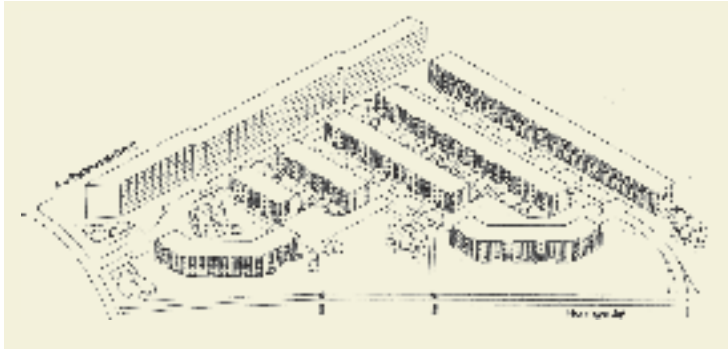


Option 2
assisted living



Option 1
apartments

The housing development between Honingerdijk and Abram van Rijckevorselweg in Rotterdam by Jan Mulder and Wytze Patijn of the Netherlands Public Housing Department, was realised between 1981 and 1984 as a set of elongated four-storey apartment blocks. The project is one of the best examples fo using fin wall construction to establish flexibility. The buildings are structured on a series of crosswalls, which are made up of fin segments, the gaps allowing for rooms / units on either side to be easily connected or disconnected. Each building is divided into zones; a central internal zone with horizontal circulation and services, and two zones of rooms along the outer sides of the building. The resulting space, only limited by the position of the vertical circulation and the fixed vertical service ducts, is subdivided by closing the gaps between the structural wall segments. This means that one entire floor section can be connected through a central corridor to form large family units, or that smaller apartments can be created.



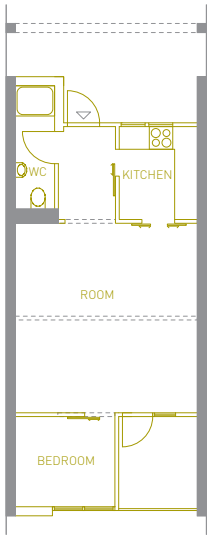
Plan Drawing Scale 1:200

Projekt Wohnhaus

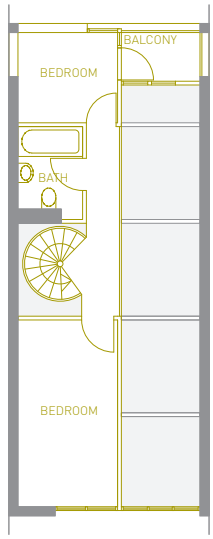
089

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1984	Germany	Anton Schweighofer	Study

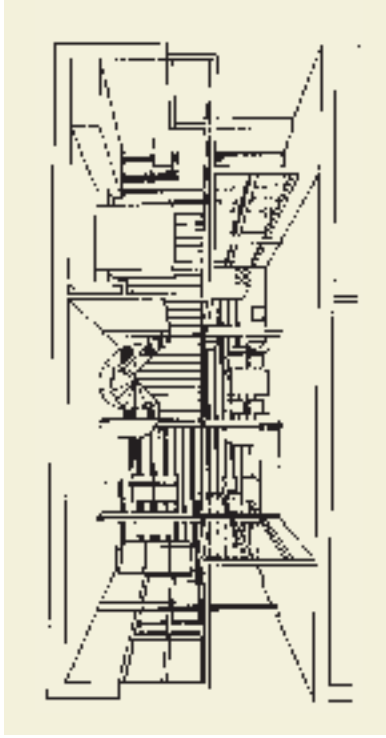
Schweighofer's work is characterised by the aim to develop spaces that are functionally as indetermined as possible. This is either achieved through the provision of a series of rooms that are individually accessible from a central hall or corridor but can also be interconnected with one another (see the earlier Wohnhaus of 1982), or it is achieved through the provision of excess raw space that can be completed by their users. This project for a multi-storey apartment house in Berlin proposes a set of apartments that can adapt over time: the initial double height space can be filled in with an additional platform to realise an additional storey. Over a period of time a one-storey double height one-bedroom apartment can be sequentially transformed into a two-storey four-room maisonette. The future upper level is implied through beams at regular intervals. Onto these beams, floors can be laid so that a range of spatial arrangements — horizontally as well as vertically — are possible. A 49m^2 apartment can therefore be changed into a space of 97m^2, which can be used as an open loft space, a tightly built-in conventional apartment on two levels or as a live and work combination.

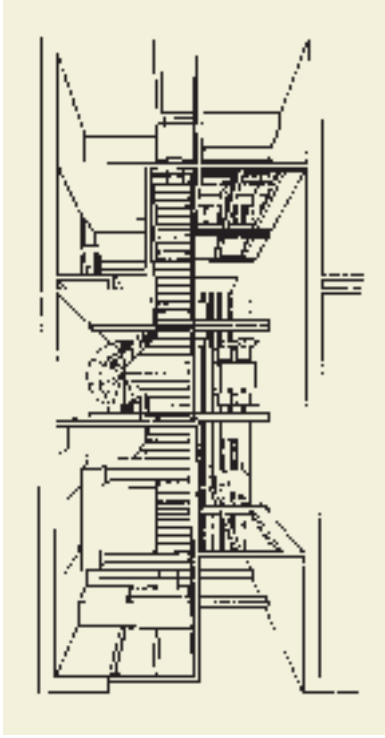


Double height space



Double height space
divided into two storeys
(upper floor is shown)





Plan Drawing Scale 1:200

Nemausus

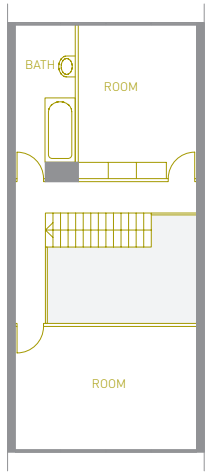
091

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1985	France	Jean Nouvel, Jean-Marc Ibos	Multi-storey apartment block [l14]

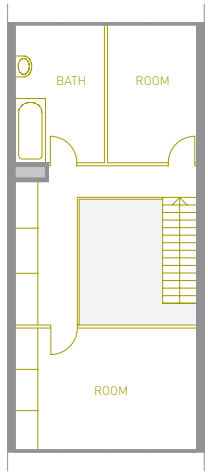
The housing scheme at Nîmes uses the principle of providing an excess of raw space that the tenants can then adapt as they wish. The economics work because whilst there is an abundance of space initially both in terms of area and volume, it is very cheap (one square metre was built for around £300 in 1985), the argument being that quantity of space is more valuable in the long term to the occupants than quality of finish. The 114 dwellings are either single level, split level or evolve over three levels; all of them are double aspect, most fitting between a five-metre crosswall system. Access to each unit is via a wide deck which runs along the entire length of every second level.

The most common unit type is a four-room two-storey apartment of between 97m^2 and 116m^2 in which the maisonette stairs are the only fixed elements in the otherwise undivided space. Services and wet zones are either grouped as a freestanding block in the centre of the entrance level of a floor plan or as one long strip located against one of a unit's perimeter concrete walls. Because of simple and straightforward structural and technological principles, each apartment can be easily subdivided or left undivided. Hot and cold water connections, as well as waste water to and from kitchen sinks, are wall mounted allowing for easy accessibility as well as changeability.

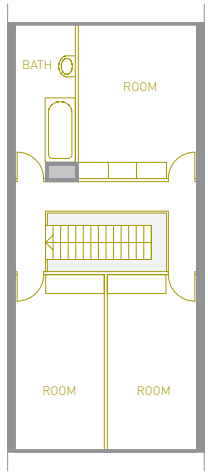
Although there is an apparent freedom granted to the tenants in subdividing their dwellings according to their needs, they are restricted by a covenant that forbids them to paint or plaster walls, or to carpet the floors; curtain colours are predefined by apartment size (blue for two-room, yellow for three-room, and red for four-room).



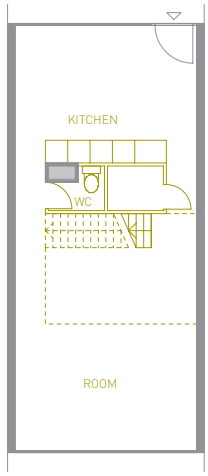
Upper floor
Option 1



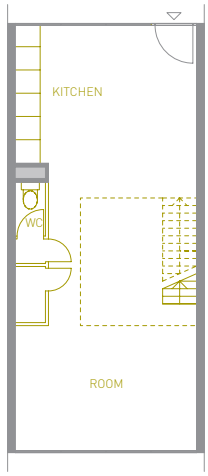
Upper floor
Option 2



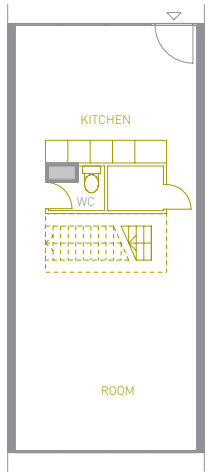
Upper floor
Option 3



Lower floor
Option 1



Lower floor
Option 2



Lower floor
Option 3

Plan Drawing Scale 1:200

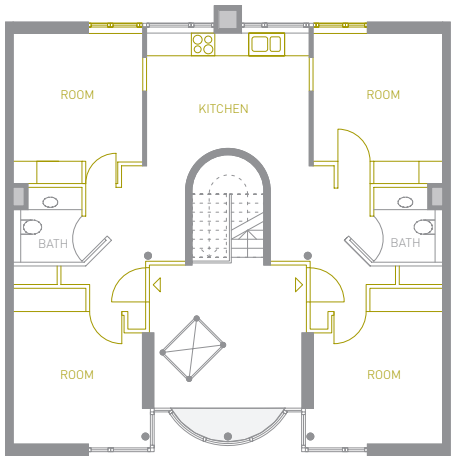
Fleksible boliger

094

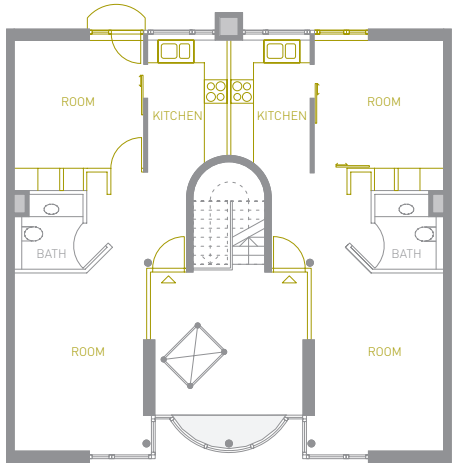
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1986	Denmark	Tegnestuen Volden	Study

Fleksible Boliger was a submission to a competition on 'Flexible Housing for the Young and the Old' called for by the Danish Boligministeriet in 1985. The winning entry by the architecture firm Tegnestuen Volden develops a scenario for how one floor in a multi-storey apartment house can be changed over a period of 44 years.

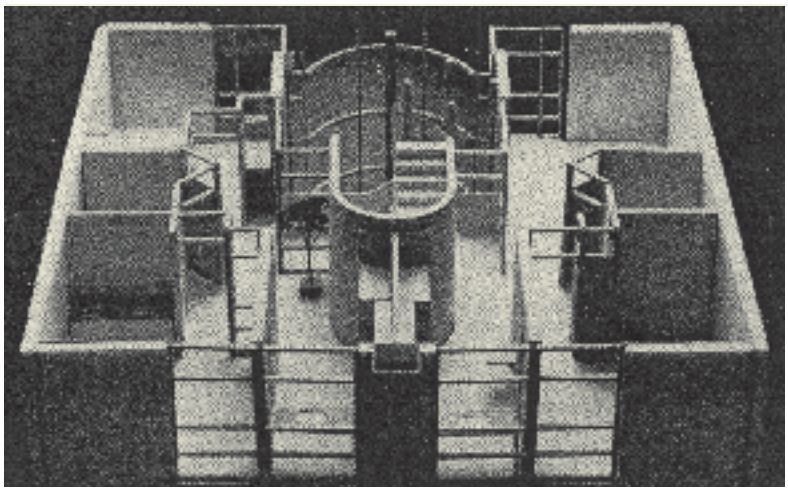
The scenario planning is accommodated in a square plan with a central circulation core and one apartment that has an entrance to each side of the staircase. Bathrooms are within the same central zone as the central staircase, located against each of the party walls. One further service duct is located centrally against the rear façade. The possible variations in inhabitants, which are played out from 1986 to 2030, develop around possibilities of dividing the single unit into two units by placing a partition wall between the back wall of the staircase and the rear elevation and by changing the position of the entrance doors and the way in which the individual rooms are accessed. With these simple measures in place, the floor space can be arranged to suit a variety of social groupings: four adults sharing one apartment, two equally sized apartments being used by two separate families, one small bedsit on one side of the stairs and a larger unit to the other side, or a section that can be separated off as a semi-independent unit.

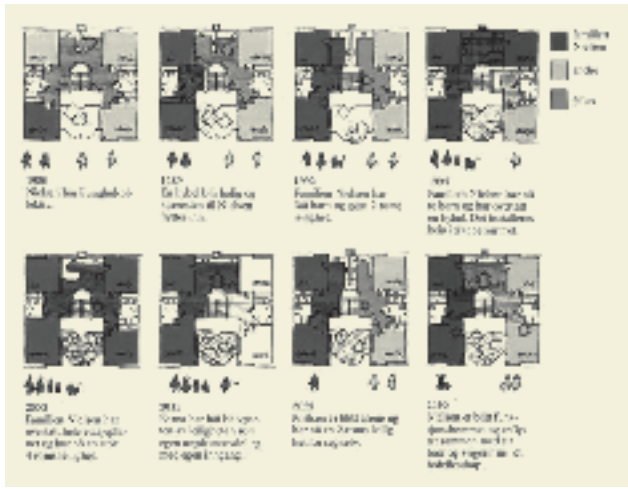


Typical floor
4 rooms, 2 baths and kitchen



Typical floor subdivided into 2 units
2 rooms, bath and kitchen each



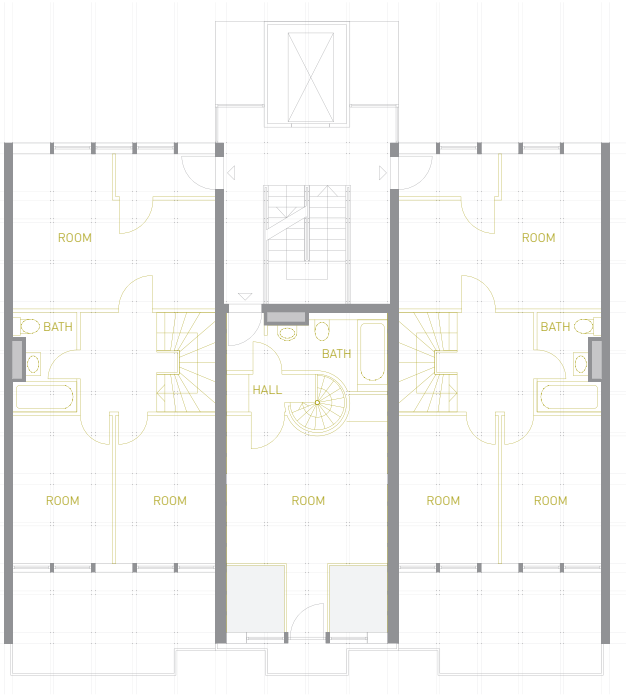


Plan Drawing Scale 1:200

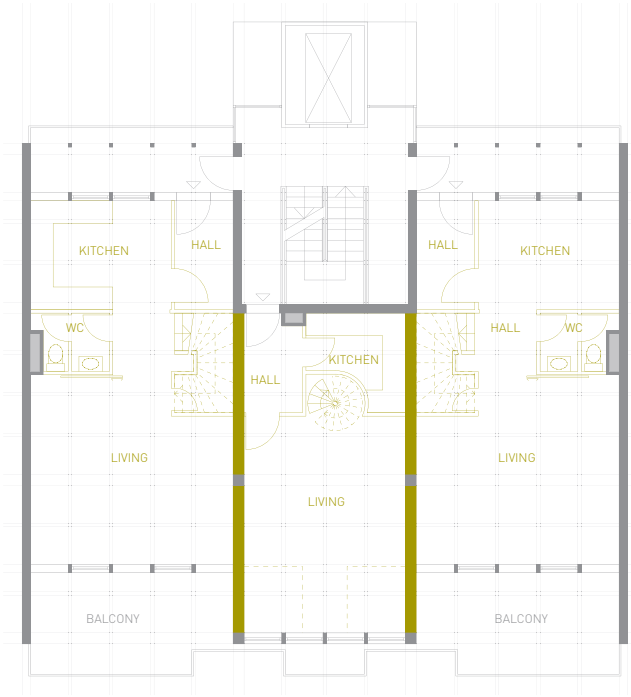
Wohnregal

095

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1986	Germany	Stürzebecher / Nylund	Multi-storey apartment house [12]



Second floor



First floor

The Wohnregal was conceived as a self-build project, erected under the overall umbrella of the International Building Exhibition (Altbau-IBA) in Berlin in 1987. The intention behind the project was to provide a cheap prefabricated reinforced concrete frame and slab structure, which acts as a shelf onto which future residents could build façades, partitions, party walls and intermediate floors using a timber building system.

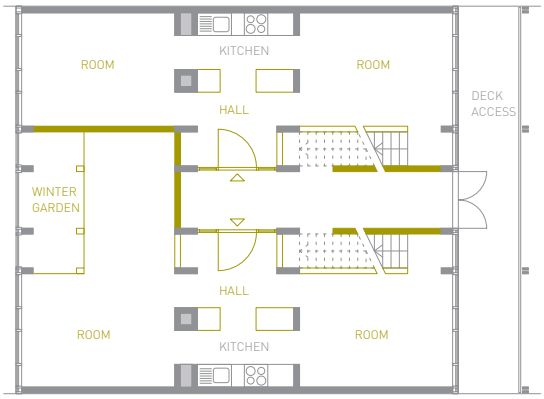
The infill grid is based on a one-metre span, a dimension which is used for doors, windows, openings and corridors. Vertically, the grid interval is 35cm, leading to an overall clear height for maisonettes of 5.6 metres. This interval also defines the height of windows and doors in the elevations. Within this grid and the structural restrictions posed by the reinforced concrete frame floor, plans as well as individual elevations were determined in a participatory process. The planning process focused around a 1:20 model which allowed the lay self-builders to visualise the architectural plans and to specify precisely the position of partition and party walls, as well as windows and balconies. The resultant spatial and elevational aesthetic is much looser than is found in traditional housing schemes, and even most flexible housing schemes.

Plan Drawing Scale 1:200

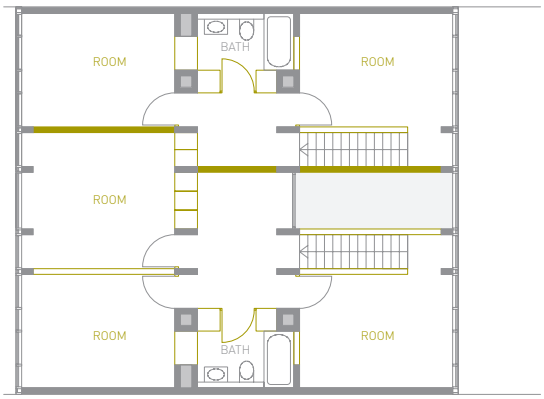
Funktionsneutrale Räume

096

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1987	Switzerland	Walter Stamm	Study



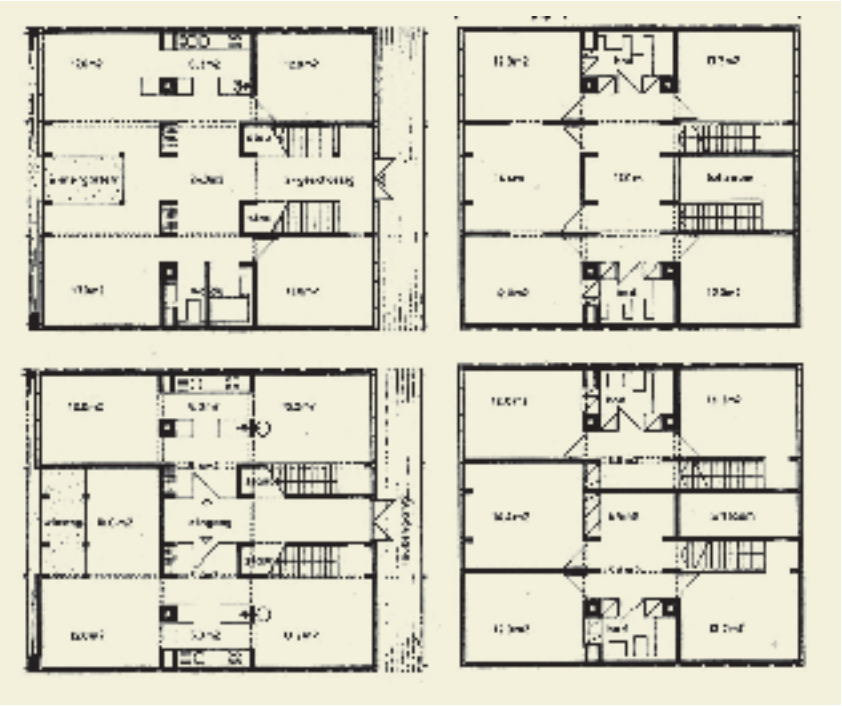
Second floor



Third floor

Walter Stamm's competition entry for a housing scheme in Winterthur challenges the notion that flexibility is best achieved through free space; instead it shows how flexibility can be achieved in a relatively determined structural and plan form. Stamm proposes a four-storey house, the first two storeys accessible from the ground floor and the upper two storeys from a deck access on the second floor. Stamm sets a primary structure of a series of fixed elements between crosswalls. These elements, some as small as 30cm long, suggest but do not overdetermine subdivision; they present a skeleton onto which a secondary structure of walls and doors may be attached.

The fixed elements are either attached to the external façades as stub walls or are contained in a central zone that runs across the plan and defines the circulation. Service ducts are also within this central zone, located against each of the party walls. The rhythm of the fixed elements, which are set apart by either 60, 90 or 150cm, gives a wide range of possibilities for subdivision to be determined by the tenant. The flights of stairs can either be contained within a unit in order to create a maisonette type, or can be used as public vertical circulation for the upper storeys. In the latter case, one storey can either be one large unit, or can be subdivided into two apartments. The smallest unit within this system is just over 34m^2, but two 4-storey town houses of 185m^2 and 245m^2 are possible as well as four apartments, each across one storey.



Plan Drawing Scale 1:200

Honor Oak Park

097

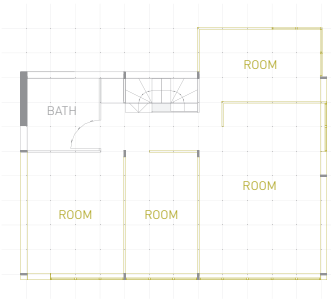
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1987	Britain	Walter Segal, Jon Broome & self-builders	Detached houses [13]

The thirteen buildings in the London borough of Lewisham were the second phase of self-built houses to be overseen by Walter Segal in that area. They represent a refined version of the building system developed by Segal and Broome in order to increase the choice open to individual self-builders not only during the initial building process but also in the future. The system was designed to empower self-builders to take control of both the design and construction of their homes, and was seen as a direct antithesis to the mass housing schemes that had been developed in the public sector, with their repetitive and inflexible designs giving the dwellers no control over their own environment.

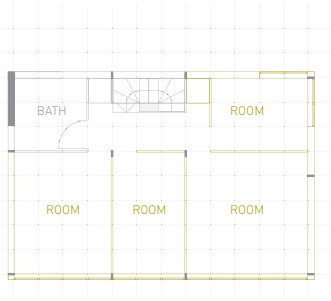
The self-builders were selected from a list of families interested in building their own houses. Upon joining the scheme they were supplied with very basic plans and sections and a typewritten specification that described the sequence of construction. They could then adapt the layouts to their own purpose.

The main element of flexibility within the Segal system is lightweight dry and demountable construction systems with a modular frame that accepts standard panel sizes. Adaptations and improvisation are possible within a set of precise rules: the overall dimensions are given (a multiple of the underlying 65cm grid), and the location of the service and circulation core is set together with the position of the twelve structural members.

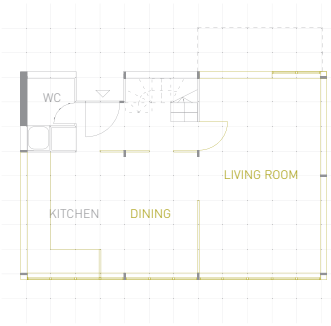
Whilst the exterior of the buildings is relatively uniform, no two floor plans are the same. Ground floor plans show how kitchen, dining and living room may either be separated or combined into one large space, some plans have a bedroom downstairs, and first floor plans vary in number of rooms and range of sizes for bedrooms. Because the self-builders know the building inside out through having been part in the construction process and because of the readily accessible building materials and simple construction, adaptations and extensions to the building can be easily accomplished, as indeed has happened over time. [See also Fig 7.19]



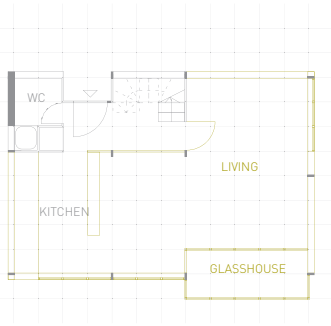
First floor. Option 1



First floor. Option 2



Ground floor. Option 1



Ground floor. Option 2

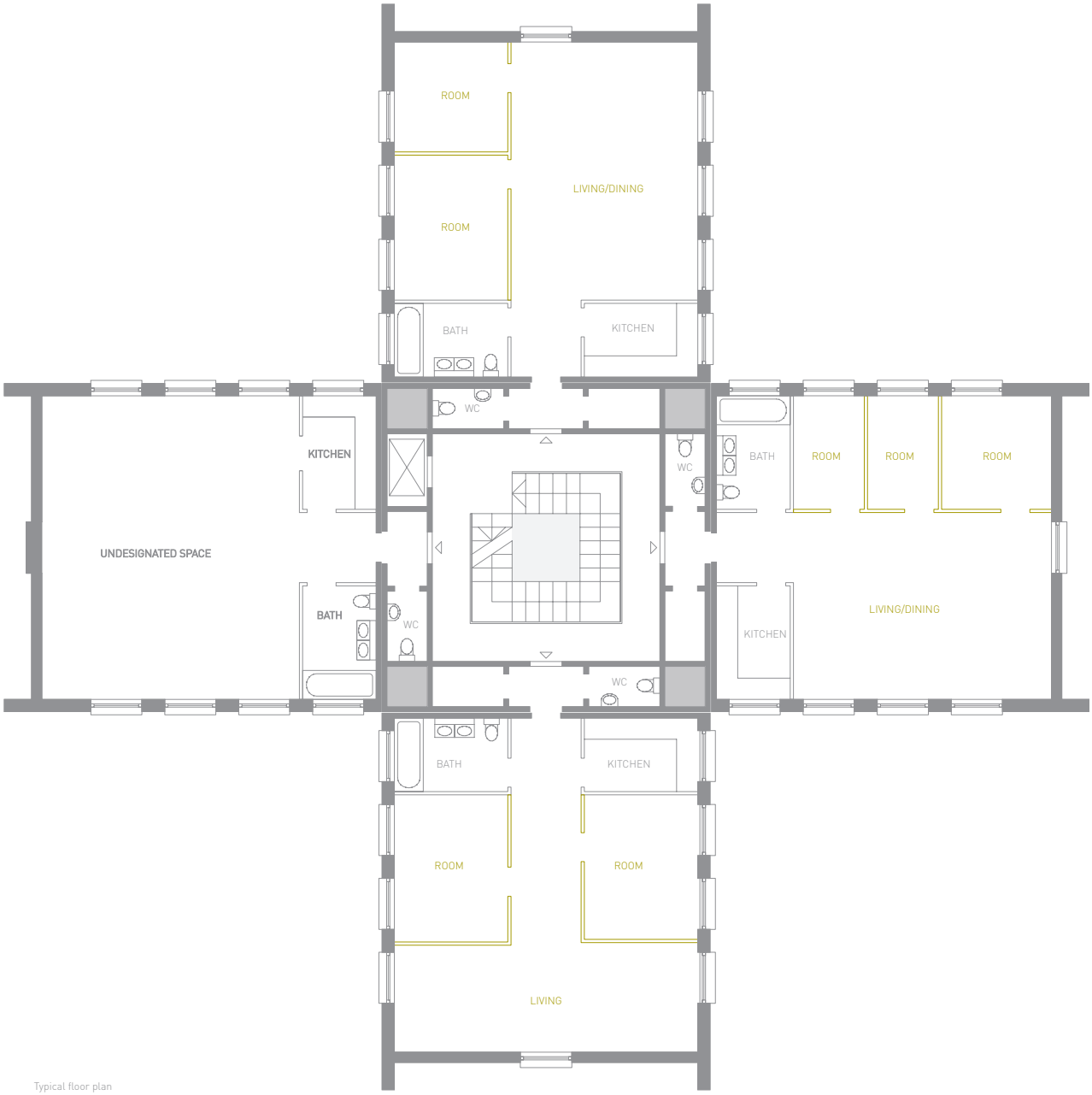
Plan Drawing Scale 1:200

Ingolstadt [Europan 1989]

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1989	Germany	Andreas Hild	Study

The four-storey apartment house was designed for a site in the Piusviertel in Ingolstadt, as part of EUROPAN 1 in 1988/1989. The overall theme of the competition was focused around changes in lifestyles, building technology and architectural attitudes; architects were challenged to respond to wide-reaching changing social conditions.

Andreas Hild's proposal is a building arranged around a central core of staircase and surrounding gallery. The next layer, still part of the central core, consists of service cores in each corner of the square, the entrance to the apartments, storage rooms and a WC. Attached to each side of the square are rectangular plans of 9 by 11 metres, with bathrooms and kitchens adjacent to the central core. Apart from these fixed rooms, each apartment is a loft-style open space that can be freely subdivided within a grid of 120cm. Whilst the overall size of the plan can't be added to or changed, the interior as well as the number of windows gives scope for different forms of organisation.



Typical floor plan

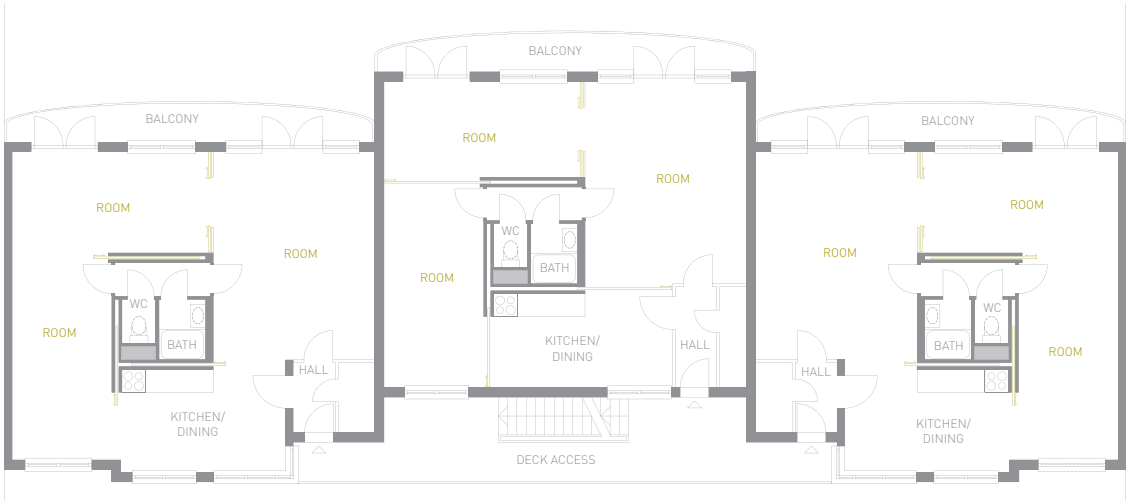
Plan Drawing Scale 1:200

Dapperbuurt

102

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1989	The Netherlands	Duinker & van der Torre	Multi-storey apartment house [49]

The urban infill project for the Dapperbuurt quarter in Amsterdam consists of 49 apartments in three buildings. This five-storey building on Wagenaarstraat has three apartments per floor, all accessed via a street-facing deck access. The nearly square floor plans are identical in design. A small cubicle is located in one corner of the plan and contains a small entrance hall, a storage cabinet and a vertical service duct. From this anteroom, two doors lead into the plan. One door is in line with the entrance door and opens onto an elongated room that faces the inner courtyard. The second door enters a space along the front façade. The overall plan is only interrupted by a box that sits centrally and contains the kitchen along one of the shorter sides, a bathroom and separate WC, a service duct and a corridor that cleverly provides access to, and privacy for, the bathroom and WC. It also allows separate access across the apartment, enabling a much greater degree of independent useability of each space. Three sides of this box also contain pockets for sliding walls which can divide the open space into a maximum of four rooms — temporarily or semi-permanently — to provide a wide variety of configurations. The design not only allows flexibility in use, but also give an expansive feeling in a relatively compact apartment (c.85m^2).



Typical floor

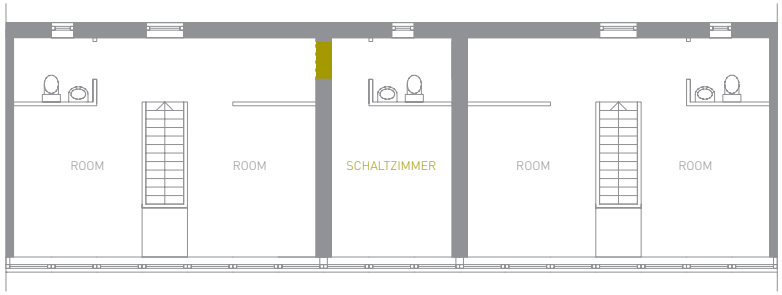
Plan Drawing Scale 1:200

Am Steinberg / Röthenbach

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1990	Germany	Metron-Architekten AG	Terrace [59]

The development in Röthenbach near Nuremberg was one of seven projects initiated by the Bavarian government in 1985 as part of a programme that invited architectural firms from adjacent countries to design housing schemes that would be used as case studies for future designs.

A series of two-storey rows of terraced houses were built between 1990 and 1991. The programme splits into 54 units of 3 rooms, 6 small apartments and 36 so-called Schaltzimmer (literally 'switch rooms'), spaces that can be allocated to one or the other unit. The six metre deep buildings are organised in nine strips, each containing 6 units and four Schaltzimmer. A zone of service rooms including bathrooms, kitchen and general storage lines the north façade of each building. Staircases are orthogonal to the direction of the rows and divide units into two equal sides. Kitchen and living room are on the ground floor with a direct connection to the south facing private gardens, whilst two same-sized spaces, are located on the first floor. The first and the last house in each row is fixed in terms of dimensions, having two rooms on the ground floor and two rooms, a storage space and a bathroom on the first floor. The four units in between these two houses, however, can be adapted in terms of size up to three rooms, including kitchen, on the ground floor and three rooms on the first floor. This transformation is made possible by the allocation of a Schaltzimmer, located on both floors between unit 2 and 3, and unit 4 and 5. Through the simple device of interchangeable panels, the Schaltzimmer can be allocated to either unit, allowing expansion and contraction of the units over time. Thus a Schaltzimmer on the ground floor can be given over to unit 2, whilst the Schaltzimmer on the first floor can be given to unit 3 or, the Schaltzimmer on both floors could be given to unit 2. Schaltzimmer located on the ground floor also have the potential to be converted into a tiny but entirely independent unit. This simple design device allows the landlord of the scheme greater scope in letting out units through being able to react to social and market demands.



First floor

Ground floor

Plan Drawing Scale 1:200

Überbauung Hellmutstrasse

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1991	Switzerland	ADP Architektur und Planung	Multi-storey apartment block

The design concept for the buildings in Zürich was developed as a result of a consultation process with future tenants who belonged to a housing cooperative committed to the idea of a form of communal living in an urban neighbourhood. The design is split into three distinct horizontal zones. At the top is a line of similarly sized rooms divided by loadbearing partitions, and with the possibility of inserting non-loadbearing partitions to define circulation. These rooms have no designated use. Then there is a row of serviced spaces that can be either bathrooms or kitchens. Finally, a zone containing what is usually a kitchen and living space, but which can also be used as a self-contained studio apartment. All apartments are accessed from an external staircase and balconies, which are generous enough to share with others.

The overall arrangement allows multiple arrangements to be achieved, from large groups of single people living together right down to selfcontained one-person studio apartments. The zoning also allows future changes to be made with ease. These changes can include the possibility of enlargement of one unit and the reduction of size of another one, which means that the overall number of apartments is not fixed but depends upon demand. In practice, the design proved most flexible in handling the multiple demands of the initial occupants. [See also Fig 5.19 and Fig 5.20]

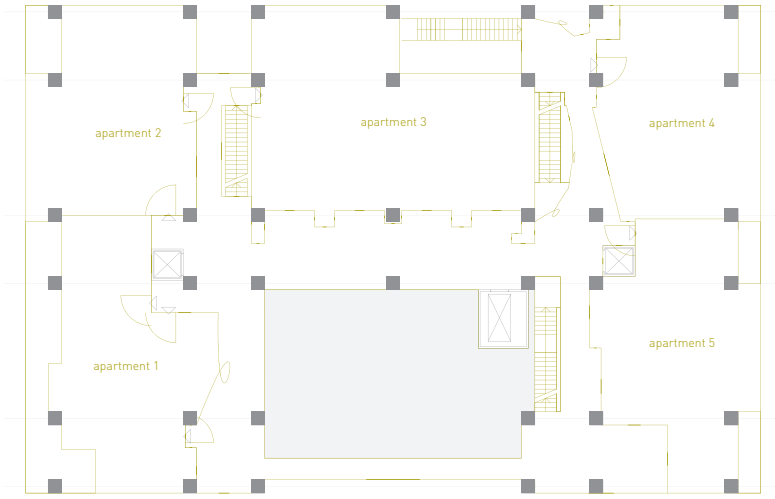
Typical floor plan

Plan Drawing Scale 1:200

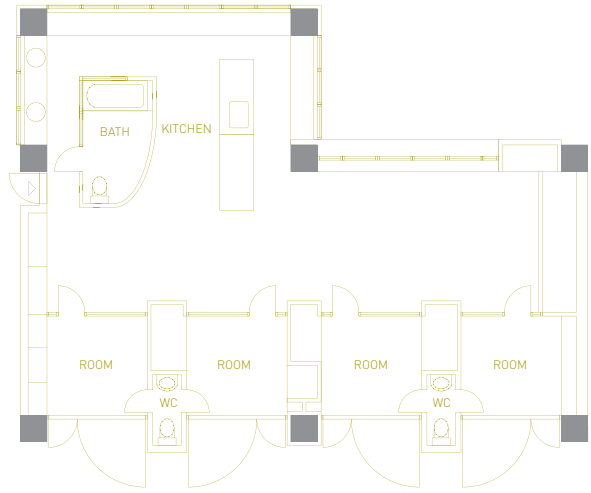
Next 21

111

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1993	Japan	Osaka Gas	Multi-storey apartment block [18]



Second floor 1:400



Apartment 3

The Next 21 project was constructed as an experimental residential complex in Osaka, Japan, by Osaka Gas Co., Ltd. The building was initiated in order to test new models for reducing energy consumption and preserving the environment through waste processing (water and refuse) and greening at the same time as creating apartments that suit and can adapt to individual residents' needs and lifestyles. Whilst most of the dwellings during a first phase of occupation (April 1994 to March 1999) were proposed by Osaka Gas, others were designed by the residents themselves. The project closely follows the principles of the Open Building movement, and is often used as an example of the benefits of a support and infill approach.

The building takes account of different needs and time horizons, both in terms of social occupation but also in terms of construction, with the latter being differentiated according to the particular life span of each component. Building elements are divided into two groups: long-life elements that provide the communal structure (columns, beams and floors), and short-life elements in private areas (partition walls, building services and equipment), which can be adjusted without disturbing the overall integrity of the system. This is clearly expressed in the aesthetic of the building, with a stable and relatively ordered structure framing a more diverse infill suggestive of change.

Wall components are based on a modular system and can be placed anywhere on the predetermined grid. The services form a separate constructional layer. Wiring and piping for gas, water and electricity are located in raised floors or suspended ceilings. When parts have to be exchanged, or when systems have to be renewed, panels in the ceiling or floor plates allow easy access.

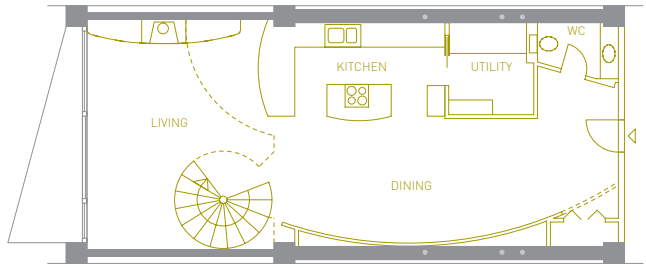
Plan Drawing Scale 1:200

Banner Building

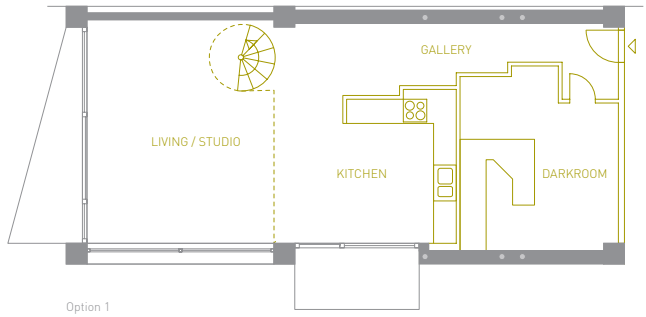
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1994	USA	Weinstein Copeland Architects	Multi-storey apartment block [20]

Following the principles of the US loft, the Banner building provides purchasers with raw space that can then be designed on an individual basis. Three kinds of units cater for different purposes and aspirations. Six rental units are located in a separate two-storey wood frame structure towards the rear of the site and a second building towards the front of the site accommodates fourteen owner occupied two-storey high live / work units of 167m^2 each, which sit on top of a two-storey base building that is zoned for retail, light manufacturing and commercial use.

The front building is a cast-in-place concrete slab and frame structure, with plumbing stacks positioned within the party walls. Bathrooms and kitchens can thus be positioned anywhere along the left and right-hand side of each apartment. The spaces are tall enough to allow a mezzanine to be inserted. The workings of the building were described in an owners' manual, which was written by the architects and explained the essentials of the individual units. Apart from these technical details, each occupant could decide how to fit out the available space. Whether or not to have rooms, how to organise living and working within one unit and how these two functions would connect — if at all. Within the existing loft shell, anything is possible and because of the simplicity and clarity of design and construction, any addition to the unit can be easily removed and replaced by something entirely new.



Option 2



Option 1

Plan Drawing Scale 1:200

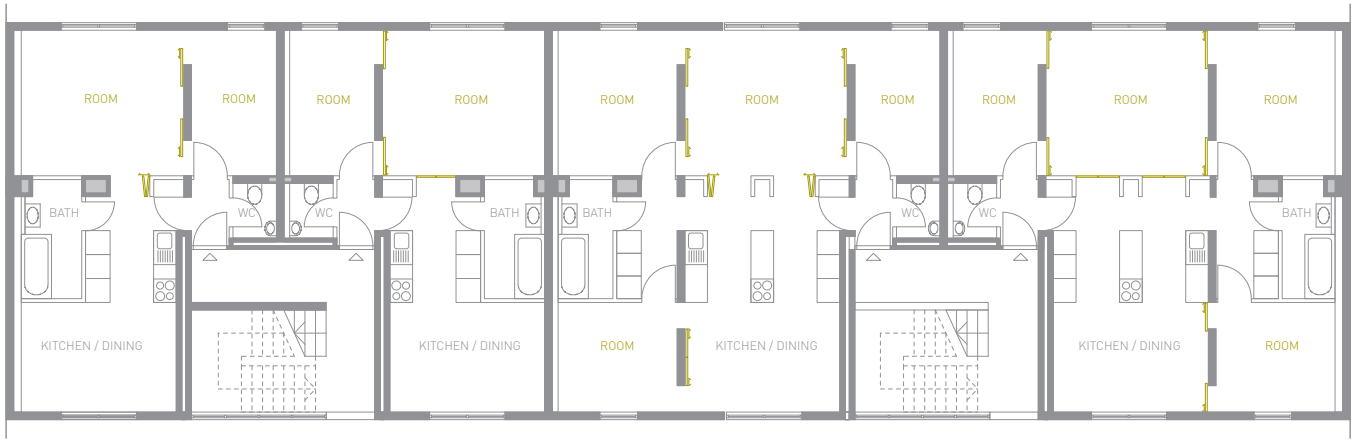
Housing Graz-Straßgang

114

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1994	Austria	Riegler Riewe Architekten	Multi-storey apartment house [24]

This apartment block in Graz explores the idea of flexibility in use, its plans suggesting multiple ways of occupying space. The building is organised on three levels with each staircase serving two apartments per floor. The size of apartments ranges from smaller units of around 45m^2 to larger units of around 75m^2. Each unit has a central three metre wide zone of bathroom, kitchen, hall and circulation that provides access to each room. The central zone can be divided up in various ways. Sometimes it contains the kitchen, at other times the kitchen is located in one of the outer rooms and its space in the central zone taken by storage or a small study area. In effect the central zone acts as an expanded hallway, gathering various activities of the apartments whilst allowing multiple connections to the outer rooms.

Rooms, however, are not only accessible from the central zone but can also be connected or disconnected to each other by means of foldable and / or sliding walls. The suggestion is that these might be moved on a daily basis or else be more permanently fixed. Space on either side of the core, in particular in the larger units, can be used for any purpose and predetermined use of rooms is avoided.



Ground floor

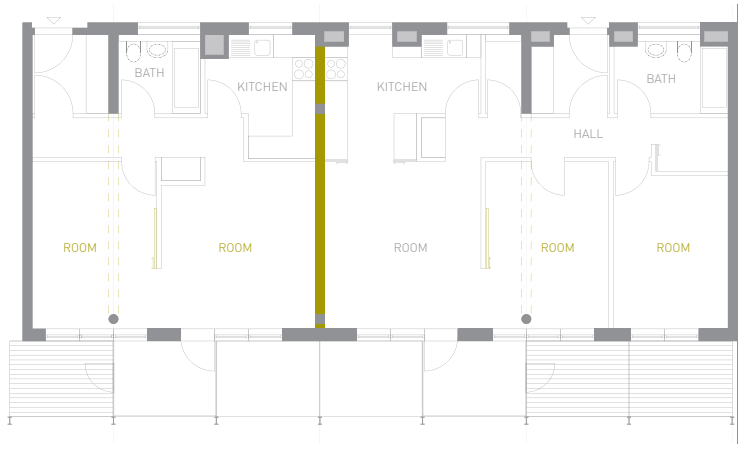
Plan Drawing Scale 1:200

Brandhöfchen

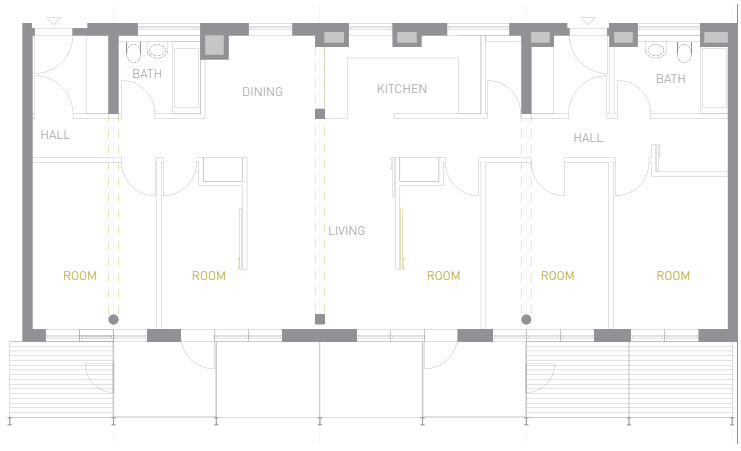
115

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1995	Germany	Kramm + Strigl	Multi-storey apartment block [100]

The scheme at the northern edge of the city of Frankfurt's boundaries is organised in five east-west oriented four-storey rows of houses. The plan is based on a regular structural grid system, with kitchens, bathrooms and entrance to the individual units in one zone along the north facing side of the building and a series of spatially equal rooms towards the south. The structure's only load bearing elements are beams and columns — none of the internal walls are load-bearing — meaning that even party walls can be removed to combine two smaller units into one large unit. Small service cores are located on each grid line (at the north façade), allowing for a range of connection possibilities.



2- and 3-room flat



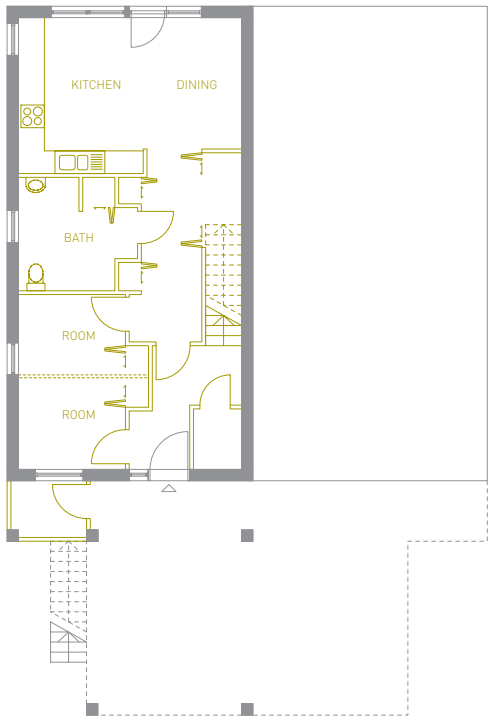
2 flats combined to one large unit

Plan Drawing Scale 1:200

London Flexhouse

117

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1996	Canada	Nouvelle Development Corporation	Single-, semi-detached or terrace



Ground floor plan

The London FlexHouse was the winner of the Canada Mortgage and Housing Corporation's National FlexHousing Design Competition. The competition set out to encourage architects and developers to create flexible, adaptable and affordable houses. The London FlexHouse comes as a three-storey unit that can be subdivided into either two or three units. It can be built as a single-detached, semi-detached or row house. A home office can be added, as well as a greenhouse on the second or third floor. The house also incorporates features common to Lifetime Homes such as wide corridors and flights of stairs, height adjustable kitchen and bathroom cabinets and counters, a fully accessible ground floor and a space that in the future can accommodate a lift to all floors. It is thus one of the few examples of flexible housing that specifically caters for ageing or disabled people.

In terms of design, subdivisions are made possible by the position of the entrance and its relation to the internal staircase. Upon entering the unit on the ground floor, the stair to the first floor is almost immediately to the right and a door to the spaces on the ground floor immediately ahead. This simple arrangement gives the potential for two separate entrance doors and thereby independent units. The ground floor can thus either be an integrated part of the house, a semi-independent unit such as a granny flat, or an entirely independent rental unit. Further flexibility is given by the design of the ground floor front room, which can either accessed separately to give a home office, divided to give two small bedrooms or accessed as a large bedroom from the ground floor unit.

Plan Drawing Scale 1:200

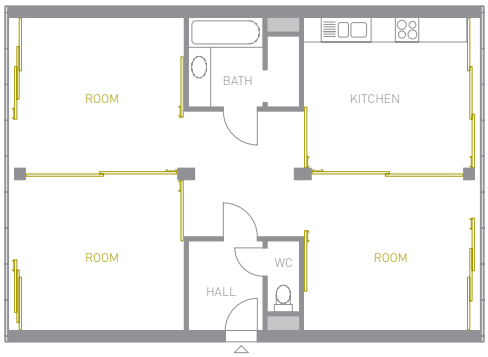
Grieshofgasse

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1996	Austria	Helmut Wimmer	Multi-storey apartment house [9]

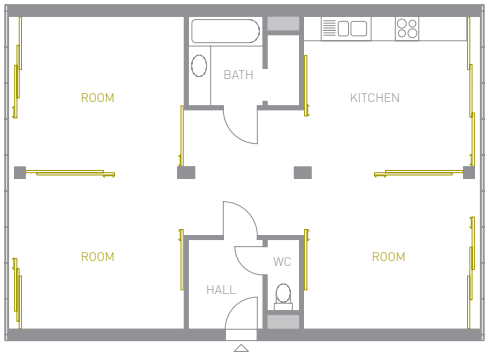
Helmut Wimmer's work deals with the development of generic structures within which different functions can evolve. The unknown in his scenarios is not only merely accepted but taken as the premise for a design.

The building on Grieshofgasse in the southwestern periphery of Vienna accommodates nine apartments on five storeys. There are two apartments per floor, one to each side of the vertical circulation, both of equal size. The entrance door leads into a small hall with adjacent WC. Through the door ahead one enters the very heart of the apartment, a space from which all other rooms are accessed. The only other enclosed space, the bathroom, is located against the opposite wall and occupies the same amount of space as the entrance hall/WC.

Sliding walls are installed so the front and the backspace can be partitioned off from the central space, and so that both the front and the backspace can be divided into half their size. Apart from the placing of a run of kitchen units, no particular use is designated to these spaces. Each room can therefore have a certain neutrality in terms of function, giving a flexibility in use that is further manifested in the multiplicity of possible connections across the central zone. [See also Fig 3.6]



Typical floor plan
Sliding doors between room are closed



Typical floor plan
Sliding doors between room are open

Plan Drawing Scale 1:200

Next Home

120

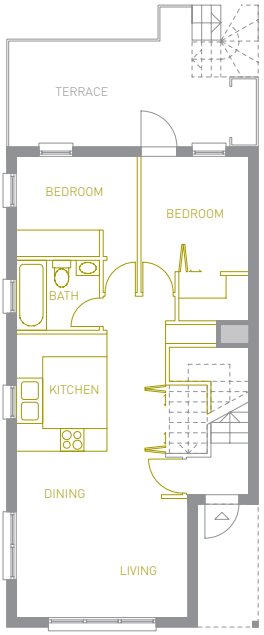
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1996	Canada	Avi Friedman	Single-, semi-detached or terrace

Avi Friedman's work, developed over a lifetime of research and practice, is concerned with adaptability of buildings that offer responses to societal changes and demographic shifts, as well as to issues of affordability. The Next Home in particular is a manifestation of an approach that enables greater choice for the occupants during the buying process as well as throughout the building's lifetime.

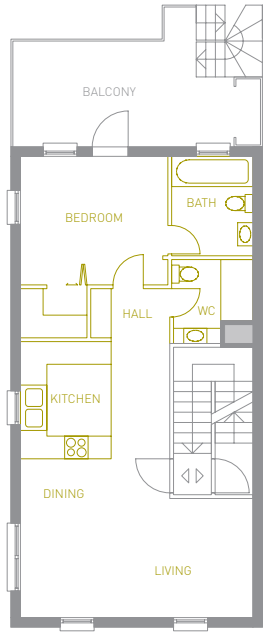
The building is designed to be built as a detached, semi-detached or row house. Each house can be occupied by a single user group, or each storey can be used independently from the others. Because of the position of the vertical circulation core, as well as the easy removeability of the joists between levels to allow the installation of internal stairs, the transformation of the building from one single-user dwelling to up to three independent units, can be made pre- and post-occupancy.

The elongated floor plan of 6.1 by 12.2 metres gives an overall floor plate of around 75m^2. These dimensions allow a subdivision across the width, to give two reasonably-sized rooms.

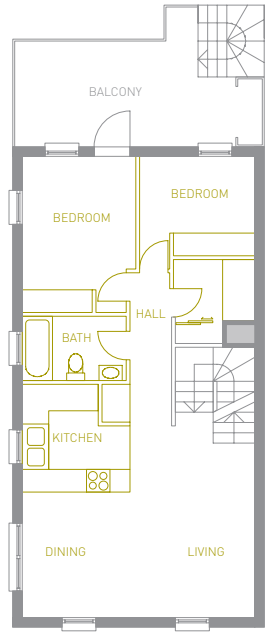
The underlying principle of the Next Home is one of a set of interior and exterior components which enables the occupant to choose from a series of materials, finishes and forms to suit both lifestyle and budgetary constraints (every element comes with a price attached). Interior elements include partitions in different lengths, kitchen and bathroom layouts and floor finishes. Exterior elements include windows, based on a module of 305mm; roof variations, which range from flat to pitched, also allow a choice of metal or asphalt decking; further add-on elements such as backyard patio, rear balcony, balcony enclosures, and one- or two-storey bay windows; and a choice of exterior finishes for front, rear and side façades.



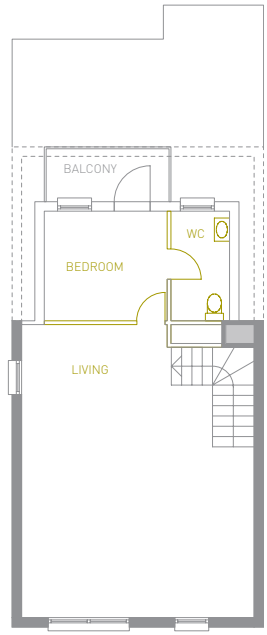
Ground floor



First floor



Second floor



Third floor

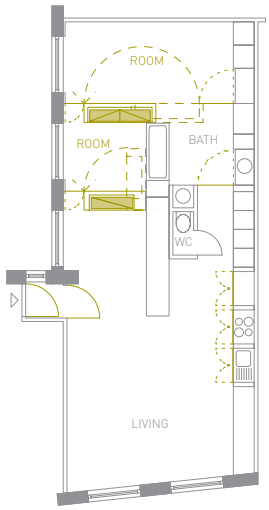
Plan Drawing Scale 1:200

The Transformable Apartment

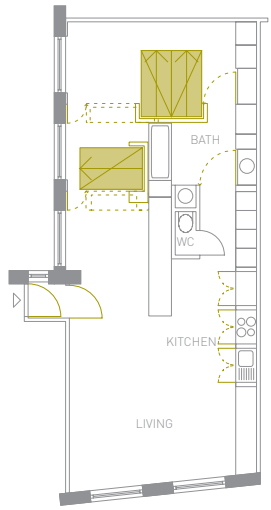
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1996	Britain	Mark Guard Architects	Apartment [1]

The transformable apartment is a contemporary exploration of the theme of foldable beds and sliding doors in order to maximise available space through flexibility of use.

Here, a 90m^2 unit is accessed slightly off-centre along one of the long sides of the floor plan. The entire wall opposite the entrance is occupied by a built-in cupboard-wall which contains the kitchen, kitchen storage, drying cupboards, and wardrobes. The doors to the kitchen can be slid back to expose three work areas, a washing up area, a cooking area and a coffee / drinks bar. Three free-standing modules to the left of the entrance contain the elements through which the otherwise undivided space can be transformed from one open plan live / work unit into a unit with up to two bedrooms. One module contains a WC and a set of doors to enclose a bathroom area. The other two contain fold down beds and sliding doors that can be pulled out to create one or two bedrooms.



Day use



Night use

Plan Drawing Scale 1:200

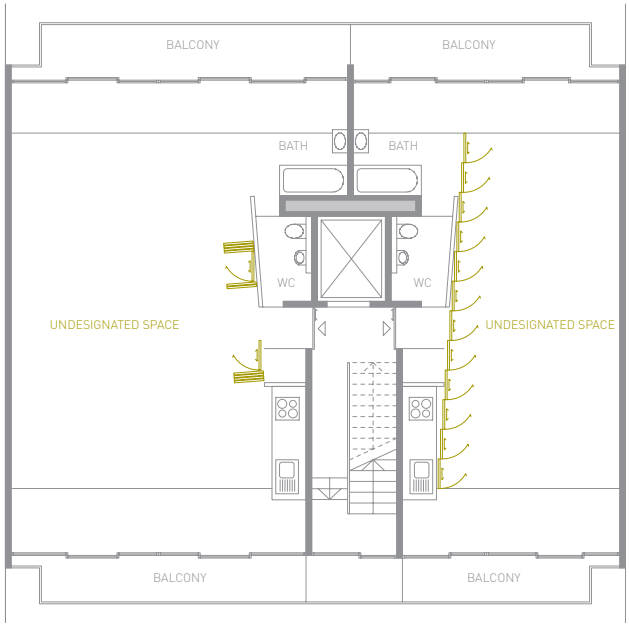
Estradenhaus

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1998/2001	Germany	Wolfram Popp Planungen	Multi-storey apartment house [27]

Built in the area of Prenzlauer Berg, Berlin, Wolfram Popp's two apartment blocks with a total of 27 units are sited on a gap site between two typical nineteenth century Berliner Altbauten. Both seven-storey infill buildings, the first completed in 1999 and the second in 2001, were privately financed and provide both rental as well as freehold apartments of between 78m^2 and 180m^2.

Whilst the buildings' name alludes to a historical term used to describe a raised floor area leading up to a window opening, the main feature in both buildings is — though executed differently — the open plan.

The first building on Choriner Strasse 56 has ten apartments, two offices and a shop (plan on the right). The vertical circulation is located with its short side to the streetward elevation. Its off-centre position creates two different sizes of apartments: one of 78m^2 and one of 108m^2. Access to each apartment is from the centre of the plan into a small hall that is part of the service zone which runs the full depth of the building. A wall of moveable ceiling high wooden panels in front of the service zone, each individually workable, reveals or hides the functions behind. The space beyond this zone is undivided and can be adapted to whatever use required, thereby offering a variety of options to the occupants. The architect wanted to determine these layouts as little as possible, but did show 12 variations some with sliding walls and moveable elements. In the end only one of the tenants opted for moveable walls.



Typical floor

Plan Drawing Scale 1:200

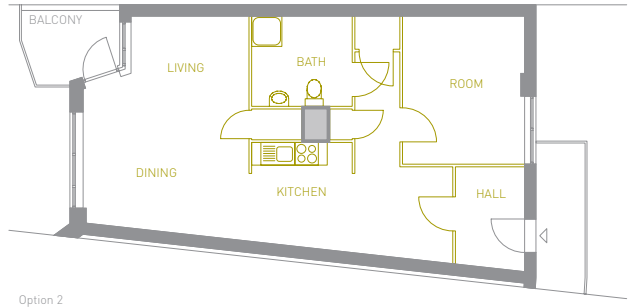
Pelgromhof

127

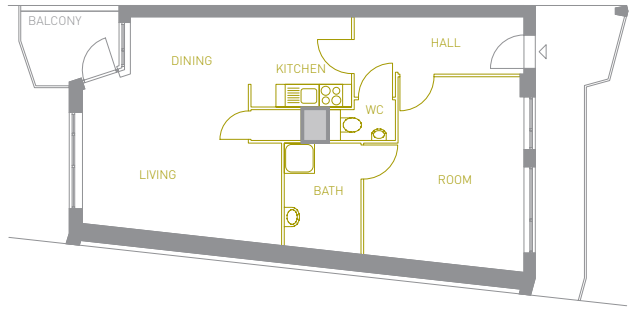
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1998/2001	The Netherlands	Frans van der Werf	Urban block [215]

Pelgromhof is a four- to six-storey apartment block of 215 units in Zevenaar, the Netherlands. The complex, aimed at people in the fifty-plus age group, offers independent apartments, sheltered apartments and a social centre that includes a restaurant, kitchen, theatre, shops, library and meeting and activity rooms.

The complex is one the largest to follow the principles of Open Building and was designed to allow the individual residents to design their spaces according to their ideas and requirements. This was possible through the construction of a base building system without predetermined interior layouts. Tenants laid out their own dwellings with the aid of a full-scale mock-up of one of the apartments. The only fixed element in the apartments is a service core combined with a storage cabinet that sits centrally in the plan. Kitchen and bathroom are attached to this module, with bedrooms typically towards the courtyard gallery access and a living room, often with balcony, facing outward.



Option 2



Option 1

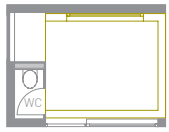
Plan Drawing Scale 1:200

Fred

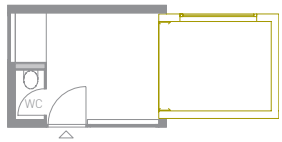
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1999	Austria	Oskar Leo + Johannes Kaufmann	Add-on / extension [1]

Fred is one of the few projects to explore the idea of built-in expandability. It is a timber container that consists of two boxes: one outer box of 3 by 3 by 3 metres and one which is slightly smaller that slides inside the bigger one. In its retracted state, it provides an interior area of 8m^2; when pulled out it has a total area of 15m^2. Kitchen and bathroom, a small room with WC and integrated shower, are in the fixed part, with the remaining area open for interpretation.

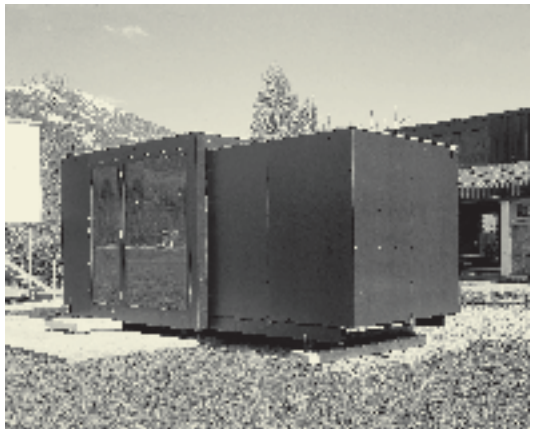
Delivered on the back of a lorry, Fred can be assembled within the space of two hours. The box sits on six steel feet: four feet support the larger outer volume and two further feet carry two bearers, extended from the large box, on which the sliding box can rest. To be entirely independent as a unit, Fred would have to be connected to the sewage system, but could then be used as an office, guest room or additional living space. Whilst not designed as a long-term dwelling, Fred introduces a new aspect to flexible design.



Module: contracted



Module: expanded



Plan Drawing Scale 1:200

Kölner Brett

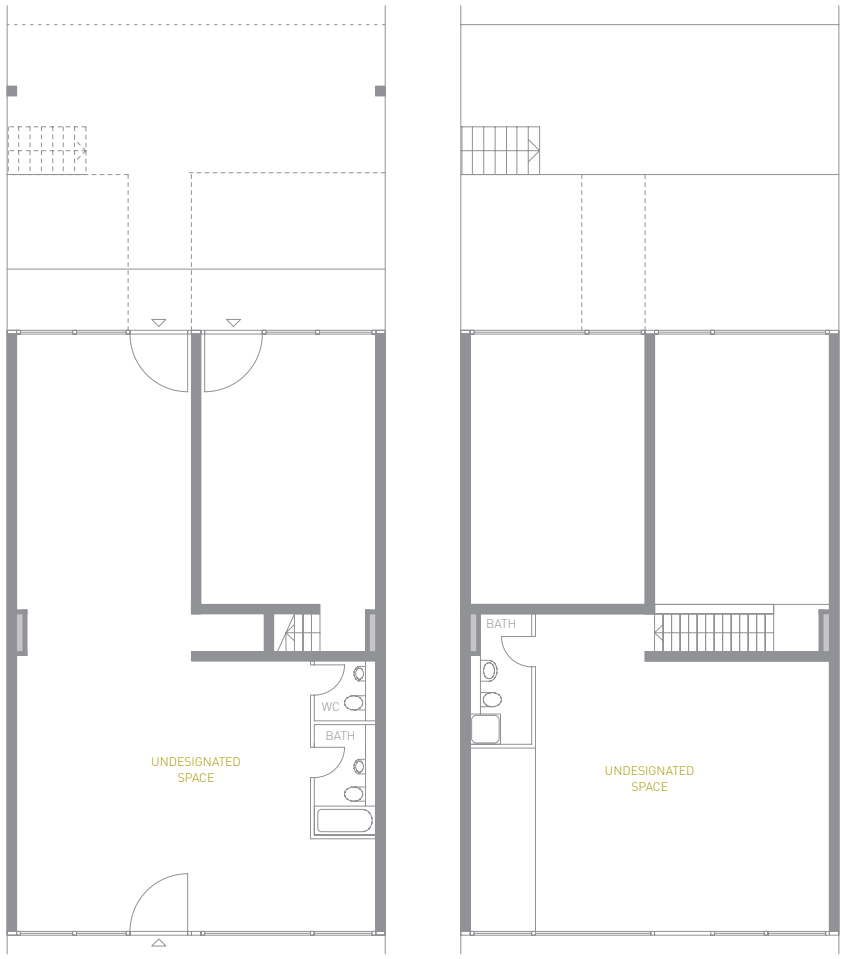
129

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
1999	Germany	Brandlhuber & Kniess	Multi-storey apartment house [12]

The building volume consists of twelve identical spatial modules which are partially on two levels and have an average usable surface area of 140m² per unit. The functionally neutral modules, providing a spatial indeterminacy that typically only exists in industrial or commercial buildings, are personalised through the use put to them by their inhabitants, who are handed over the raw shell of their space.

The four-storey building is divided into three vertical segments, each just over nine metres wide and divided into two parts back to front. Each of the storeys is initially interconnected to form interlocking units with double height spaces, which can be filled in if additional space is needed. The ground floor accommodates the entrances to six units in two types. One type is a large unit that occupies the width of one of the three vertical segments on one side of the building and half the width of the segment on the other side; this latter is a double height space. The other type of unit is entered via a smaller, but double height space that takes up what is left over by the L-shape of the larger unit. A staircase towards the rear of each of these smaller spaces leads to the other part of the apartment which takes over half a segment's length but its entire width. Two of these units have an additional entrance from the first floor of the main circulation towards the rear of the building. Units on the second and third storey work along the same lines, with the only difference being that the entrances are limited to the rear of the building.

Each unit was sold as raw space, bathroom units could be determined by the later user, which not only reduced the price of a unit, but also enabled individual control over spatial and functional arrangements. The variability resulting from this openness shows in the diverse set of inhabitants and uses which range from a dental prosthetic's laboratory to an engineer's office, and from a photographer's studio to units just used for residential purposes.



Ground floor

First floor

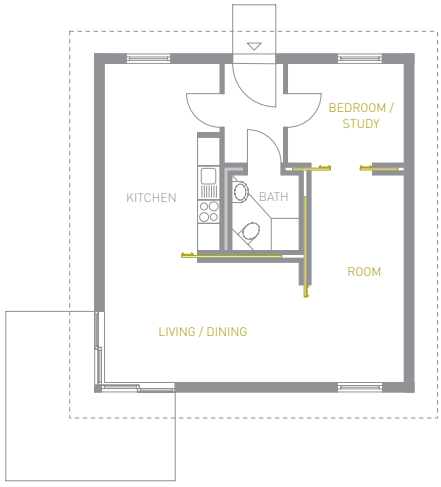
Plan Drawing Scale 1:200

Affordable Rural Housing Demonstration Project

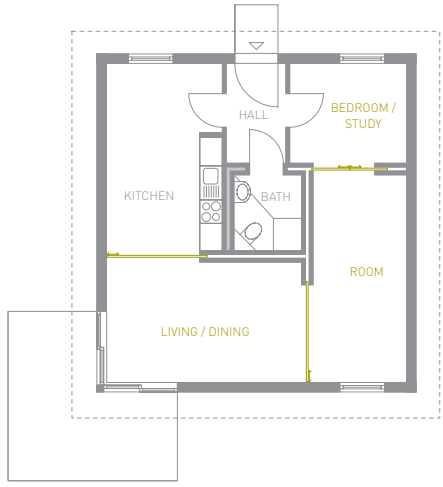
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
2000	Britain	Gokay Deveci	Single-detached, terrace [14]

These buildings were developed as part of the research project 'Overcoming Client and Market Resistance to Prefabrication and Standardisation in Housing'. The fourteen houses provide accommodation of various sizes based around a modular grid of 2.4 or 2.7 metres. The main characteristics are a central manufactured service core, lightweight wall construction and a flexible and extendable internal layout. The houses are simple and economic in their construction but through a carefully considered plan provide long-term flexibility.

The detached houses have an almost square ground plan. The only fixed element is the bathroom pod and a kitchenette, positioned centrally in plan. From the entrance one enters a hall with one door straight ahead into the bathroom. Another door leads into the kitchen and the third into a room that can be a bedroom or a study room. The plan then develops as a pinwheel around the central box, with a series of sliding and folding doors / walls allowing the space to be completely open, or else subdivided into up to four separate rooms. By either closing or opening these sliding elements, relationships between rooms can be changed on a day-to-day basis or over the building's life-cycle. Thus, for example, subdivision of the open plan space might be in response to the need for a second bedroom for visitors, or to the previously unforeseen need to accommodate a carer.



Option 1
Ground Floor Plan, detached house



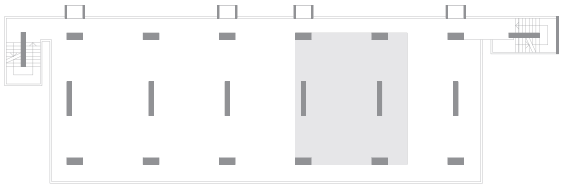
Option 2
Ground Floor Plan, detached house

Plan Drawing Scale 1:200

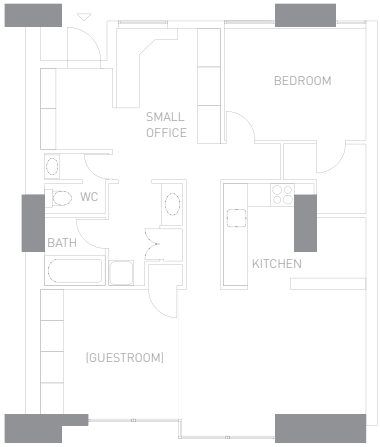
Flexsus House 22

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
2000	Japan	Takenaka Corporation	Multi-storey apartment house

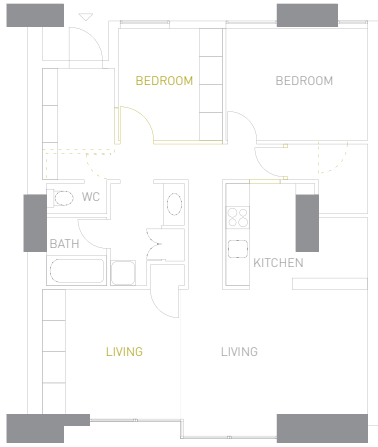
Flexsus 22 is another project in the Japanese use of Open Building as means of achieving flexibility in housing. It is a classic support and infill project within the 'House Japan Project' funded the Ministry of International Trade and Industry (1994-2001). Architecturally, it is divided into a structural framework, the 'skeleton' (supplied by Takenaka corporation), and the 'infill' (Takenaka Corporation and five other companies), which consists of the interior and exterior enclosure, together with prefabricated service elements. The three-storey building near Seto-City in the Aichi Prefecture is composed of floor slabs with large columns slightly offset from the outer perimeter in order to form a gallery which can be used either for access to the individual units or for balconies. The actual area within which the residential units are designed is divided into five bays, each 7.2 by 11.6 metres. Each housing unit can also be adapted internally and party walls can be moved at a later stage to enlarge or contract units.



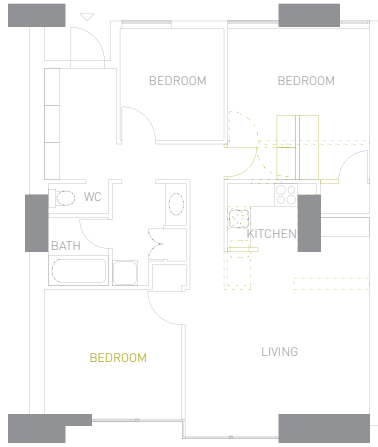
Typical floor
1:400



Stage 1 (married couple + 1 child, later +2 children)



Stage 2 (married couple + 1 children)



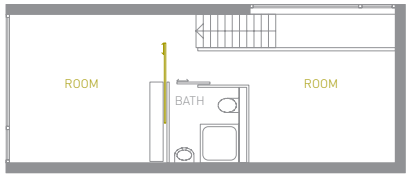
Stage 3 (married couple only)

Plan Drawing Scale 1:200

WeberHaus Option

139

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
2000	Switzerland	WeberHaus / Bauart Architekten	Single- + semi-detached, terrace



First floor

Ground floor

WeberHaus Option, developed from the 'smallhouse' idea by the Swiss architects Bauart AG, is based on a simple volumetric form that can be either used on its own, or two and three of these volumes can be combined to create a bigger unit. A prospective buyer can start with one small house and extend this when needed. Each module of 10.11 by 4.13 metres has a clear interior area of 35m^2 on the ground floor and 30m^2 on the first floor. Access to the house is via the short side straight into a front room with an open connection to the kitchen space that is positioned in the centre of the house. Past the kitchen is another room from which the first floor is accessed. The upper storey is identical to the ground floor plan. Throughout, only one type of large floor-to-ceiling window is used.

This basic unit can be, either at point of first time buying or at a later stage, extended if needed. Entire volumes or square one-storey modules can be added. The one-storey module can be attached to either side of the back room of the ground floor — either to simply enlarge this room or to create another room. On the first floor this module can become an accessible roof terrace.

Another way to enlarge the initial floor area of 65m^2, if the site and building regulation allows, is to buy a second and third volume, which can be added slightly off-set to the first. Other options of this system include the grouping of volumes. One basic module with a one-storey extension can be combined with a mirrored version of the same to form a small courtyard inbetween. Or, any number of L-shaped modules can be built next to each other, some even with the option of a pitched roof.

Plan Drawing Scale 1:200

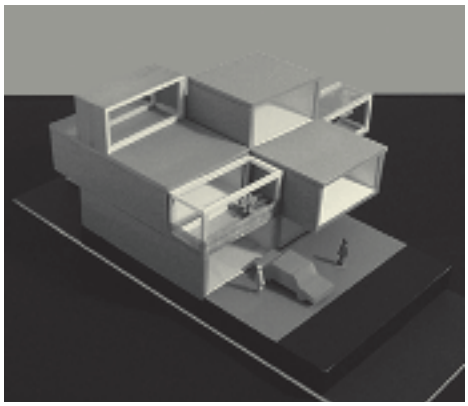
Flexible Housing in Almere

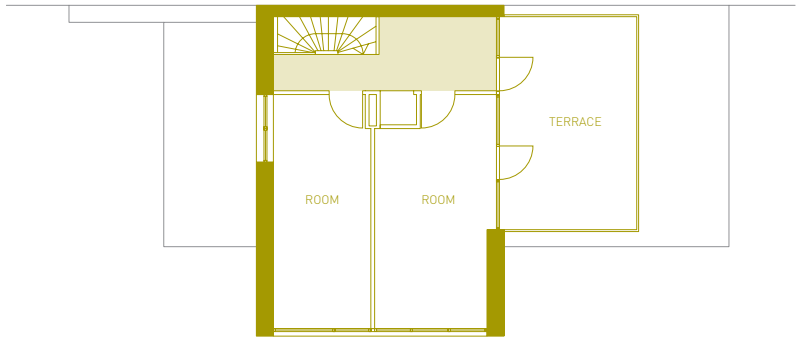
142

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
2001	The Netherlands	UN Studio	Single- + semi-detached, terrace [48]

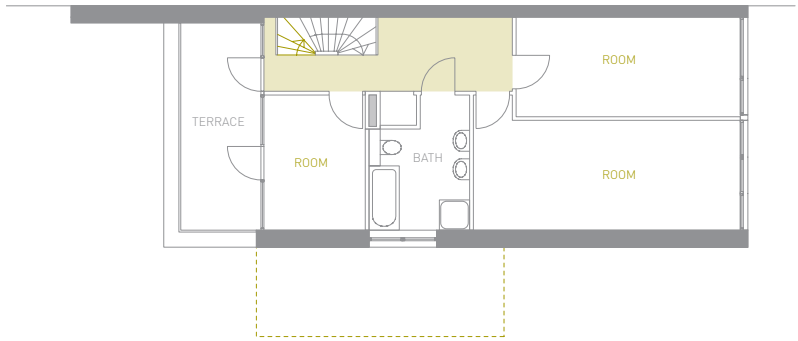
The housing scheme was built at the edge of the Dutch New Town Almere and was part of Bouwexpo Almere 2001, 'Gewild Wonen'. Each house — detached, semi-detached or grouped as terraces — consists of two basic modules of 10 by 6 metres in plan and 3 metres in height. The upper volume is shifted by 2.5 metres relation to the lower one, creating a staggered section with a distinct entrance zone on the ground floor and a terrace for the first floor.

There are two ways of extending this basic volume. The first is to add a further half-length module onto the top of the upper 10 by 6 volume, which increases the overall area from 120 to 150m^2. The second way is by means of a prefabricated box, 2.5 by 6 metres, which can be added onto the basic volumes at various points. The variability in each building's volume was matched by an internal flexibility, which meant that the position of kitchens, bathrooms and stairs was not predetermined to start with but left open as long as possible. Future occupants were thereby integrated into the process of planning by being able to determine the position of rooms and of partition walls.

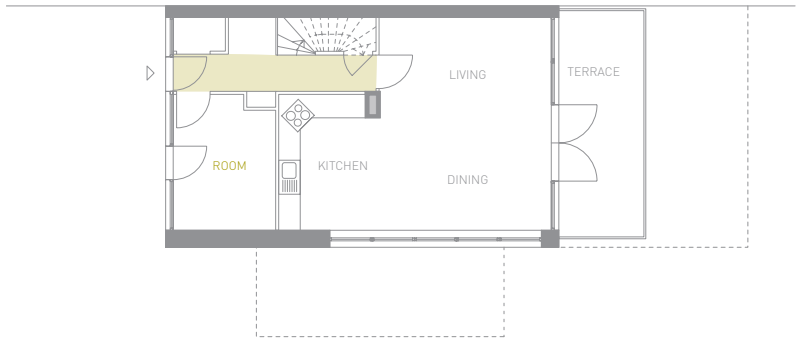




Second floor



First floor



Ground floor

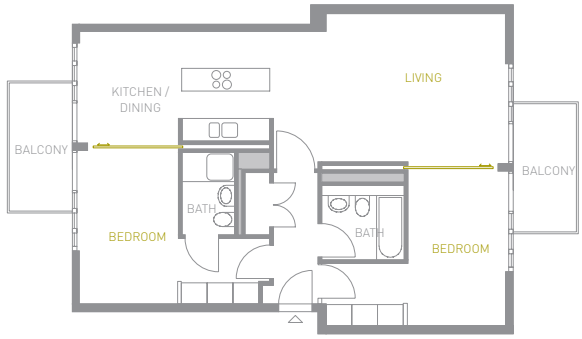
Plan Drawing Scale 1:200

Greenwich Millennium Village (II)

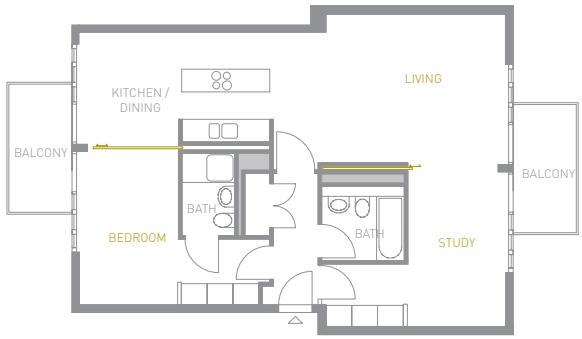
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
2001	Britain	Proctor & Matthews Architects	Multi-storey apartment block [189]

Proctor Matthews' scheme for Greenwich Village consists of 189 private units with 14 live / work units and 47 affordable units, which are accommodated in an eight-storey apartment block and three rows of two- to three-storey houses. The residential units have been designed to be adaptable to changing requirements and needs. Houses are designed to accommodate different lifestyles and users. Possible scenarios developed for a 80m^2 two-storey house include the transformation of a lower ground living room into a fully accessible bedroom or a study room; or, the building-in of a lift into the lower ground living and dining space that can then serve a bedroom on the first floor.

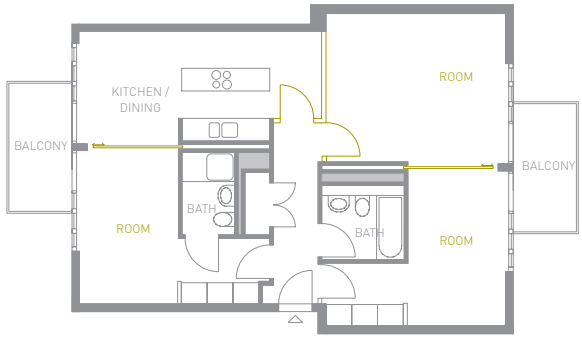
The apartments (plans below) have a clever plan that allows a variety of layouts. Two central service cores are divided by a small corridor. Around the edge is a sequence of spaces that can be divided up with walls that slide into recesses in the service cores. These acoustically isolating walls can both be closed permanently to create a two-bedroom apartment, one can be closed to make a one-bed apartment with a study space or they can be either permanently or temporarily pushed back in order to create a more open plan that can be used in a variety of ways. Finally, an extra dividing wall can be installed to create an apartment for three independent users. It is important in this scheme for the sliding walls to be of high quality in order to provide good acoustic separation. It was found that the inherent flexibility of these apartments made them popular with potential purchasers and thus the developer was prepared to fund the marginal extra cost of the sliding walls. [See also Fig 5.27]



Option 1
2 bedrooms, large living and dining area



Option 2
1 bedroom, large living and dining area, study



Option 3
3 bedrooms, kitchen

Plan Drawing Scale 1:200

KraftWerk1

146

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
2001	Switzerland	Stücheli Architekten	Multi-storey apartment block [106]

House A, fourth floor. 6-room flat, 4-room flat, 5½-room maisonette

This mixed use development for an inner city site in Zürich, comprises three buildings of which two are mainly residential and one is commercial. Around 240 people live in the development and a further 90 people have their work place there. One of the initial ideas of the project was to provide spaces for a group of 15 to 20 people to rent (600m^2 over two storeys), which could not only be subdivided and designed according to their ideas but also self-managed. These 'Suiten' were intended to allow different forms of communal and co-living through a variety of communal and private spaces. Although the full extent of these spaces didn't materialise, the building blocks feature a large variety of flat sizes, ranging from 2.5 room flats to units with up to 13 rooms, from 31m^2 to 350m^2, from singles through families to groups of independent people.

The variety in apartment sizes is enabled by a repetitive constructional system of crosswalls, which can be knocked through at points. The crosswalls are spaced at the width of a typical residential room (2.8m and 3.5m), dimensions that allows an almost infinite arrangement of layouts. Units are served by a central circulation and service core, but it is also possible to insert private internal staircases between crosswalls, to create two- or even three-storey apartments.

Haus A, an eight-storey block is organised around four vertical circulation cores, which are connected via a large corridor on the ground floor as well as interior roads — rues intérieures — on the third and sixth storey. On the ground floor are communal uses such as a kindergarten, a bar, studio spaces and some commercial units, whilst the upper storeys are residential. Haus B3, the second residential block, has three- to seven-room apartments, maisonettes, and studio apartments on four storeys.

Plan Drawing Scale 1:200

Silvertown

148

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
2004	Britain	Ash Sakula	Apartment house [6]

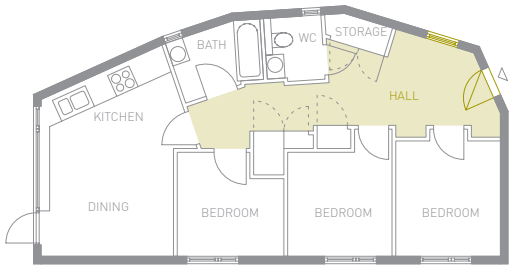
Ash Sakula's design for a small housing project in London is about the reconsideration of housing standards and regulations.

Here, the circulation space is the focus point: the hall — renamed 'sorting zone' — and the kitchen are the most important parts of the plan. The 'sorting zone' is a room in itself, a polyvalent room, capable of being used for many different functions during the course of a day or during various years of occupation: wardrobes, sorting, storing, homeworking. The kitchen is a living, meeting and children's room as well as a space for cooking.

Both rooms, the kitchen and the hall, focus on the communal aspect of a dwelling rather than the individual and thereby promote a highly sociable concept of dwelling space. The plan reverses typical spatial priorities, it is about excess space in spaces that are usually designed down to the minimum.

Whilst the use of this 'sorting zone' is determined by the architects (the hall comes completely fitted with wardrobes, desks, shelves, etc.), the scheme demonstrates nicely how circulation space can be used as an extra device in an imaginative way in order to make very tight spaces that much more interesting.

The three remaining rooms are reduced down to a minimum and can be used in a variety of ways. A small living room with TV and two bedrooms, or three bedrooms for a shared household.



Ground floor flat

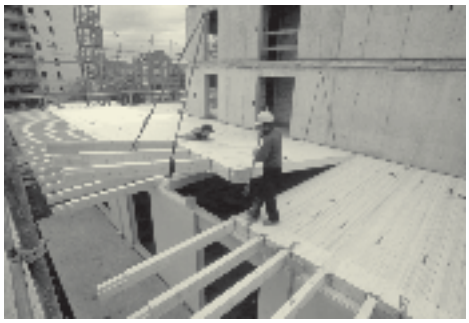
Plan Drawing Scale 1:200

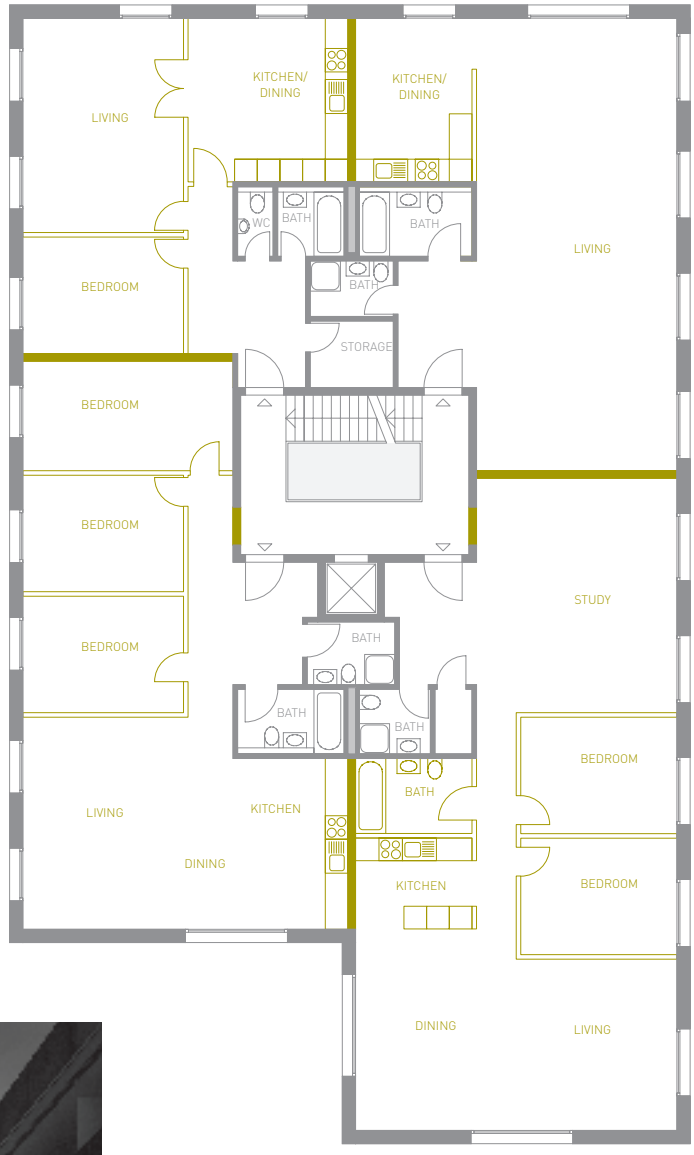
Siedlung Hegianwandweg

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
2003	Switzerland	EM2N Architekten	Multi-storey apartment house [74]

The five apartment houses were the winning entry to a housing competition called for by the city of Zürich and the housing association Familienheimgenossenschaft FGZ. Half of the occupants for the scheme were found via the open housing market, whilst the other half were people that could move from other FGZ properties.

Each of the buildings is organised around a central concrete core, which contains the communal staircase and circulation entrance halls as well as bathrooms. The only loadbearing elements are this core and the external façade, which leaves the entire plan as a raw space that can be partitioned according to needs and requirements of the occupant or that of the housing association.





Second floor

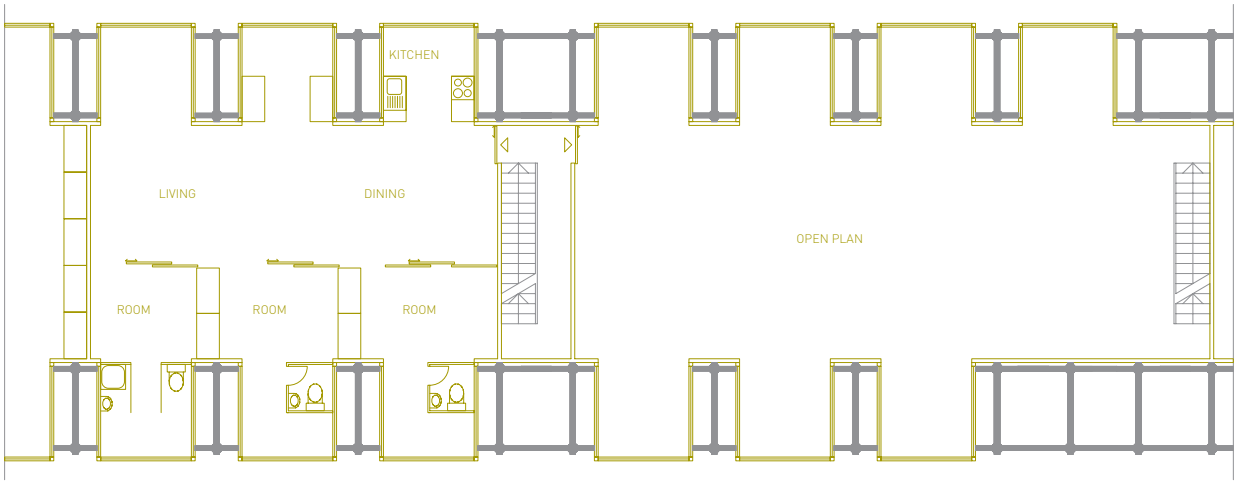
Plan Drawing Scale 1:200

domino.21

DATE	COUNTRY	ARCHITECT	PROJECT TYPE
2004	Spain	J.M. Reyes	Multi-storey apartment block

domino.21 is a modular building system, consisting of cubes that can be combined, either vertically or horizontally, to create a unit. Additional modules can be added at a later stage. The basic unit consists of a core space around which other modules or cabins can be arranged. Each unit is separately insulated, but walls as well as insulation are moveable allowing a number of cubes to be spatially and thermally connected to one. The cost of an apartment is calculated by the number of cubes, which comes to 12,000 Euros each, plus a pro rata sum of 30,000 Euros for structure, stairs and infrastructure.

The system was developed by students of ETSAM, Madrid and a number of Spanish construction firms. Units are prefabricated and then transported to the site. The system, as erected at Construtec, took 15 days to put up. Potential clients are meant to order modules by catalogue, where types of modules and materiality have to be specified (wall elements come in timber, polycarbonate and metal, partition walls are made from PVC).



Option
shared apartment and open plan

Plan Drawing Scale 1:200

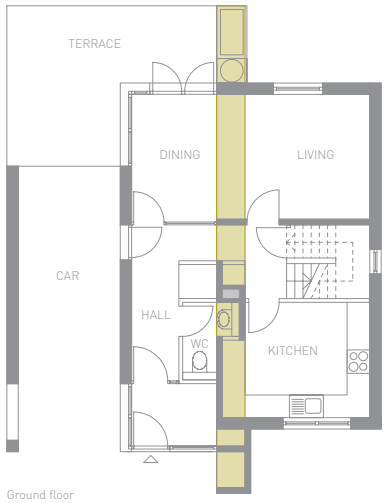
Cala Domus

158

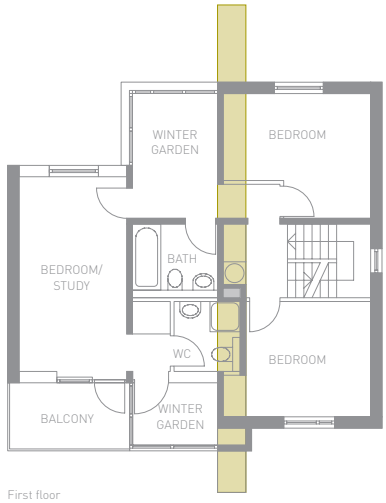
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
2005	Britain	PCKO	Terrace [74]

PCKO's housing scheme for Newhall, Harlow, is an example of the architects' 'Living Wall' concept, which is designed to allow flexibility in the provision and adaptation of services. The project consists of 74 private residential apartments and houses, ranging from around 100m^2 for a two-bedroom maisonette to 213m^2 for a townhouse with live / work area.

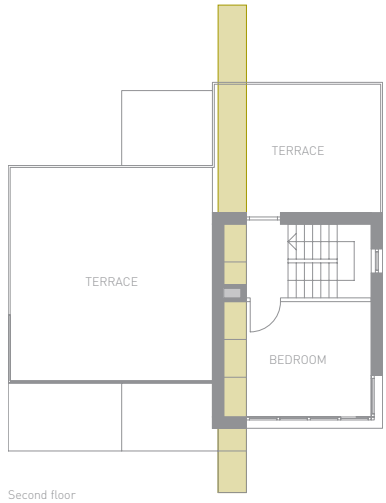
Most of these buildings incorporate a 'Living Wall', a dedicated zone of space running from the front to the rear of each house, which provides for all horizontal and vertical service distribution such as piping and electric wiring as well as storage spaces for refuse and recycling. All wet rooms are also attached to or extend into this wall. This zone has excess capacity, and is accessible both internally and externally so as to allow adaptation and renewal of existing services, or the exchange of entire existing items with pieces of new servicing technology. In effect the 'Living Wall' acts as pacemaker for the house as a whole; most of the complex technological change will occur in this area, leaving the rest of spaces open for physical adaptation over time.



Ground floor



First floor

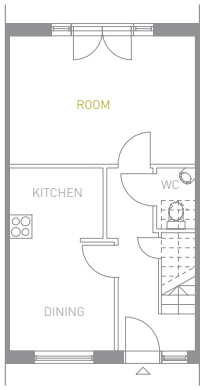


Second floor

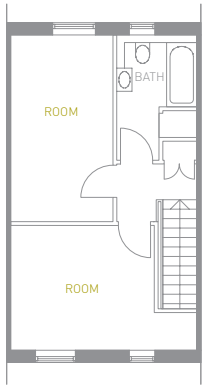
Plan Drawing Scale 1:200

Oakridge Village

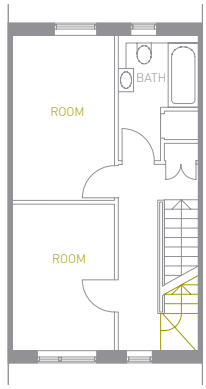
DATE	COUNTRY	ARCHITECT	PROJECT TYPE
2006	Britain	HTA Architects	Terrace [299]



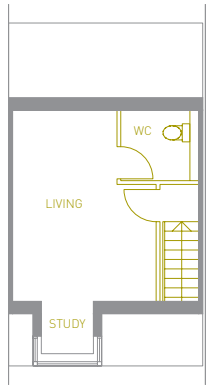
Ground floor



First floor, option 1



First floor, option 2
with stairs to the attic



Second floor

Oakridge Village was designed by HTA as a mixed tenure neighbourhood with 300 units, of which 50% are affordable tenures. There are, however, no external differences between rented and sales housing types.

The entire development is based on mass-customisation which is linked into the project process. A website helped to create a link between the designers and the end user, which allowed all the variations of the house types to be displayed (www.useronline.org).

The website displays information about the predefined house types, which ranges from 2 bedroom (3 person) flats and 2 to 4 bedroom houses for sale to 2 to 3 bedroom houses and flats for rent. Future tenants could thus choose from a limited range of alternative layouts. Throughout, the plans are arranged to fit within the same front-to-back dimension to allow types to change late in the construction process. The service zones are designed to be pods and the remainder of the walls are panels.

Flexibility at Oakridge was used at the construction stage to allow customer choice. Users could choose the external appearance including whether to have a plain façade, an oriel window or a balcony, and whether to have a plain roof or an attic room.

The final construction was a steel-frame manufactured off-site but the finishes were all applied on site.

Plan Drawing Scale 1:200

5

THE DESIGN OF FLEXIBLE HOUSING

THE DESIGN OF FLEXIBLE HOUSING

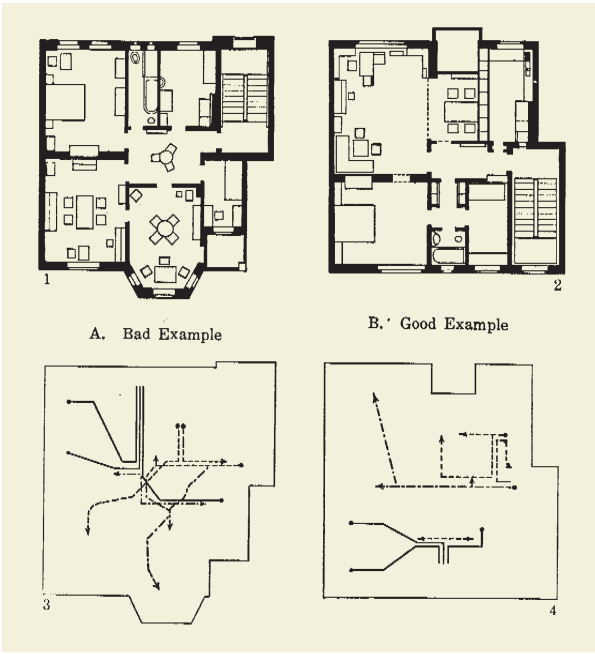
The book has thus far considered the 'whys' of flexible housing and then presented case studies of some of the seminal examples. The next two chapters show how flexible housing has been and may be achieved. This chapter explores issues of use and plan, and the next issues of structure and construction; the former is concerned with how flexible housing may be designed spatially, the latter with how it may be made. The first chapter of the book distinguished between 'hard' and 'soft' strategies for the design and making of flexible housing, in the end arguing for an approach that started out with a soft, indeterminate, way of designing into which harder, determinate, elements might be inserted. This chapter follows the same logic, starting with design strategies that promote concepts of indeterminacy before focussing on some more specific design tactics. Our intent is not to promulgate a single method of designing flexible housing; it is almost a contradiction in terms to suggest that something that is concerned with openness to change could be achieved through a fixed rule. Instead we suggest ways of thinking about flexible housing design illustrated with examples of previous work.

From Hard to Soft

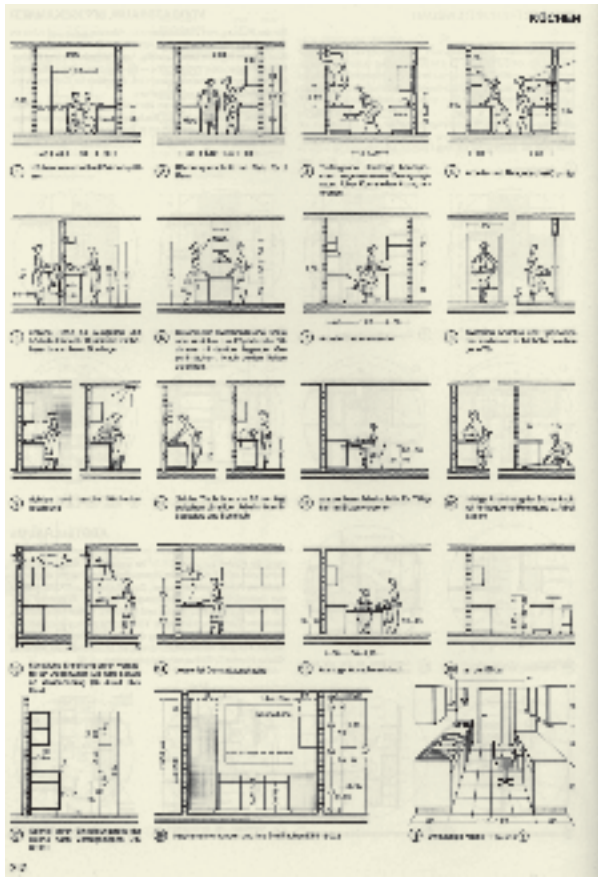
The problem of housing design is, to make a sweeping generalisation, a problem of the modern era. [1] In the pre-modern era one can broadly distinguish between the design of the one-off house and the evolution of housing. The former was the domain of the architect or designer, and focussed on the special: the villa, the palace and the town house. The latter was largely the sphere of the vernacular, an architecture that develops not through the intent of the designer but as an unfolding to social and physical context. As we have seen, the vernacular holds as many clues for the future of flexible housing as do the determinist acts of architects, but in the modern era the development of housing design is largely dominated by the hand of the architect, the demands of the market and the social pressures of the era, all of which override the more organic sensibility of the vernacular.

It is with the rise of the industrialised city that mass housing becomes an issue that needs addressing with an intentionality that is beyond the scope of the vernacular. As a problem of the modern era, housing design is subjected to the rationale and order of modernity. The architect, as expert, is expected to deliver solutions, and the success of these solutions is judged against the criteria of predictability and control that define modernity. It is thus not surprising that housing design, particularly in the twentieth century is subjected to the rule of quantity and determinism. The plan becomes far more than a simple architectural device of commodity, firmness and delight; it assumes the role of ordering device, a plan that purposely structures action. This 'hard' use in plan — at the level of the building, dwelling and room — is concerned with the idea that every single part of a dwelling can be designed and tuned in a way that first reflects and then determines the activity within. In the 1920s and 30s in particular, architects and planners started to standardise activities and create norms for every aspect of living.

Margarete Schütte-Lihotzky's 'Frankfurt kitchen' of 1927 is the classic example of this. The essential actions of food preparation were measured and mapped as part of Frankfurt's social housing programme. The resulting data was then transferred into an 'ideal' kitchen design, predicated on notions of spatial and social efficiency. In 1928, Alexander Klein designed the 'Functional House for Frictionless Living' where he tried to eliminate the crossing of paths as users moved from one essential



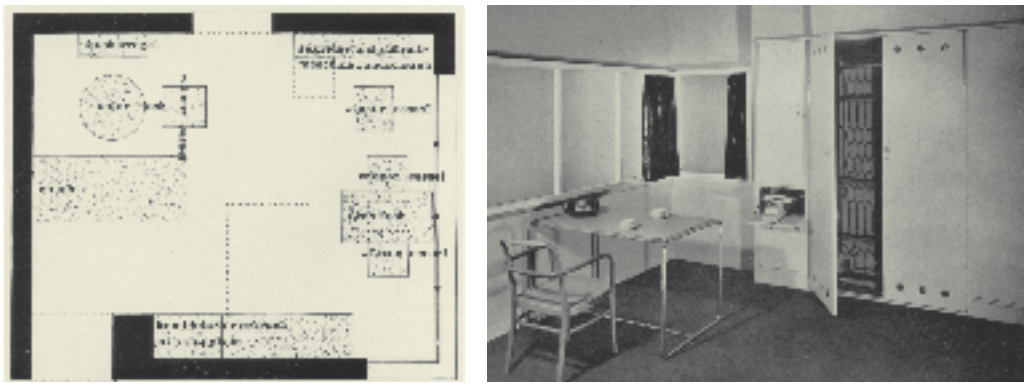
5.1 Functional House for Frictionless Living, Alexander Klein, 1927. Before and after (with the 'elimination of social friction.')



5.2 Bauentwurslehre, Ernst Neufert, 1936. Extract showing ergonomic data.

task to another, by reducing 'the possibility of accidental encounters and, therefore, social friction'.[2] [Fig 5.1] Ernst Neufert's seminal book *Bauentwurslehre* (1936) went even further. The compendium specifies every possible dimension conceivable in the planning of buildings and spaces, ranging from the norms for parking spaces to the size of kitchen tables. [Fig 5.2] These measurements are then seamlessly translated into recommendations for the arrangements of a huge range of building types from housing through hospital wards to the functional diagrams of fire stations.[3]

Under the guise of easing workload for women (Schütte-Lihotzky), organising and managing movement (Klein) and the providing of guidance for architects (Neufert), spaces were designed to be the most 'efficient', which normally resulted in their reduction to the absolute minimum space standard. The user was viewed in the same way as every other element in this equation: a part of the apparatus that will perform the same function again and again with no possibility of changing or combining any of the functions, not to mention doing things differently. The central concept here is of an architect or planner who assumes control of his or her subjects and their actions, from daily cycles to the lifecycle of building. It is this attitude of control that leads to the inflexibility of tight-fit functionalism in which a room has a prescribed use, functional data on which leads to prescriptive sizes and layouts. [Fig 5.3] When built, these spaces play back their founding assumptions with a circular logic: the determinations on use lead to typical furniture layouts which in turn



5.3 Bachelor flat, Merkelbach Karsten, Amsterdam 1932. Plan and interior showing very prescribed usages within a minimal dwelling.

prescribe the size and shape of the room which when built fix the patterns of use. Such a positivist logic is clearly against the principles of flexible housing, and so it is necessary to move away from the idea that housing layouts can or should be seen as precise anticipations of occupation. This is to move from the hard to the soft. We therefore begin the explanation of 'how' flexible housing may be achieved with a discussion of indeterminacy, before moving to design strategies that are more specifically related to the cycles of living and design tactics related to the spaces of dwelling. The structure of this chapter moves from a consideration of the building as a whole, then from the outside of the unit to the layout of the inside, and finally a consideration of individual rooms and elements.

Indeterminacy

What if designers actively embrace the inevitability of change? What if they relinquish presumptions of control? This would lead to the notion of indeterminacy, which is something that frames uncertainty in a positive way, effectively promoting flexibility in terms of use. The notion of indeterminacy challenges modernity's will to order and with it the will of the architectural profession to control. But indeterminacy is not a recipe for formal anarchy in which the architect throws away their spatial skills or ideas of intent. Rather it demands a recasting of priorities, with the architect working in the background. The moves made need just as much skill and awareness, but they are continually guided by the understanding that what unfolds in space is dependent on far more than the architect's hand alone. In terms of housing an approach that starts from the acceptance of indeterminacy suggests layouts that allow multiple modes of occupancy, to layouts that are not fixed in a functional sense, and to floor plans that are left indistinct and vague both in character and technology so that they can accommodate not only one thing but many.

The Indeterminate Building

Indeterminacy starts with the deliberate provision of spaces whose function is not predefined; it works at a number of scales, from the building as whole down to consideration of individual rooms. At a building level, indeterminacy is about projects that can accommodate different uses within the same structural system.

5.4 495 West Street, Tamarkin Architecture, 2000. Plan and interior showing loft dwelling principles. 136

Indeterminacy, or exchangeability of functions, thus helps avoid one of the most common problems in building: obsolescence. Buildings that are constructed and designed in a way that allow functional change can respond to specific social or economic demands or pressures, and thus potentially extend their useful life. The first question, therefore, to ask of a housing scheme is: could it accommodate any other function? If the answer is no, then it is likely that the scheme will not only be inflexible in terms of other functions but also inflexible in terms of different future mixes of housing occupancy.

The UK architects, Gerard MacCreanor and Richard Lavington, argue that a building 'must allow trans- as well as multifunctionality, that it should be able to accommodate changing uses: living into working, working into leisure or several uses simultaneously... in order to cope with future needs and changing conditions. [4] Historically, a number of building types have proven robust in hosting different uses over time, notably the terraced house and the C19 industrial warehouse building. The latter typology has been adapted for many purposes including studio spaces, residential accommodation, commercial activities and office space. MacCreanor and Lavington note that industrial buildings, mills and warehouses have proved to be highly flexible in use through a combination of neutrality in layout and expression, and through the use of ordinary and adaptable building technology. [5] Effectively industrial buildings provide raw space that can accept varied activities, and when something does not fit, they are tough enough to be knocked around to accommodate it. [Fig 5.4]

Raw Space

The word 'raw' is used here as the opposite of cooked. The normal architectural inclination is to take a set of raw ingredients, combine them precisely, and cook according to a recipe; the resultant dish / building is presented as a fait accompli. [6] The indeterminate architect, however, does not follow such a linear or controlling route. His or her spaces are not fully formed (cooked), and their eventual spatial form is a shared production of designer and user. However, the idea of raw space is not as straightforward as it may sound. An indeterminate building or plan also does not mean that it is completely neutral, with no input from the architect except to fix

the technical solution. As Herman Hertzberger notes, a system that is kept flexible for the 'sake of the changing objects that are to be accommodated... would indeed yield the most neutral solution to specific problems, but never the best, the most appropriate solution.'[7] Provision of open, neutral, space alone thus does not suffice, or at least it may be inefficient or inappropriate in terms of space usage. The most successful raw spaces are those that act as armatures for future occupation in an anticipatory manner, providing a set of clues that are suggestive rather than determining. A sophisticated interpretation of this approach is Bernard Leupen's notion of the frame and generic space. Leupen works through the apparent conundrum that in order to create flexible space one has to pay most attention to the permanent elements. 'The permanent constitutes the frame within which change can take place', he argues, 'while the frame is specific, the space inside the frame is general.'[8] It is the specificity of the frame that demands that it is designed intentionally with a view to the future freedoms that it may contain. [Fig 5.5]

The flexible occupation and reoccupation of raw space is highly dependent on a number of factors. The first is the structure, the dimensioning of which affects the viability of the internal layouts. There is no golden rule as to what is an ideal structural dimension; too small and the structure overdetermines the layouts, too large and the structure becomes inefficient. Generally a structural dimension that is the width of a dwelling unit (typically between 5m and 8m) provides the most flexibility for internal layouts; traditionally such spans were not seen as appropriate or feasible for domestic construction, but with new constructional systems they are economically achievable in timber, steel or concrete. Within this structural framework, the designer has to carefully consider the best points for access (generally in the centre of the plan), the position of servicing (either in specific zones or else widely distributed) and the most efficient module size (a standard module allows repetition in structural division and components but should not limit options for subdivision). All this is far from haphazard as a design approach: in order to ensure a workable and flexible use of the generic space that they are providing, designers will need to test hypothetical layouts against their dimensioning, access, servicing and module strategies, and then adjust these strategies if they do not allow a range of options to unfold. 046 061 071 083

5.5 Wohnanlage Genter Strasse, Otto Steidle, 1972. The frame under construction, full of anticipatory promise. 067

5.6 Nemausus, Jean Nouvel, 1985. Interior showing double height space and semi-complete interior. 091

Excess Space

As suggested in the first chapter, there is a correlation between amount of space and amount of flexibility. Some recent schemes have exploited this correlation by providing more space but at lower specification, arguing that flexibility in the occupation of space is of more importance than the niceties of having a fitted kitchen or fully decorated rooms. One such is the Nemausus scheme in Nîmes, France, designed by Jean Nouvel. 091 Here undivided space with double height areas was handed over in a semi-finished state for the tenants to fit out, though their ultimate choice was restricted by a number of impositional rules that dictated things like the colour of their curtains. [9] [Fig 5.6] Clearly there are financial implications in the idea of excess space, with the cost of providing more space in the first instance to be weighed up against the savings on fitting-out and finishing. It is also an approach that is against the current trend towards seeing housing as a complete and instant package, chosen according to various lifestyle options.

Slack Space

If raw space is just suggestive of the way that space may be adapted and infilled with various uses, a more intentional approach is that of slack space. This is space provided by the designer, the occupation of which is not fully determined. It is space that something will happen in, but exactly what that something might be is not programmed. Slack space is not just any space, but areas that are anticipatory of potential occupation. Externally slack space is found on flat roofs that can be built upon, courtyards that can be filled in or a communal stairwell

with landings big enough for occupation by its users. Internally it might be found in an alcove that can be later enclosed or have furniture built into it, a balcony that can be glazed and turned into an additional room or those nooks that are good to have but one does not quite know what for. [10]

In all these cases, the designer intentionally provides spaces for appropriation but does not determine their exact use or configuration. An explicit example is Donnybrook by Peter Barber Architects (it was Peter who suggested the term slack space based on Cedric Price's initial idea of unprogrammed space). [11] 160 Here the startling image of a modernist outcrop in the heart of the grime of East London appears like an accident waiting to happen. In most hands the disturbance of the purity of white forms would be seen as an affront to architectural perfection, but Barber is adamant in his intent for those flat roofs to be taken over by washing lines, sheds, umbrellas, and other enclosures of the everyday. [Fig 5.7] The terraces at first floor level provide an invitation to do something, and only when that something really happens will the scheme achieve a richness of occupation that was always intended. Another approach to slack space is that of Otto Steidle in the scheme on Genter Strasse, Munich. 067 Here he provides reserve space into which it is possible to expand over time, but he also provides very visual clues as to how this might be achieved, with projecting corbels at every half storey level on the columns anticipating the addition of structures in the future. Anton Schweighofer's sketch design for a residential building in Berlin offers this slack space in the third dimension. 089 A double height volume, initially only used on one level, can be gradually filled in. A basic unit of 49m² could potentially grow to a 98m² maisonette, expanded in stages to suit changing needs.

5.7 Donnybrook Quarter Housing, Peter Barber Architects, 2006. Aerial View. 160

The most developed approach to slack space is that of the Dutch architect Herman Hertzberger in the design of the Diagoon houses in Delft. 059 Based on the idea of the 'unfinished building', Hertzberger provides spaces, both internal and external, that can be filled-in according to the specific requirements of the building's inhabitants. 'In principle unfinished', he writes, 'the actual design should be seen as a provisional framework that must still be filled in.' [12] Internal balconies, external terraces, a protected corner outside — all of these and more anticipate being taken over so that the dwelling is completed not by Hertzberger but by the occupants. [Fig 5.8] One of these features is the unfinished roof-terraces, where one inhabitant built a complete greenhouse, which was eventually dismantled to make space for an extra penthouse-room. [13] The flexibility in the Diagoon houses arises from the provision of slack space that can 'absorb and accommodate the influences of changing times and situations'. [14] It is therefore about the making of space, but also about leaving space for interpretation. [15]

5.8 Diagoon Houses, Herman Hertzberger, 1971. 059

Adding-on

Herztberger's approach is at heart a soft one; he leaves space for expansion and change at various points throughout the Diagoon houses, stepping away from the building after completion of his part in the process and handing over the responsibility to the inhabitants. A much more deterministic, and thus hard, approach to the notion of expansion is that of UN Studio in their Flexible Housing in Almere. 142 The individual houses are conceived of as a basic package, which can be extended and elaborated depending on personal preferences. The extension comes as a pre-designed and fixed-dimensioned box of 2.5 by 6m, which offers 'the possibility to elaborate and increase its volumetric potential... [and is] "plugged-in" to the basic package at the needed position.' [16] UN Studio thus offer the potential to expand but only within the confined frame of the office's architectural language; through determining the position, volume and appearance of the extension they thereby stay in control of future changes to the building.

In the private sector, the ability to change the size of one's dwelling is predominantly used as a marketing tool to attract buyers. The Dutch Wenswonen, or Desirable Living, concept by Heijmans N.V. exploits the increasing demand from some house buyers to be able to determine one's own space. 151 Whereas this might have a history in the development and design of single-detached houses, it is quite a new concept for multi-storey developments in the private sector. Wenswonen uses a systematic design and construction process with a combination of factory and on-site construction. Future homeowners can select not only the size of their dwelling (additional factory produced room units can be attached to the concrete base building) but also the façade and interior layouts. Custom designed software allows each

household to make design decisions about interior layout and the design of the façade (elements can be selected from a kit of parts prepared by the architect) step-by-step, with price information at each stage. Initially, only the positions of the service duct and stairs are determined. Within the limits of the concrete shell and the pre-determined computer system, the project gives variability at design stage by allowing the owner to tailor their home to specific needs. [Fig 5.9] In addition, the overall volume of the base building can also be extended through adding modules, at design stage or later on, at two pre-specified points: on the rear façade and / or the addition of a third storey.

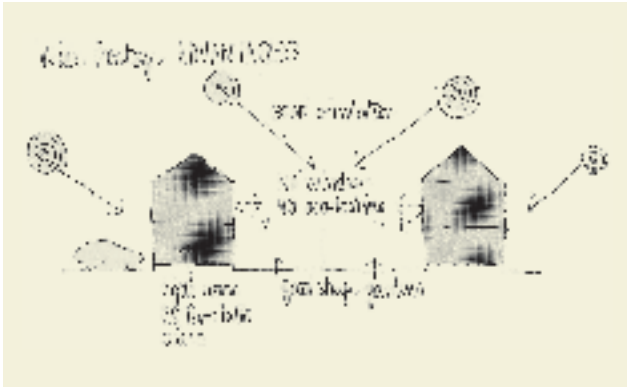
5.9 Wenswonen, Heijmans NV. Typical plans showing base and infill approach.

Whether soft or hard, the ability to extend is a key part of flexible housing design, particularly for houses (as opposed to apartments). As with indeterminacy, an additive concept of design runs counter to some of the normative concerns of architecture, in which the virtue of the building is provided by its very wholeness. Wholeness here is both aesthetic, in terms of proportion and balance, and also functional, in terms of efficiently mapped use. Additions disturb any notion of completeness and challenge the role of the architect as the provider of the perfected whole. The potential for addition is yet another example of flexible housing asking the designer to accept, and enjoy, the role of facilitator as opposed to determiner. It is analogous to the difference experienced in walking down the front of a street of terraced houses, in which expressions of the individual are held at bay behind the decorum of curtains, and then sneaking round the back where the lives of the residents erupt into an accumulation of accretions — back extensions, conservatories, dormer windows, roof terraces, garden sheds. It is the difference between seeing those accretions as an affront or seeing them as something that is both inevitable and enjoyable.

The additions at the back of a terraced row are a direct spatial manifestation of changing social and economic demographics; as circumstances change the terraced house allows growth and adaptation. In the classic London house plan, additions are anticipated by the placing of the staircase against the rear façade, giving direct access to any future extensions without having to pass through existing rooms. This is the first principle of designing for potential additions: to project where the extensions might go and design access & services accordingly. The Extendible Houses project by Van den Broek and Bakema takes this approach. 065 Here, the idea is of a terraced house on an elongated site where, through the siting of the building on the site, spaces in front and to the back of the house provide the possibility of front and rear extensions. Illustrations of the project also show how a third storey could be added. Another project with extendibility built-in is Brockley Park in London by Lewisham's Architects' Department. 079 The basic 'module' (4-person unit) could be extended by

adding a single storey block to the front of the house (designated as the 'granny pod'), and this extension also came with planning permission for a second storey on top of it.

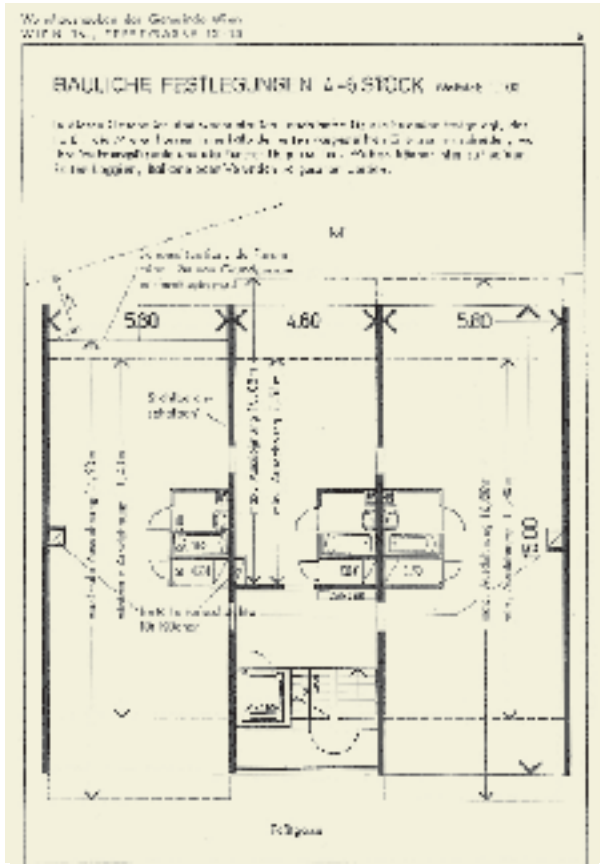
An alternative to the standard terraced house has been developed by the architect Peter Phippen of PRP Architects. He argues that narrowness of the typical terraced house (typically around 5.5m in the UK) limits the options for the placing of additions. Instead, he advocates the wide frontage house and has shown it to be equally efficient in site usage as a narrow fronted scheme, providing multiple positions for additions as well as being compatible with modern methods of construction.[17] [Fig 5.10]



5.10 Wide Frontage Housing, PRP Architects.

Expanding Within

The ability to add is best suited to coping with demographic changes within detached or terraced houses. It is less useful as a design principle for multi-occupancy and multi-storey housing. Here any extension outwards from the initial structure is not usually an option unless it is done wholesale; it is problematic both structurally and legally to stick on an individual addition halfway



5.11 Feßtgasse Housing, Ottokar Uhl, 1980. Plan showing potential for expansion.

up a building. This means that any growth has to be contained within the original frame. A number of flexible housing projects have exploited this idea by providing excess space within the frame in the first instance, into which individual apartments can then grow as needed. The clearest example of this is Ottokar Uhl's Feßtgasse Housing in which the position of the façade is not fixed so that the size of the apartments can be varied. [Fig 5.11] 084 Another example is the Kallebäck Experimental Housing in which the tenant is provided with a basic 'shelf' on which to start their home, which can then be expanded over time. 042 In practice the initial residents of both projects generally opted to fill in most if not all of the excess space provided, but the principle nonetheless stands. Where both these schemes are

concerned with horizontal expansion, Otto Steidle's Genter Strasse housing provides an excess of three dimensional volume from the very beginning, which can then be claimed over time, both on the outside through building into the non-filled parts of the expressed frame and on the inside by filling in the initially one-and-a-half or two-storey spaces. 067

Helmut Wimmer's apartment block on Koppstrasse in Vienna is another example where the size of the dwelling can be individually determined. 135 The building consists of three 8-storey slabs with U-shaped structural cores and short loadbearing fin walls. The cores are expressed along the public circulation space, accommodating a service duct, bathroom and separate WC (this zone also holds the kitchen and entrance to the dwelling unit), creating small recesses. Wimmer calls these spaces 'Vorgarten' or front gardens, serving as an entrance zone to two units at the same time. The alternation of an 'extroverted' core and the 'introverted' zone determines the rhythm of the public face of the building and creates a zone within which individual inhabitants can determine the extent of their dwelling, which are further expandable into a 2-metre wide zone of balconies. [Fig 5.12] It is also possible to enclose the front garden and turn it into part of an apartment.

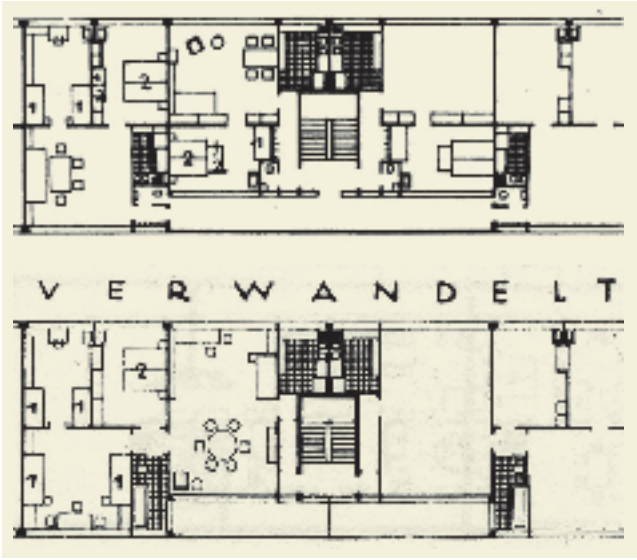
5.12 Wohnregal Koppstrasse, Helmut Wimmer, 1999. 135

Joining Together

Clearly there are cost implications in the provision of excess space, even if it is unfinished or unenclosed at the start. A more economical solution to expansion within multi-occupancy housing is that of joining up. In most housing, the design of each individual unit is considered in isolation from the others; this tends to lock in a particular size and layout to suit immediate demands. This specificity often precludes the possibility of combining units at a later date, or at least makes it problematic in terms of both planning and construction. However, the facility to join units together can provide many more options at a later date; for example two one-bedroom units could be joined together to form a three-bedroom apartment, or a family house joined to a smaller apartment to accommodate an extended family. This latter is achieved in Proctor Matthews' scheme for Rochdale, where the largely Asian community has a large number of multi-generational families. 163

Historically one of the earliest examples of an architect designing units with the specific intent that they might be joined together is Karl Schneider's Verwandelbare Wohnung of 1927. 012 [Fig 5.13] Schneider's simple device is in designing the access to two units so that they can either be entered separately or as one. Sharing an entrance hall is the most expedient method of allowing units to be joined, but then (as Schneider does) one also needs to allow the internal layouts to be altered. Similar principles of joining horizontally are used in a number of later schemes. 055 064 075 094 What all these schemes show is that it is perfectly possible to provide the potential for joining units together at little or no cost and without compromising the quality of the separated units. One of the most sophisticated versions is the Kraftwerk scheme in Zürich by Stücheli Architekten

in which a repetitive system of crosswalls with built-in 'soft' panels (i.e. preformed openings that can be easily knocked out) permits units to be joined together in an enormous variety of ways. 146



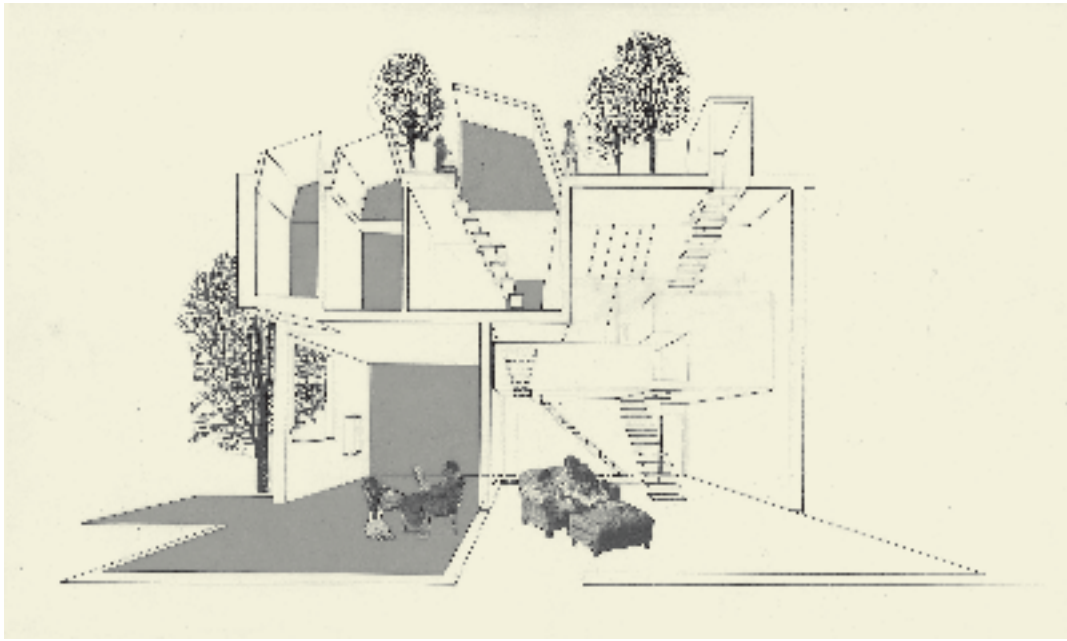
5.13 Verwandelbare Wohnung, Karl Schneider, 1927. Plans showing separated (above) and joined (below) units. In the latter case the balcony can be used as a private space. 012

Switching it

The logistics of joining up whole units may be somewhat complex, depending as it does on adjacent tenancies being available at the same time, and agreement between the parties if the units are in two separate ownerships. However, in the long term it is still an important principle and, certainly in the social sector, gives housing providers a much wider range of options in terms of what they are able to offer. A more modest approach is that of the Schaltzimmer, literally translated as a switch room. This is a German model, developed in the traditional apartment block and more recently exploited in the Am Steinberg scheme by Metron-Architekten AG. 103 The Schaltzimmer concept provides a room that can be used by one of two apartments. When the resident of the larger apartment no longer needs the Schaltzimmer, they can give it up to the other unit. The Schaltzimmer thus gives the users the opportunity to expand or contract their apartments. In some cases the Schaltzimmer is a bit larger, and provided with a small bathroom and kitchen so it can either be used completely separately or else partially joined to another unit and used as, say, a granny flat, home office or studio for rent.

Dividing up

By implication, two units that have been joined together can be easily separated again. But what if one starts with a larger unit, possibly on more than one level, and need to divide it up? If, say, one's children have left the nest but you do not want to move house? Or if there is a divorce but the settlement makes disposal of the jointly owned home problematic, so the house needs to be split up along with the relationship? [Fig 5.14] Of course any building can be in some way divided, but it makes sense to enable this to be done expediently, as is shown in a number of schemes such as the London Flexhouse and Next Home in which carefully designed vertical circulation, entrance positions and the service provision allow the various levels of the house to be combined or separated in a number of ways. 117 120 Other examples of designing a home with a view to it being divided in the future are Neave Brown's Alexandra Road in London, and his smaller housing scheme in Winscombe Street. 058 Both projects are based around the notion of zones, and both develop the concept of a ground floor that can be separated off and handed over to a different use or user. Initially bedrooms are downstairs and living rooms upstairs, which decreases the space needed for circulation. In his own house in Winscombe Street, the

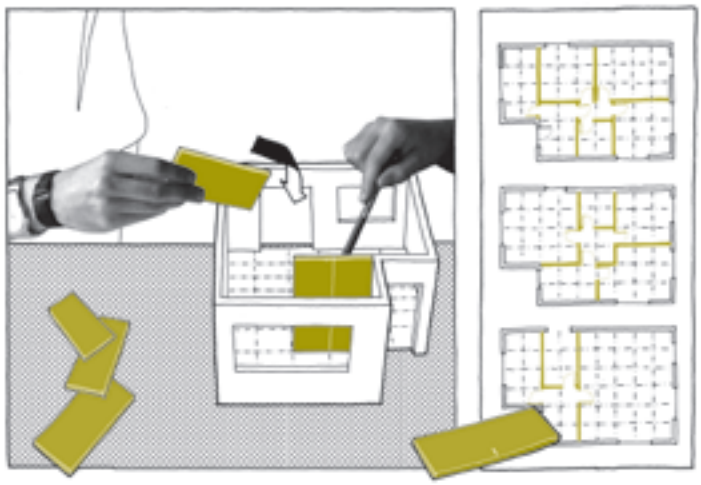


5.14 The Divorced House, DSDHA, 2003. The division of a London house to provide two separate units.

three vertical zones of children on the lower ground floor (with its own entrance), family on the upper ground floor and adults on the top floor has proved remarkably resilient over time, the lowest zone having been used variously as children's bedrooms, teenage apartment and (now) artist's studio.

Moving In

Thus far we have skirted around the outside of the housing unit, seeing how it may be added to, expanded into, joined together and divided up. It is now time to enter the unit and examine the interior layout for its potential for change. As has been discussed above, it is not enough simply to leave an undesigned empty shell in the hope that people will fill it in all manner of ways. Bernard Leupen's argument that attention to the permanent is the way of achieving subsequent freedom is worth repeating here. The most successful flexible housing schemes have consistently mastered the access, the services and the position of these elements in relation to the structure. The flexible deployment of what Leupen (following Stewart Brand) calls the scenery — the internal partitions that define the final spatial layout — is dependent on these permanencies. If one moves through the hierarchy of fixed elements in terms of their permanency, from structure, to skin, to access, to services, to scenery — then the layout of rooms becomes the final, and least fixed, component in this temporal sequence. If, on the other hand, one starts with the specifics of the plan layout and from there determine access, service and structure, it is highly likely that the housing will be inflexible. For many designers this will mean reversing the normal sequence of approaching housing, starting with the permanent in order to allow flexibility in the more temporary, paying less attention to the foreground and more to the background.



5.15 The role of the designer here becomes one of critical moderator and technical enabler as to how and what can be done within an empty shell.

A good way of understanding this principle in action is to look at the schemes that were founded on the tenets of participation. Here the flexibility of the internal layout is not developed as an architectural concept in its own right but as a response to a wider social imperative, that of empowering tenants to take control of their future dwellings. The role of the designer here becomes one of critical moderator and technical enabler as to how and what can be done within an empty shell. [Fig 5.15] This approach puts the occupant in charge, allowing them to define their ideas for dwelling. Flexibility here is a social issue first and then an architectural one. The attention is thus not on the niceties of the layout per se, but on setting up a supporting framework in which tenants can deploy their future home. What is needed, therefore, is an understanding, as a designer, of how that framework may best enable freedom of layout.

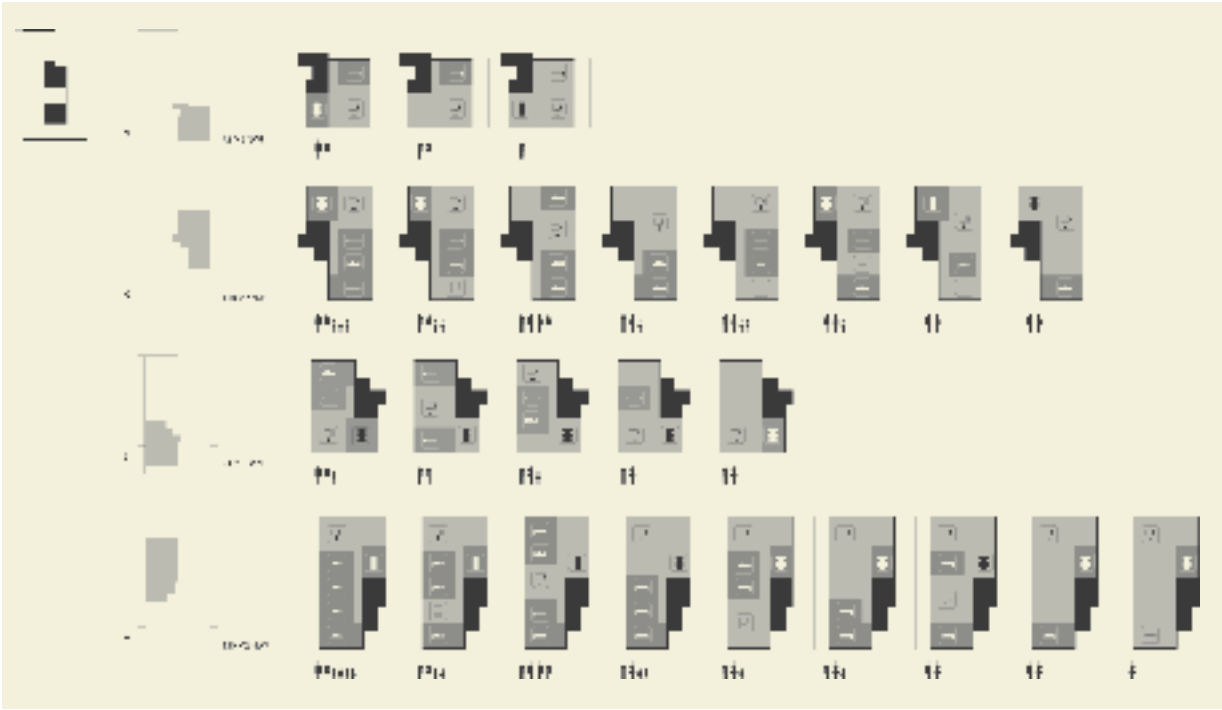
Looking at the best participatory schemes there is a sense of the designer preparing the ground by working backwards and forwards between setting the framework (structure, skin, access and services), testing the layouts that the framework allows, and then refining the framework on the basis of those tests. Thus at Montereau the architects developed ten hypothetical layouts. 061

The fact that none of these were taken up by the tenants, and that in the end no two of the plans were the same, should not be taken as a sign of an inherent weakness in the architects' planning but as quite the opposite: as a testament to their skill in understanding the importance of refining the relationship of the elements in the background framework. [Fig 5.16] On a smaller scale, but also managed by a housing co-operative, is the housing development Hegianwandweg in Zürich. 155 Only the external walls and the internal core of circulation, entrance hall and bathrooms are load bearing. [Fig 5.17] This allows the free disposition of partition walls between rooms and apartments, making it possible to respond to the wishes and needs of new tenants with regard to the division of rooms as well as the size of the dwelling unit.

Unfortunately the regulatory systems that define housing tend to kill off this type of user-led flexibility at its very roots. In order to obtain planning permission for a residential building, it is usual to provide the planning authority with a complete set of plans showing definitive layouts. This makes flexibility — as in user involvement in the design of a floor layout — extremely problematic from an organisational point of view, because the final layout is often delayed until very late in the planning and construction process, and so permission has to be gained retrospectively. Yet, there have been some projects in various national contexts that have challenged rules and regulations in a creative and playful way — trying to stretch both the imagination of future residents and the precise point of involvement and control of the public authority. These schemes have worked by getting agreement for the principles of massing, circulation and unit numbers, but leaving the approval of final layouts until near the time of completion. [18]

5.16 Montereau, Arsène-Henry, 1971. 061

5.17 Siedlung Hegianwandweg, EM2N, 2003. Interior under construction showing open spans. 155



5.18 Siedlung Hegianwandweg, EM2N, 2003. Plans with 25 different scenarios. 155

The openness of the participatory method is not, however, available to most housing designers who generally are designing for an unknown user. Rooms thus have to be laid out in advance, but it is important that the initial layout is always conceived with the possibility of change. One method of achieving this is through scenario planning — the idea of projecting future uses onto the initial and seeing if it can adapt to them. We have already seen this done in a semi-scientific way with the work of Stam, Van den Broek and Leppla. More recently at Siedlung Hegianwandweg, the architects EM2N showed 25 variations in plan that could be achieved through the internal rearrangement of walls, each version shown with a different combination of users. 155 [Fig 5.18]

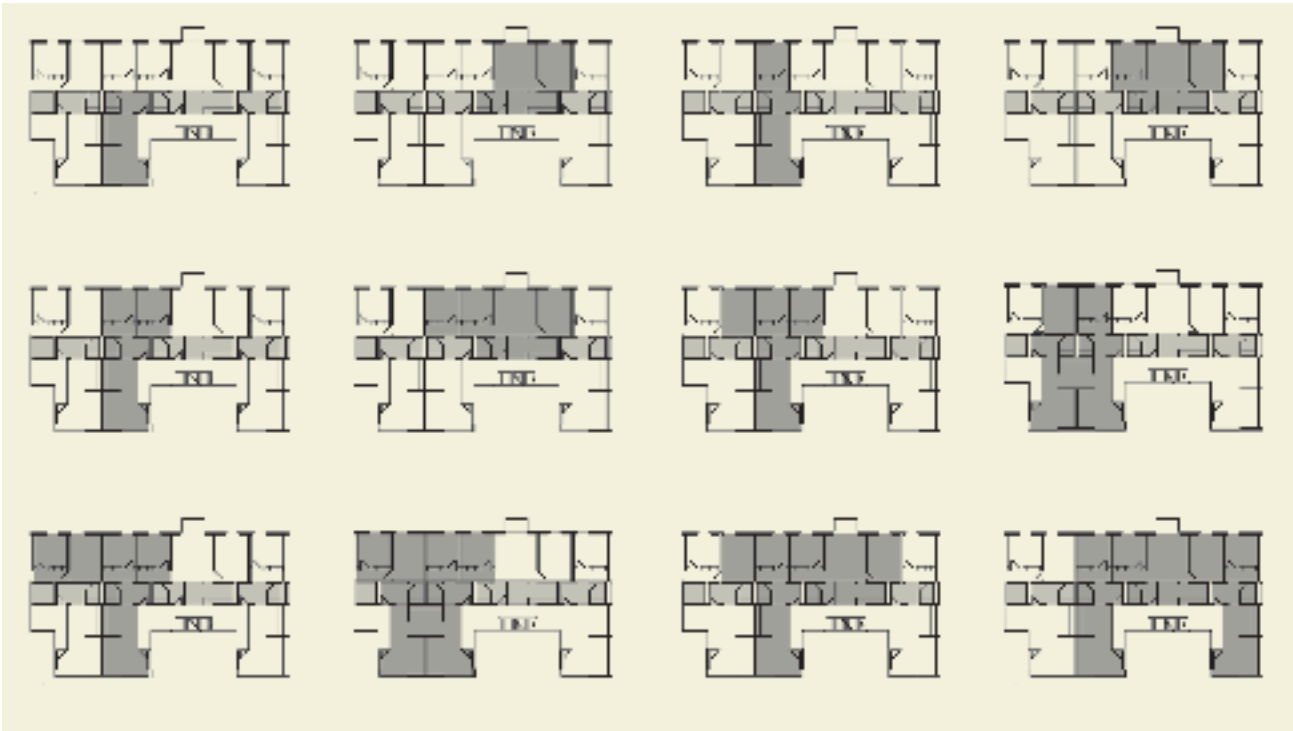
Rooms without labels

One of the most provocative, but also sensible, suggestions at a recent conference on flexible housing, was that the best way of achieving flexibility would be to get rid of room designations. [19] In making this recommendation the speaker was only really echoing the recommendations made by Parker and Morris in their seminal report forty-five years before. They argued that labels on rooms inhibited flexibility 'both in the initial design and in the subsequent use of a dwelling'. Their recommendation was that one should set space standards for the unit as a whole rather than for the individual rooms. This approach is, they argue, 'flexible, questioning such widespread assumptions as that equal floor areas should be devoted to sleeping, dressing and sanitary needs as to all other needs put together.' They were remarkably clear that the report was 'not about rooms so much as about the activities that people want to pursue in their homes'. [20] Why, then, one could ask is there still something such as a specification of standards of space by reference to individual rooms with specific labels? As we have seen, the naming of the room goes hand-in-hand with the controlling of the activities in that room. Assumptions are made about

the conventional arrangement of the dwelling and the particular way in which a given room will be used, and from these assumptions space standards applied. This is seen most clearly in the Housing Corporation Scheme Development Standards, which oversee the vast majority of social housing design in the UK. Vague and incredibly deterministic at the same time, the Scheme Development Standards require that 'internal environments should be comfortable, convenient, capable of sensibly accommodating the necessary furniture and equipment associated with specific room activities and be suitable for the particular needs of intended user groups.' [21] A dwelling and room, this implies, has a specific user group and this user group a specified set of furniture. Inflexibility is set right at the start.

This contrasts with the approach of the traditional Japanese house. 001 Whereas in a Western context 'the function of all a house's spaces are consciously set from the very beginning', in the traditional Japanese set-up the situation is much more fluid: rooms are only imperfectly partitioned and based on a generic module, so that later functional and social changes are easily achieved. [22] This concept demands not only the removing of labels for rooms, but also a re-thinking of the spatial hierarchy imposed by specific layouts. Room labels designate use, and with this an accepted pattern of occupation in which standard social patterns, often based on outmoded conventions, are spatially inscribed in the layout of the dwelling. Instead of formally arranging rooms according to a pre-set system of classification, a non-hierarchical and loose-fit system allows for much greater openness in how rooms will be interpreted. As with the indeterminate building, this approach to indeterminate rooms does not imply a desire for neutrality; the architect carefully determines the layout and proportion of a set of rooms and then leaves the rest to the occupants. Typically the rooms will be equally sized and arranged off a central hallway. [23]

Unfortunately this approach of soft indeterminacy runs counter to the mindset and rules of many housing providers, and indeed potential purchasers and tenants who are led down the route of normative expectations and are often unable to see beyond standardised solutions. A designer will often be handed a set of regulations stipulating the specific rooms to be provided and the furniture that needs to be accommodated in each of the rooms; from this service layouts follow, together with the positions of doors and windows. In the end the regulations more or less set the spatial layout, all but dispensing with the need for a designer. However, enough examples of rooms without labels have worked successfully for the approach to be pursued against the stringent demands of tight-fit functionalism. Indeterminacy was used as a response to the housing shortage crisis in the 1920s and 1930s in the belief that the resulting buildings could cater for a wider range of occupants. A typical example of this approach is the Hufeisensiedlung in Berlin designed by Bruno Taut and Martin Wagner. 010 The design provides three similarly sized rooms (denoted on the plan simply as 'Zimmer' — 'room') off a central hallway, with the services (bathroom and kitchen) in a separate zone. The occupation of the rooms is thereby left open to the interpretation by various possible user groups: maybe three single people, or a couple with two children, or an older person with a carer. A more refined version of this strategy can be found in one of the classic projects of Czech modernism, the Letohradská project in Prague by Evzen Rosenberg in which each floor typically comprises of two apartments of different size. 025 Within the



5.19 Überbauung Hellmutstrasse, ADP, 1991. Plans with variations. 109

individual apartments, rooms are of an equal size and can be accessed separately from a central lobby, whilst the services are contained in a separate zone. The use of indeterminate rooms is also beautifully exploited in the Hellmutstrasse scheme in Zürich by ADP Architektur und Planung, which is one of the most sophisticated flexible housing schemes of recent years. 109 The zone of similar sized rooms along one side allows multiple arrangements to be achieved, from large groups of single people living together right down to self-contained one-person studio apartments. [Fig 5.19]

Circulation

What becomes apparent in an analysis of housing examples based on indeterminate rooms is that a key to their success lies in the way that the rooms are accessed. Circulation space in housing is too often regarded as something that must be reduced to its minimum, almost eliminated from the plan in the name of efficiency. However, there are a number of projects that rethink circulation space and transform it into an opportunity rather than a necessary evil. It is worthwhile, therefore, to pose a set of questions about the potential of circulation space, both external and internal, to allow a much greater variety of uses than simply moving around. What can communal circulation be used for? How big is a hallway? What are the dimensions of a corridor? How are the individual rooms accessed? What is the relationship between the vertical and the horizontal circulation? How many doors are there to a room? These are questions that challenge the assumption of circulation space being the minimum necessary to access units and rooms.

5.20 Überbauung Hellmutstrasse, ADP, 1991. Exterior with circulation spaces wide enough to sit out on. 109

External Circulation

In multi-unit housing, consideration of the circulation needs to start with the communal spaces. Gerard MacCreanor makes a good argument that the vertical circulation can be seen as an extension of the street, 'inviting communal activities to take place'.[24] To achieve this demands some generosity so that the staircase and its landings become more than a means of access. One can see this in the Hellmutstrasse project, where the straight flights of stairs link together a series of balconies wide enough to sit out on, to place plants on and, in some cases, to set a table on. 109 [Fig 5.20] There is a sense of occupation and ownership of these spaces that is lacking from so much deck access housing. In relation to the overall area of the project, the additional space is marginal, but it opens up a flexibility in terms of use. Such a contribution is particularly important in social housing sector, where a certain external looseness counters the restrictions of internal space standards that are increasingly being driven down to the minimum. Employing excess circulation area can also build-in the potential division of one large unit into two units or the possible separation of work/live arrangements in one and the same dwelling. For example in Proctor Matthews' Abode scheme in Harlow the 'main' entrance is up stairs to a piano nobile, whilst there is a secondary entrance at ground level to an area that can either be used as workspace connected to the house or else divided from the unit above. 152 In the West Plaza condominium apartment block, MLTW/William Turnbull Associates use the same principle, with two entrances provided for each large apartment so that they can easily be divided into two. 045

Internal Circulation

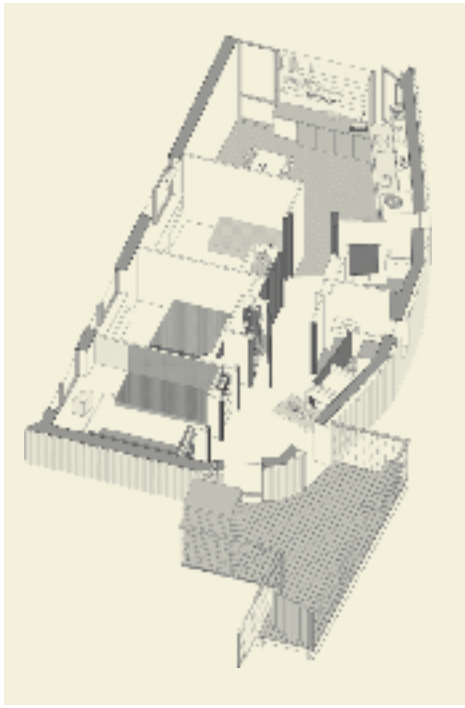
The same idea of a marginal increase in circulation giving a significant payback in terms of flexibility in use can be applied internally as well as externally. At the standard 0.9m width a corridor is no more than a passage for movement. This is the term that Robin Evans uses in his pioneering article on the social occupation of space in housing, *Figures, Doors and Passages*. He notes how the introduction of the corridor in the nineteenth century leads to a separation of rooms and with it the loss of a certain sociability. 'The cumulative effect of architecture during the last two centuries', he argues, 'has been like that of a general lobotomy performed on society at large, obliterating vast areas of social experience.'[25] Citing Alexander Klein's research project of 1928: *The Functional House and Frictionless Living*, Evans argues that the norms of efficiency that arose in the early twentieth century are embedded in contemporary housing design, with the corridor being reduced at worst to Klein's agent for social separation or at best to an empty expediency. [Fig 5.1]

To see the corridor as something more than a means of access challenges this modernist norm of separation and categorisation. However, at 1.20m wide circulation can begin to be used for storage, and at 1.50m it becomes

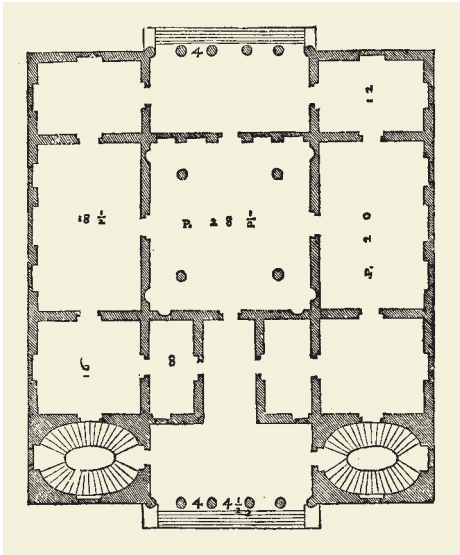
5.21 Kettenhaus, Becher + Rottkamp, 2001. Interior showing wide circulation with multiple uses. 145

a room in its own right, available for a variety of uses: as a play space for children, as a big wardrobe room, as a space for a desk, and so on. 145 [Fig 5.21] The dimension of these spaces becomes the most important criterion for their usability. A large hall might be able to be a playroom, but does it have any wall space to put cupboards against? A hall might even become a kitchen — a space which is seen by some as a central room of a dwelling anyway. For instance in the design for a block of apartments in Berlin by the Austrian architect Anton Schweighofer the kitchen becomes the central zone of the apartment.

An even more productive reworking of internal circulation can be found in Ash Sakula's small housing project for the Peabody Trust in London. 148 This is a design that could be interpreted as a critical reconsideration of British housing standards and regulations which state that circulation space should be sensible for the room activities and not much more. [26] In this context, it is therefore bold to view the circulation space as a focus point in a housing design. In Ash Sakula's project, this is exactly what happens: the hall — renamed 'sorting zone' — and the kitchen become the most important parts of the plan. The 'sorting zone' is a room in itself capable of being used for many different functions during the course of a day or during various years of occupation. With a window at one end a built-in desk and plenty of storage, this space becomes a social centre for the apartment. [Fig 5.22]



5.22 Silvertown, Ash Sakula, 2001. Axonometric with 'sorting zone' shown at bottom right.



5.23 Villa Plan, Palladio, From I Quattro Libri, 1570. A typical Palladian plan with no corridors but a permeable circulation pattern.

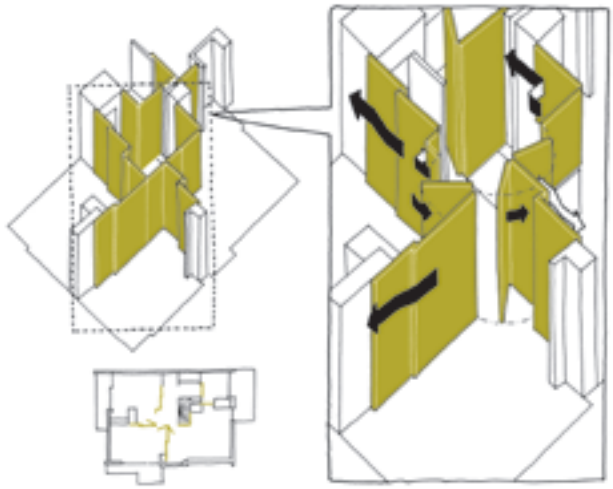
Permeable circulation

Robin Evans' provisional history of doors and passages starts in the Renaissance. He shows how rooms with multiple doors, and plans without corridors, radically reorientate our sense of sociality. '(It is) an architecture arising out of the deep fascination that draws people towards others; an architecture that recognises passion, carnality and sociality.' [27] Thus in a Palladio villa circulation, rather than being framed as its own category (the corridor), permeates the entire plan. [Fig 5.23] Movement is not seen as a functional activity but as a social one. Whilst carnality may not be a direct aspiration in contemporary housing, this type of permeability in plan does lead to a breaking down of the functional walls that individual rooms erect around themselves. Evans ends his essay with a call for the revival of 'the matrix of connected rooms', [28] a call that has been answered by some recent examples of flexible housing.

The advantage of this principle of permeable circulation is that it dissolves the strict hierarchy and categorisation of rooms, and empowers the user to move around and configure their home in a variety of ways. 123 If mobile elements within the plan are combined with a permeable circulation and service core, the different possibilities in using the spaces take on an element of true choice for the inhabitant. One of the most developed examples of this approach is the Graz-Straßgang scheme by Riegeler Riewe Architects. 114 Here the kitchen units take the form of a series of islands along a route that connects the entrance to the bathroom, with the main rooms on either side of this central core. Each of the rooms can be joined together or separated with sliding doors. As Peter Allison notes: 'in effect, this layout can be read as a small labyrinth within which each occupant can select those connections which most suit their individual requirements.' [29] More modest in its scope, but following the same principle of permeable circulation, is the connection of two or more rooms together. This has particular advantages in small apartments where absolute privacy between living and sleeping areas is not a necessity, and the joining of rooms gives both a feeling of space as well as more options for how they might be used. 162

Movable Elements

The discussion of permeable spaces introduces one of the key features of flexible housing, namely movable elements. As we have seen, flexibility can be achieved within a fixed framework, but it is more often associated with parts of the architecture being able to actually move. There is a direct, almost simplistic, conviction that flexibility in architecture is best delivered through actual physical change. [Fig 5.24] As was argued in the first chapter this is often little more than a representation



5.24 Schröder Huis, Diagram. 'There is a direct, almost simplistic, conviction that flexibility in architecture is best delivered through actual physical change.'

of flexibility, but nonetheless the concept of movable elements remains powerful. Movable and sliding walls, or hinged partitions, support a fluid notion of space that can be divided, separated, integrated or opened according to the needs and wishes of the occupants. The use of movable elements begins to dissolve the social structuring and assumptions that are implied by the rigidity of the standard dwelling, creating instead a 'topography of movement'.[30]

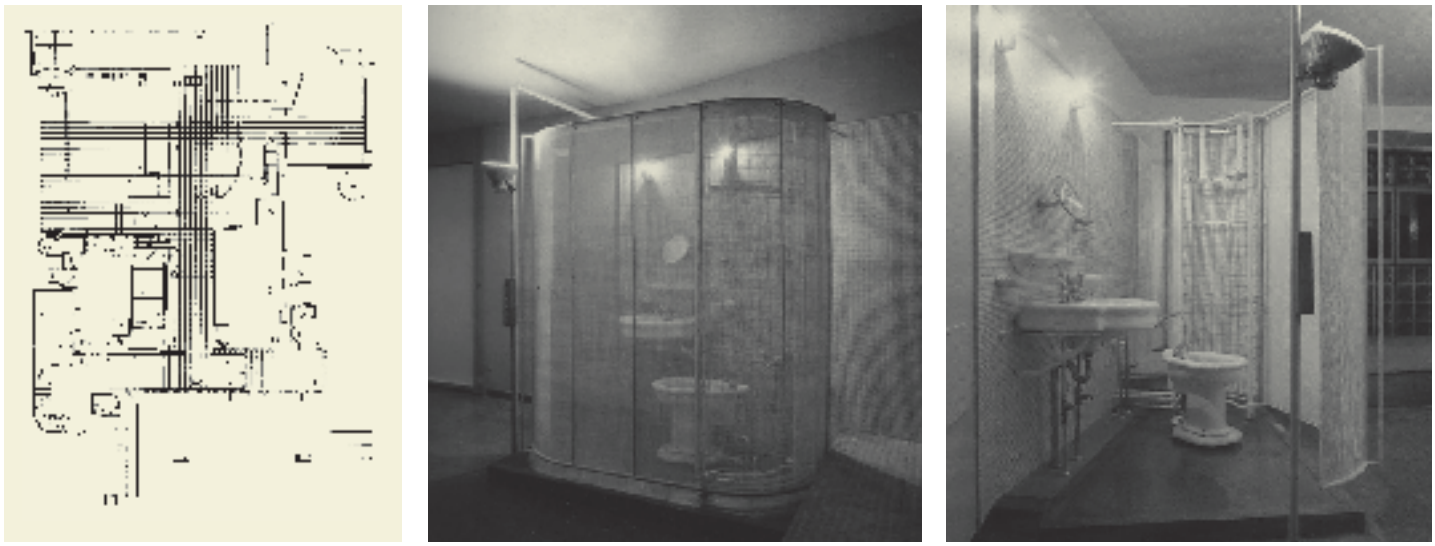
There is a long history of moving screens and temporary dividers being used in the traditional dwelling, whether in the Japanese house, the vernacular houses described by Paul Oliver,[31] or the curtained bedspaces of the seventeenth century Dutch interior. In all these cases the divider is part of the fabric of life. It is essentially a 'soft' device in the sense that it is not imposed from outside as a determination of use but rather evolves in response to a pattern of usage in order to provide privacy, to separate functions or to define spaces for cultural reasons. However, in the twentieth century this softness often turns hard. The sliding screen or folding door can become mechanisms for deployment by the architect as part of a deterministic programme. Modern technology makes it possible to perform the apparently magical acts of making walls disappear and moving around what has previously been fixed. Not only is there something directly appealing about these tricks but, as we have already seen, they fit into a more general tendency of modernism to reflect the perceived dynamism of the times in a dynamic architecture.

Sliding and Folding

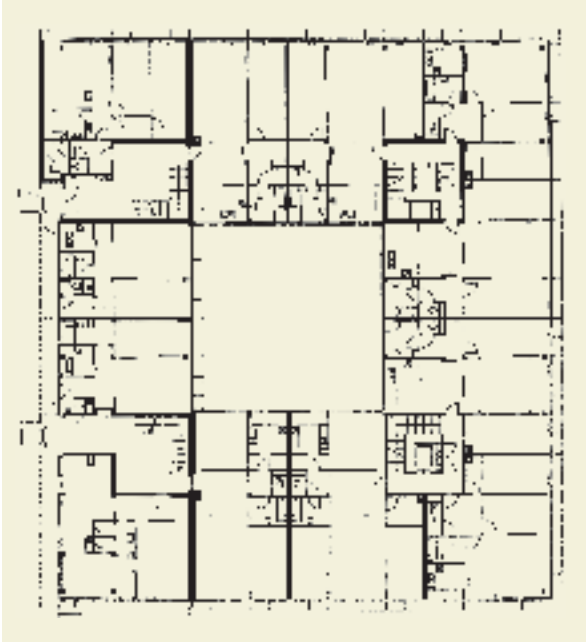
The modernist history of movable elements in housing always, and for good reason, tracks back to the Schröder Huis. 009 Not only did Rietveld do it first, but he also did it best. The design of the sliding and folding elements is brilliantly orchestrated so that in minutes the space can change from a completely open plan into a series of physically (but not acoustically) separated spaces. The panels fold away unobtrusively into a cupboard or wall pocket and when folded away, no structural element imposes any form of spatial order onto the exposed space. When opened up, the panels meet in the centre of the plan, with the end panel of each screen wall acting as a door to each of the three individually accessible rooms. Despite the divisible open plan the approach is very determinate, not only because there is only really one possible option in dividing/opening the space but also because the client Truus Schröder takes on the role of the controller by determining how the members of her family have to live their lives.[32] What is most interesting in the solution is how a radical, flexible, design grew out of a radical, flexible, social programme that attempted to rethink how an unconventional family group might live together. In this it shows brilliantly how movable elements take on a social function that transcends the technical mastery with which they are often associated.

Another house that has been placed in the canon of pioneering modernist houses, Pierre Chareau's Maison de Verre of 1929 (done in collaboration with the Dutch architect Bernard Bijvoet), also employed a range of movable items: screens, sliding walls and various mobile partitions. [Fig 5.25] In the normative, modernist, reading of the house these movable elements exemplify the spirit of progress and technological advancement with which the house is associated.[33] It is these elements that have captured the imagination of generations of architects, including the leaders of the hi-tech movement.[34] However in Sarah Wigglesworth's more subtle, feminist, reading of the building it is exactly 'the mobile nature of many of the props (that) symbolises and supports the architects' myth of control: control over movement, social life and material expression.'[35]

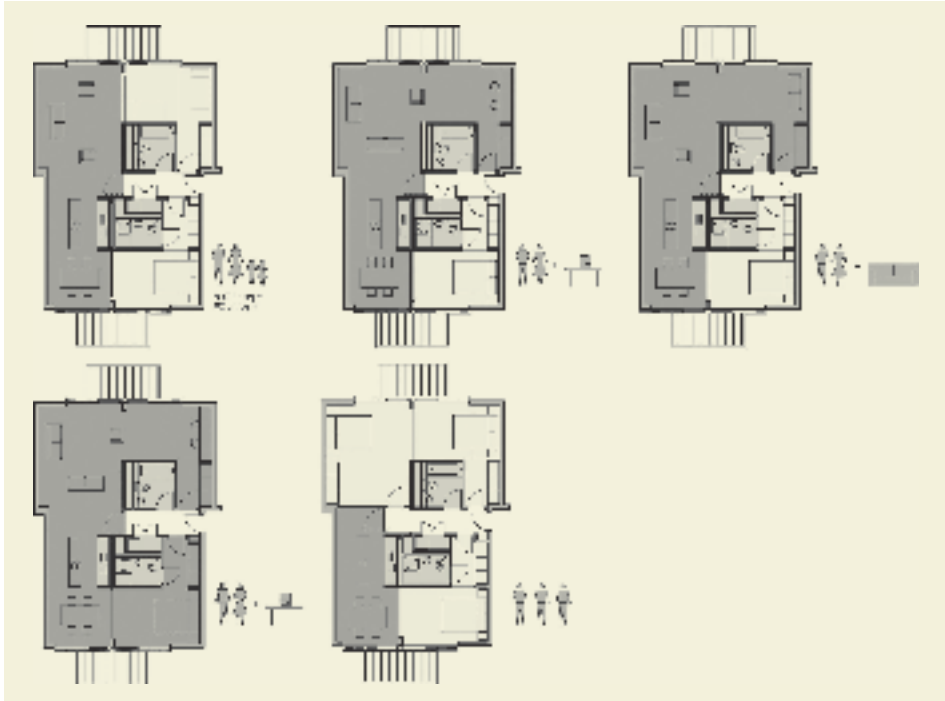
This tension in flexibility between an aspiration for freedom being shadowed by the will to control was discussed in Chapter 1. It is always present in movable elements, which are the most emblematic figures of flexibility. Generally the more determinist movable elements are those that are conceived of as foreground mechanisms; as a result, even when folded away, one is aware of their presence. For example, in the Wulzendorfstrasse housing scheme designed by the Austrian architect Helmut Wimmer the folding walls remain, once moved aside, as a prominent remnant in the room. 122 [Fig 5.26] Whether a plan like this really is flexible depends entirely on its user: it might be, but it equally well may not be. Because the sliding walls don't 'disappear' in a wall pocket, the combined kitchen, dining and living room will never be entirely open. Theoretically, through opening up all sliding panels, one large room could be created. However, its practicability would depend entirely on the amount of furniture, privacy requirements of users and their overall tidiness — requiring active participation from its users. The sense that the plans give is that the lives of the inhabitants are shaped by the walls, rather than vice-versa.



5.24 Maison de Verre, Chareau and Bijvoet, 1929. Bathroom with sliding screens shown closed and open.



5.26 Wulzendorfstrasse, Helmut Wimmer, 1996. Plan showing sliding walls. 122



5.27 Greenwich Millennium Village, Proctor Matthews, 2001. Plans with variations that can be achieved through various combinations of sliding walls. 143

The Moving Wall

The opposite approach to this kind of determinism is to start with a plan that works without movable elements and then add them in order to provide additional spatial and functional variety. In this way the movable elements provide flexibility over and above that given by the basic layout, often loosening up what has been quite fixed. An example is Proctor & Matthews' scheme for the Greenwich Millennium Village, where the sliding partitions replace sections of fixed walls. 143 The plan is effective with or without the sliding walls but, because the movable elements are acoustically sound they give a wide variety of options, from a completely open 'loft' space, to an apartment for three individuals. [Fig 5.27]

The Greenwich scheme works through the use of large sliding panels that can completely disappear into the thickness of the wall in order to create open connections between rooms. More modest are those schemes where sliding or folding elements are used to adjust the space of small apartments over time, be it daily, seasonal or longer term — adjustments that release space according to changing needs and so make the most of otherwise tight plans. 022 023 [Fig 5.28] This was the approach used in Steven Holl's housing project in Fukuoka in which 'diurnal hinging allows expansion of the living area during the day, reclaimed by bedrooms at night' whereas 'episodic hinging reflects change in family over time; rooms can be added or subtracted accommodating grown-up children leaving or elderly parents moving in.'[36] 106 This may be seen as a modern, and softish, interpretation of the traditional Japanese house.

House as Furniture

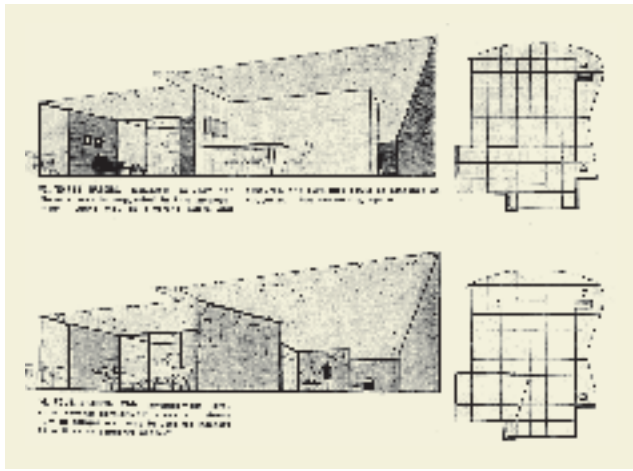
This chapter started with the idea of indeterminacy, the provision of a background frame for users to appropriate as they see fit. Through the course of the chapter this 'soft' stance has gradually hardened so that now we come to approaches in which the architect's hand is now in the foreground and with it more determining. The most extreme approach is to treat the house as a piece of complex equipment, and then to design it in the most efficient manner possible. In the early twentieth century the railway sleeping carriage became an exemplar for this reading of house as equipment. Giedion, who devotes thirty pages of *Mechanisation Takes Command* to an analysis of railway compartments, argues that: 'it is not actually a room, it is combination furniture inside which the passenger can move.'[37] As such the sleeping car embodies a number of lessons that can be transferred to housing. First is the efficient and multiple use of space; Giedion shows how the sleeping car has developed over time to provide different configurations by day and night 'Economy of space', says Giedion in a memorable phrase, 'is the mother of convertibility.'[38] Second is the positivist approach that can be identified in the design of the modernist furniture, in which a set of 'problems' (sitting, sleeping, eating) are ruthlessly stripped down to their bare ergonomic essentials and then provided with logical, technical, solutions. Giedion was particularly

5.28 Lawn Road Flats, Wells Coates, 1934 (restored by Avanti Architects, 2005). Sliding door / wall between rooms in minimal apartment. 023

interested in the development of types of furniture that adapted to different needs: 'Furniture was dissected into separate elements, into separate planes. These movable elements, which a governing mechanism linked and regulated, enabled the furniture to change in adaptation to the body and various postures. The furniture was thus endowed with a flexibility unknown before, and ceased to be a rigid, static implement... Patent furniture could perform alternate functions.' [39] Giedion's argument is that if furniture could be developed according to functional analyses just like other machines, then there was no reason why this approach should not be extended to housing, even if it brings with it what one critic calls the Taylorisation of the architectural plan. [40]

Thus when Le Corbusier describes the concept for his semi-detached houses at the Weißenhofsiedlung in Stuttgart as a combination of sleeping-car and a saloon-car equipped either for the day or the night, one gets a more explicit connotation of house as machine-for-living-in than in some of the more iconic villa projects. [41] At the Weißenhofsiedlung a number of dimensions, such as the 0.70m wide corridor, are directly related to the minimal dimensions of railway cars. Furniture is designed-out, as Corbusier proposes cupboards big enough to accommodate clothing, linen, hats and shoes — even the bed can be rolled underneath. He declares that the well-calculated dimensions of each of the compartments within these cupboards would replace all furniture that previously not only cluttered spaces beyond reason, but also led architects to design rooms bigger than necessary. [42] Corbusier employs the same principles of minimal space standards and adaptability in the Maisons Loucheur with its explicit references to the transformable equipment of the railway sleeping car in its day/night configurations. 016

This modernist or, more particularly, positivist interpretation of house as a functional piece of furniture continues through the twentieth century. Most dramatic is Fred MacKie and Karl Kamrath's project Movable Space Dividers, in which the 'architecture' is reduced to little more than an enclosing frame. 031 The house is defined by a system of movable 'space dividers' each of which is treated as a piece of furniture. These would be distributed in a large open space according to the needs and wishes of the user and stored in closets if not used. A series of drawings published in *Architectural Forum* in 1942 illustrate the proposed principle. [Fig 5.29] The first phase shows an open plan living area with adjoining terrace. The second phase illustrates the division of the house into two spaces, separated by means of movable



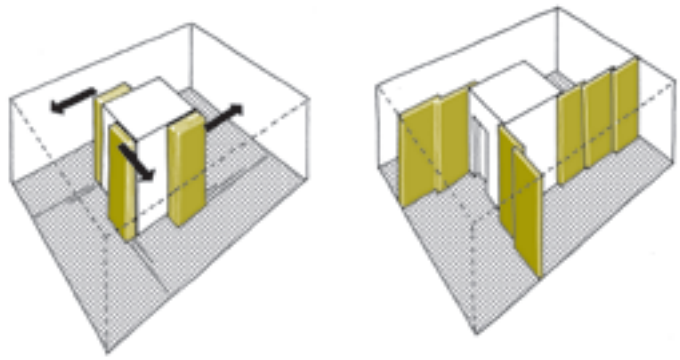
5.29 Movable Space Dividers, MacKie + Kamrath 1942. 031

units made of translucent plastic. Phases three and phase four show further subdivisions into a greater number of rooms. The movable space dividers not only came in different materials and levels of translucency, but also as hinged elements, which could then be used as doors. The selection of integral sound insulation and

various surface treatments meant that room acoustics could be varied at will. Despite the indicated modular grid, the lightweight walls could be placed anywhere and at any angle, giving a variety of options only confined to the shape of the house. [43]

5.30 Apartments with transformable cores, Abalos and Herreros, Project, 1990.

Although the published plans of MacKie and Kamrath's project rather inconveniently ignore bathrooms and kitchens, one assumes that these could easily have been accommodated within the general system. In the 1960s, architects and product designers started to look at the issue of mobile kitchen and bath units. These are the most fixed of all the elements in the normal house, and so freeing them from their cores would, it was argued, finally present a completely open and flexible plan. Masanori Umeda designed one such mobile unit, a kitchen on wheels, connected with the static service duct via an elastic flexible tube. [44] Units could be pulled out when needed and placed wherever it was most convenient. Taking the concept to its extreme, Spanish architects Abalos and Herreros developed a project for an apartment with a transformable core. [Fig 5.30]



5.31 The idea of the fixed service core and looser planning of the remaining spaces, often with movable or adaptable partitions.

In contrast to Le Corbusier and Van den Broek, the architects don't attempt to predict a 24-hour pattern of use, but give each apartment a series of components that serve 'the unpredictable uses of the private setting'. [45]

The opposite to this approach of the moving appliance is to start with the service elements (kitchen, storage, bathroom) and fix them in the plan, leaving the space around undefined and open to multiple uses. This is the approach taken by the Smithsons in their Appliance House projects in which 'the storage spaces and appliance spaces... are the fixed things and define the house space proper.' [46] 038 The principles, if not the flair, of the Appliance Houses, can be seen in countless examples of flexible housing based around the idea of the fixed service core and looser planning of the remaining spaces, often with movable or adaptable partitions. [Fig 5.31] It is an approach that fits well into the mantra of starting with, and paying most attention to, the permanencies in order to allow the other elements to unfold in a flexible manner.

The Room as Furniture

A more modest understanding of the house as a form of equipment is to treat the individual rooms as pieces of furniture, or at least build in furniture that can fold out or down. This is an approach that is particularly

5.32 Lawn Road Flats, Wells Coates, 1934 (restored by Avanti Architects, 2005). Built-in furniture in bedroom. 023

5.33 Room to Grow, Ash Sakula, Competition 2002.

appropriate when dealing with tight spaces, as exemplified in Wells Coates' Lawn Road Flats, where a carefully designed element hides away all the detritus that might otherwise fill the compacted spaces of the apartment. 023 [Fig 5.32] The principle can be expanded to include fold-down beds, sliding doors to cover up kitchen units, fold-out tables and ironing boards, bunk-beds over storage units — and many other examples where a room is reduced to a few robust elements that are condensed into something fixed, leaving the rest of the space free. This is shown well in Ash Sakula's prize-winning submission to the Room to Grow competition for a child's space in the C21 home. [Fig 5.33] Based on an area of around 15m² and a room height of 2.4 metres, the proposed room has fixed elements that don't change but are designed in a way that they can adapt to changing situations as a child grows older. A desk, for instance, runs all along one wall of the room: 'It is low, but not too low, strong enough to climb on and jump off, and is a making area, a drawing area, a homework area, a computer area, a place for a TV, hi-fi, telephone charger, set down space for keys and money and everything else. And before all that, it is wide enough for changing and dressing a baby.' [47] The cupboard is large and deep, 'its doors store stuff a bit like a fridge, but this time access from outside through large elliptical holes. Good for jumpers, shoes, socks and knickers. Inside are baskets that store winter and summer clothes, old books, games or toys' and above it is 'a built in bed, accessed by climbing up the cupboard doors... This can be the main bed in the room, or it can be secondary — as a play platform and guest (or sibling's) bed.' The built-in 'furniture' is open for interpretation, even if the child eventually moves out, the room can be used as a guest bedroom or a study, using the fixed elements in an entirely different way.

With a discussion of winter socks we come to the end of this chapter, which has moved from the scale of the site to the scale of the intimate. On the way we have encountered overarching strategies and particular tactics to achieve flexible housing. Many of these approaches are summarised in Chapter 7, *A Manual for Flexible Housing* which, as with this chapter, does not propose a single solution but rather suggests a range of options to choose from. How one does this is largely a question of design intelligence, projecting a series of questions against any proposed design, the first of which is: can this design respond to change? The next chapter asks the same question of the construction of housing.

Chapter 5 Notes

1 This follows Le Corbusier's proclamation that 'The problem of the house is the problem of the epoch.' Le Corbusier, *Towards A New Architecture*, London: The Architectural Press, 1946, p.210.

2 Jonathan Hill, *Actions of Architecture*, London: Routledge, 2003, p.15.

3 Ernst Neufert, *Bauentwurslehre: Handbuch für den Baufachmann, Bauherrn, Lehrenden und Lernenden*, Berlin: Bauwelt Verlag, 1936. The book is in its 38th edition, has sold over 300,000 copies in Germany and an additional 500,000 copies worldwide.

4 Gerard MacCreanor, 'Adaptability', *a+t*, no.12, 1998, p.42.

5 Christoph Grafe, 'Dutch courage for the future', *Architects' Journal*, 209, no.22, 1999, p.33.

6 Sarah Wigglesworth, 'Cuisine and Architecture', *Architectural Design*, 72, no.6, 2002, pp.102-6.

7 Herman Hertzberger, *Lessons for Students in Architecture*, Rotterdam: Uitgeverij 010 Publishers, 1991, p.146.

8 Bernard Leupen, *Frame and Generic Space: A study into the changeable dwelling proceeding from the permanent*, Rotterdam: 010 Publishers, 2006.

9 Lionel Duroy, 'Le Quartier Nemausus', *Architecture d'aujourd'hui*, 252, 1987, pp.2-10. Jacques Lucan, 'Nemausus 1 Wohnüberbauung mit Lofts, Nîmes, 1985', *werk, bauen + wohnen*, 77/44, no.3, 1990, pp.56-58.

10 Daisy Froud and Geoff Shearcroft, 'Public Nookie', *Made (Welsh School of Architecture)*, 2, 2005.

11 Cedric Price is in many ways the prophet of an indeterminist approach, as the chapter title, 'Uncertainty and delight in the unknown', of his book suggests. Cedric Price, *Cedric Price*, London: Architectural Association, 1984, p.53.

12 Hertzberger, *Lessons for Students in Architecture*, p.157.

13 Ibid., p.160.

14 Ibid., p.146.

15 See Hertzberger Ibid., Chapter 8 'Making space, leaving space'.

16 Ben van Berkel, 'Flexible Housing in Almere, The Netherlands', *Industria delle costruzioni*, no.372, 2003, p.73.

17 See: http://www.prparchitects.co.uk/press/articles/2004 Articles/Value-of-design: 'We have tested this approach on a number of real and theoretical sites and we are satisfied that they can offer attractive layout opportunities... with many different options for car parking. We have established to our own satisfaction that on the right sites wide frontage types can offer as high a density as narrow and medium types because they can be built closer back to back without loss of privacy.'

18 Thus at Montereau the architects negotiated an elaborate system of waivers in order to delay the moment of final approval.

19 'Flexible Housing: Current Perspectives and Future Potential.' University of Sheffield, Sept 2005.

20 Ministry for Housing and Local Government, *Homes for Today & Tomorrow* (also known as the *Parker Morris Report*), London: Her Majesty's Stationery Office, 1961, p.4.

Chapter 5 Notes

21 Housing Corporation, *Scheme Development Standards*. 5th edn, London: Housing Corporation, 2003, p.10.

22 Kiyoyuki Nishihara, *Japanese Houses: Patterns for Living*, Tokyo: Japan Publications, 1968, pp.108-11.

23 see Martin Albers, Alexander Henz, and Ursina Jakob, *Wohnungen für unterschiedliche Haushaltsformen*, Schriftenreihe Wohnungswesen, Band 43, Bern, 1988, pp.62-63. Verena Huber, 'Flexibilität und Kreativität', *werk · archithese*, 64, no.11/12, 1977, p.28.

24 MacCreanor, 'Adaptability', p.42.

25 Robin Evans, 'Figures, Doors and Passages', in *Translations from Drawing to Building and Other Essays*, London: Architectural Association, 1997, p.89.

26 Housing Corporation, *Scheme Development Standards*, pp.10-11.The *Scheme Development Standards* is a guide for Housing Associations and their consultants.

27 Evans, 'Figures, Doors and Passages', p.90.

28 Ibid.

29 Peter Allison, 'Mobile elements in social housing in Austria', *ARCH+*, no.134/135, 1996, p.105. See also Haus Frey by Ernst Plischke.

30 Patrik Schumacher, 'Architecture of Movement', *ARCH+*, no.134/135, 1996, pp.106-7.

31 Paul Oliver, *Dwellings: The Vernacular House Worldwide*, London: Phaidon, 2003, p.166.

32 It is easy to associate this determinism with the architect alone but, as Alice Friedman has shown, the approach grew out of a close collaboration between Rietveld and Mrs Schröder. Alice Friedman, *Women and the Making of the Modern House*, New York: Abrams, 1998, p.88.

33 Frampton's influential article 'rediscovered' the Maison de Verre for a new generation of late modernist architects. Kenneth Frampton, 'The Maison de Verre', *Perspecta*, 12, 1969, pp.71-129.

34 Richard Rogers, 'Paris, 1930', *Domus*, 443, 1966, pp.8-19.

35 Sarah Wigglesworth, 'A fitting fetish: the interiors of Maison de Verre', in *Intersections*, ed. by Borden, I. and J. Rendell, London: Routledge, 2000, p.105.

36 Michel Jacques and Annette Nève, eds., *Steven Holl*, Basel: Birkhäuser, 1993, p.66.

37 Sigfried Giedion, *Mechanization Takes Command*, Oxford University Press, 1948, p.437.

38 Ibid., p.460.

39 Ibid., p.390.

40 Jörg Werner, 'Alltags-Anpassungen', *Arch+*, no.100-101, 1989, p.52.

41 Karin Kirsch, *Die Weißenhofsiedlung* Stuttgart: Deutsche Verlags-Anstalt GmbH, 1987, p.125.

42 Ibid., p.126.

43 Fred MacKie and Karl Kamrath, 'The new house 194X: 20. Movable Space Dividers', *Architectural Forum*, no.77, 1942, p.120.

44 Werner, 'Alltags-Anpassungen', p.57. In 1968 it won 2nd place in the BRAUN prize, and from 1976, the kitchen was produced in Italy. Similar projects were Joe Colombo's 1969 'Visiona' for Bayer-Leverkusen and Oliver Mourgoue's 1972 'Visiona 3'.

45 Gustau Gili Galfetti, *Pisos Piloto. Model Apartments: Experimental domestic cells*, Barcelona: Editorial Gustavo Gili, 1997, p.65.

46 Alison Smithson and Peter Smithson, *The Charged Void: Architecture*, New York: Monacelli Press, 2001, p.191.

47 Robert Sakula and Cany Ash, 'Interview with Robert Sakula and Cany Ash of AshSakula Architects', London, 2005.

6

THE MAKING OF

FLEXIBLE HOUSING

THE MAKING OF FLEXIBLE HOUSING

Inflexible Construction

The last chapter investigated the way that one might design flexible housing through a consideration of use, focussing in particular on the plan. This chapter will look at the way that housing might be constructed in order to increase its potential for flexibility. As with issues of plan and use, the starting premise is one of designing out inflexibility. To investigate this, we start with an unravelling of the most prevalent UK house type: the cavity-walled, two-storey, pitched roof, semi-detached house. In terms of both use and construction, these buildings are an object lesson in inflexibility, mainly because the priority is for them to satisfy the short-term needs of the marketplace using the standard techniques of a backward-looking construction industry. For a number of reasons explored in Chapter 3, the standard UK house is almost purposely inflexible. We will therefore briefly analyse each of its elements in turn, using them as examples of what not to do if one is to construct housing in a flexible way.

The Inflexible Wall

If one sat down with a blank piece of paper and attempted to design from scratch the most inflexible form of external walling, the result would not be far from the cavity wall. Try forming an opening in a cavity wall in order, for example, to add a new extension and one immediately meets problems. Loadbearing walls are inherently less flexible than frame walls in this respect, but with a cavity wall the problem is compounded. At the head of the new opening one needs to support not one but two leaves of masonry, and somehow a cavity tray needs to be inserted. To the sides both leaves will have to be stitched in and the cavity closed to frame the opening—a still messier job if the inner and outer leaves are not (as is often the case) horizontally coordinated, in which case cut bricks and blocks are inevitable. Whilst a brick is sometimes described as the ultimate module of the building industry,[1] brickwork doesn't look so good when patched in like a scar.

The Inflexible Partition

Just as the external walls of the standard UK house are inherently inflexible in their construction, so is the internal structure. With party-wall-to-party-wall spanning still not the norm at least some of the internal partitions are loadbearing in order to support the joisted floors and the partitions of the floor(s) above. Any alteration to these walls therefore needs structural work and their complete removal requires major structural surgery. The problem is compounded by the tight-fit functionalism of so many of these houses, with rooms designed down to a specific size and use. Any reconfiguration of the use of these rooms therefore demands a wholesale reconfiguration of the structure, particularly if the underlying foundations are strips that follow the line of the loadbearing internal partitions, as opposed to a concrete raft.

Even when the ground floor walls are not loadbearing, some developers will construct them out of blockwork in order, they argue, to give a more robust feel to the property for potential purchasers. This means that even if future occupants wanted to move or adapt such walls they might be put off because of their seeming solidity. The hybrid nature of the typical developer house also militates against future change. Blockwork, brickwork, loadbearing timber, non-loadbearing timber, metal studs, are expediently thrown together, and their taking apart requires a form of forensic investigation and expert intervention, beyond the means and skills of the user who wants to make a simple adaptation.

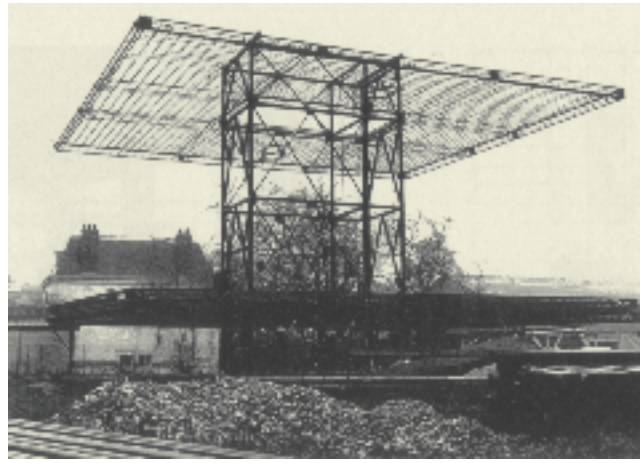
The Inflexible Roof

It is the roof of the typical developer house that is perhaps the obstructively inflexible element of construction, and the most unnecessarily so. Stick your head through the loft hatch and one is confronted with a dense array of trussed rafters, which immediately squashes any hopes of vertical extension. Down on the ground it is likely that the only flat roofed element, the attached garage, will be designed to its structural limits, stifling any opportunity to add another floor where it could have so easily been achieved.

Inflexible Services

The services in the typical developer house appear to have been designed in a back to front manner. Draw a plan, add on service outlets (electrical points, sinks, radiators and so on) and then trace back to the junction box or boiler. Then run the services along those lines, cajoling pipes and wires through places that they do not really belong. Anyone who has drilled neat holes through floor joists and then threaded radiator feed pipes through them knows that the resulting configuration will be in place for good. Equally the random burying of electrical conduits or pipes within walls means that one is lucky to locate them in the future, let alone adapt them in any logical manner. They are placed without a view as to how they might be changed in the future and with little chance of being easily accessed. The rewiring of such a house means just that, a total ab initio operation.

Overall, then, the internal construction of the typical developer house conspires to fix the initial plan of the house and with this works against any future adaptation. The construction starts with the specifics of the design in plan and then adopts a constructional solution to fit that design; walls and services are thus not necessarily determined by a logic of adaptable construction but by following the lines in plan of the rooms. The construction therefore effectively freezes that particular design.



6.1 Immeuble Lods, Groupe Rameau, 1972. A project that explicitly applies principles of office construction to housing design and construction. 066

Constructional Principles

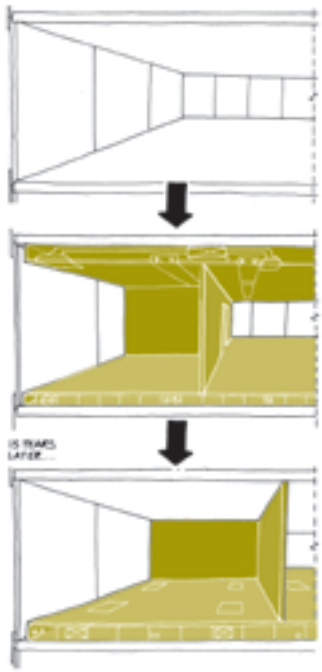
It may be that the standard, inflexible, methods of house construction are so entrenched, at least in the UK, that one has to look beyond the house-building industry to find examples of construction that enable flexibility. A good example is the speculative office. Here flexibility is not just a nicety but a necessity; the developer has to build in the potential for future tenants to adapt and upgrade their premises at any given time, both in terms of layout and services.[2] The constructional principles of the speculative office were exploited in schemes such as Immeubles Lods in France, which explicitly uses office building technology and planning principles to give maximum flexibility in the housing. 066 [Fig 6.1] The obverse is also becoming quite common, with 1960s and 1970s office buildings, which no longer have the floorplates or storey height to deal with contemporary office needs and servicing, lending themselves to be converted into housing.[3] [Fig 6.2]

The frame

It is worth, therefore, looking at some of the constructional principles embedded in the speculative office. The first is the frame: the speculative office is almost always constructed around a dumb, generic, frame. The structure is generally neither celebrated nor is it a direct mapping of a particular plan layout. It is just there — a background armature that enables a variety of plan forms to evolve within. The frame here is both literal — the structural frame — but also metaphorical — the frame for action within. A key feature of the frame is that it provides long spans so that space within is indeterminate, allowing non-loadbearing partitions to be put in and removed at will. [Fig 6.3] The speculative office thus almost by definition provides generic space, in contrast to the highly specific and determined space that one finds in most housing. It is what Rem Koolhaas denotes the 'typical plan... zero degree architecture, architecture stripped of all traces of uniqueness or specificity.'[4] Importantly Koolhaas identifies the way that the typical plan is at the same time enabling and (thus) ennobling.[5] It effectively encourages adaptation and in this is empowering.

If one follows arguments of Bernard Leupen then it is precisely the permanence of the frame that allows the freedom of the generic space to be altered, extended or used in a variety of ways; citing Hegel, Leupen notes that freedom is the recognition of necessity.[6] A frame essentially separates a building into a loadbearing structure and non-loadbearing inserts that have the potential for change. This distinction is set by the nineteenth century French architect and theorist, Eugène Viollet-le-Duc who in his principles of structural rationalism 'defined the constructional framework as a necessity', distinguishing between primary elements, the

6.2 Wohnen +, blauraum architekten, 2005. A project that exploits the flexible qualities of the speculative office block by converting a redundant 1970s office into housing. 159

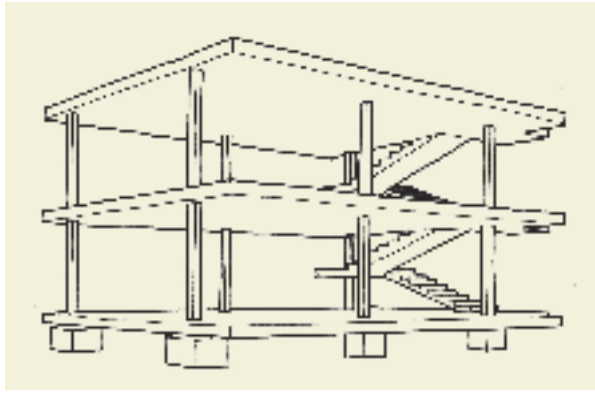


6.3 The space within the speculative office is indeterminate, allowing non-loadbearing partitions to be put in and removed at will.

6.4 25 Rue Franklin, Auguste Perret, 1903. The explicit separation of frame and infill at the dawn of modernism. 005

structure and mechanics of building, and the secondary elements, the walls, cladding and other infill.[7] One of the first explicit European examples of the use of the frame was in Auguste Perret's 1903 apartment block at 25 rue Franklin in Paris. 005 [Fig 6.4] The constructional frame is visible and highlighted by a different cladding material, thus showing the infill wall as a secondary and potentially interchangeable medium. In Cordula Seger's words the infill wall 'acts as a metaphor for the soft, interchangeable and perpetually changing medium in general'.[8] For our purposes, Perret's building is important not for its actual flexibility — those infills are indeed metaphors — but for the way that it so clearly establishes the modernist distinction of frame and infill that will later inform so much flexible housing construction.

For Colin Rowe the frame, or more specifically the frame invented in Chicago for skyscraper construction, is 'to modern architecture what the column was to classic architecture'.[9] The seminal image in defining the distinction of frame and infill is Le Corbusier's Maison Dom-ino. 006 [Fig 6.5] Colin Rowe sees Dom-ino as the canonical statement of modernist space;[10] for Peter Eisenman it signals the start of the self-referential sign that for him defines the Modernist condition.[11] But such formalist and semiotic analyses tend to overlook the simple fact that Maison Dom-ino was a maison, and thus first an investigation into mass-produced housing rather than into the language of modernism.[12] For the purposes of this chapter, what is telling is that the investigation starts with a means of making housing, and that from this investigation flow a series of principles that might inform flexible housing. First, Dom-ino determines distinct lifespans for different parts of the building; the plan consists of concrete slabs and columns (the collective structure that had to be capable of leading a long life) whilst the internal and external partition walls are seen as lasting for a much shorter period. Secondly the constructional system allows variability in plan. Concrete columns are placed at the very edges of the concrete floors in the longitudinal direction and moved back from the edges in the other direction. This enables openings to be positioned independently from the structural system and makes possible numerous variations for the arrangement of the interior possible,



6.5 Maison Dom-ino, Le Corbusier, 1914. The seminal statement of the house as supporting frame. 006

6.6 Molenvliet, Frans van der Werf, 1997. Van der Werf is one of the most important exponents of the principles of Open Building, here clearly exploiting the qualities of the base and infill principle on which Open Building is founded. 078

some of which are illustrated in the *Oeuvre Complete.* Thirdly, the infill, or in Le Corbusier's terms 'light filling', of walls and partitions are capable of being erected by unskilled labour.[13] There is a directness and simplicity in the constructional system that enables future adaptation.

The Support

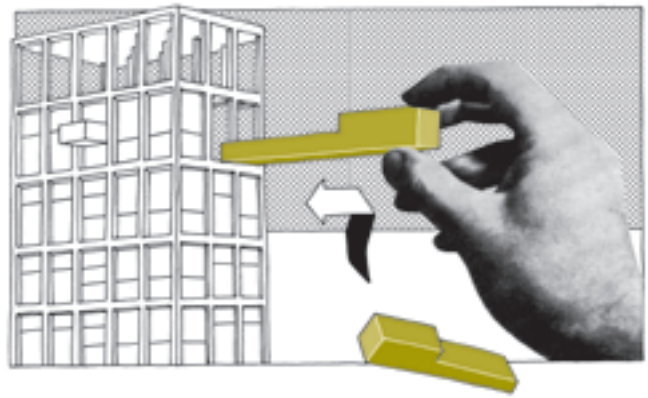
These three principles — of the differentiation of the constructional elements, of allowing variable plans and of simple constructional techniques — are central to the construction of flexible housing. It is maybe surprising, therefore, that one on the most trenchant advocates for housing that is adaptable by its users, John Habraken, should so insistently reject the Dom-ino as a model. 'Seen as a building, this support would not be a neutral skeleton like Dom-ino: it would be architecture.' He then struck through the iconic image of Dom-ino with a large cross.[14] It may be that Habraken was simply uncomfortable with the legacy of mass-housing that Dom-ino spawned, but nonetheless, as Leupen notes, there is a clear line of thought from Dom-ino to Habraken's concept of supports.[15]

In his book *Supports: an alternative to mass housing*, the term 'support' is used as much as a social metaphor as a physical reality. Habraken is insistent that his approach is 'one possibility among many,'[16] and so purposely does not circumscribe the concept by overdetermining its formal or constructional character. His definition of a support structure is simple, it is: 'a construction which allows the provision of dwellings which can be built, altered and taken down independently of others.'[17] The actual means of achieving this ambition is left open, but what arises out of the approach is the direct distinction between the support structure and what it supports in terms of infill. The terminology of these two elements is fluid but the principle is quite fixed. Whether Mies' insistent separation of supporting structure and infill at the Weißenhofsiedlung, the 'base building' of the Open Building movement, the 'carcass' of Habraken's 1960s research foundation SAR, Leupen's 'frame' or indeed the place we started, the dumb frame of the speculative office, there is a common constructional approach that distinguishes between what is permanent and what is changeable. [Fig 6.6] It is this approach, simple and obvious as it is, which is an integral principle for an

explicitly flexible system — otherwise good intentions might just get lost in constructional ambiguity over time. The basic principles are straightforward, namely that housing should be considered as a structure of supports and infills. The supports provide the basic infrastructure and are designed as a long-life permanent base. The infills are shorter life, user determined and adaptable. The support and infill approach also implies different levels of involvement on the parts of the user and professional, with professionals assuming more control over the support, users over the infill. Of all the projects in the book, one illustrates this approach with a glorious directness, taking the distinction between support and infill to its logical conclusion. In Erik

6.7 Kallebäck, Eric Friberger, 1960. 042

Friberger's Kallebäck housing scheme the floors are designed as shelves, stacked on top of each other, onto which individualised housing units are inserted in the most literal of ways, caravan-like sheds in bright colours and pitched roofs. 042 [Fig 6.7] The same principle of a basic support structure with the infill designed, and in this case built, by the users is seen in the Wohnregal scheme in Berlin. 095



6.8 Bottle rack principle derived from Le Corbusier.

Bottle Rack Principle

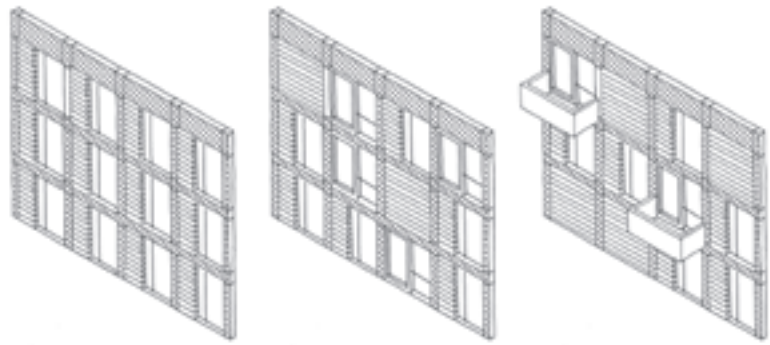
Another version of the support and infill approach is the bottle rack principle, first alluded to by Le Corbusier in the *Oeuvre Complete*. The rack is erected first, into which a complete dwelling unit can be inserted like a bottle. [Fig 6.8] The suggestion is that the dwelling units are prefabricated and interchangeable over time. The closest that one gets to the realisation of this approach is at the Marseille Unité, where the initial idea was that individual 'bottle-like' units would be assembled off-site and then hoisted in place within the concrete frame; 'the cells of the rack were left open to receive these conceptually packaged apartments.'[18] The system that was eventually built at Marseille did not use prefabrication, but consists of a concrete column and beam structure, which is divided into three-storey-high units divided by cast concrete slabs that act as fire breaks. Inserted into this concrete frame, the individual apartments are made up of a steel frame with a subsidiary timber frame for infill walls and floors. This approach allowed an immense variety of flat types and sizes in the initial design (23 in all, ranging from small 'bachelor-flats' to units for a 10-people family). In principle, the rack-like nature of the skeleton allows horizontal break-throughs, but in reality each apartment is completely separated from the

neighbouring one and the floor is not continued across the gap, making connections problematic. In the later Unité at Firminy this system was changed, enabling the creation of larger units as happened in the major renovation in the 1990s. 048 However, as Edward Ford notes the Unités' fundamental difficulty is the structural redundancy of the bottle and rack system. 'The rack must be large enough to support itself without the unit; the unit must be strong enough to support itself without the rack and to withstand transport. The result is often a structure that, when completed, is literally twice the necessary size, hardly an efficient building system.'[20]

Layers

The second principle that can be transferred from the speculative office to flexible housing is that of layers. In the speculative office one can generally distinguish between frame, cladding, partitions, services and finishes. Each layer is legible and with this, to a greater or lesser extent, separable. In constructional terms, layering is really just a more finely nuanced version of support / infill. The latter is a binary system of permanent / temporary. With layers, this binary is sub-divided in an acknowledgment of two aspects. First, elements of construction have widely differing lifespans and therefore their method of assembly should recognise this if the various elements are to be changed when they reach the end of their useful life. For example, in the standard UK developer house the services (with an anticipated lifespan of, say, 20 years) are buried in loadbearing floors and walls (with a much longer lifespan). To change the services one therefore has to hack around the permanent structure. In the speculative office, however, the two are kept separate through raised floors, vertical service risers and suspended ceilings, so that services can be easily and independently upgraded.

The second aspect of layers is the degree of control that the designer and user respectively have over them. This is a theme that Habraken returns to in a later book, *The Structure of the Ordinary*. His argument is that the typical architect or professional designer will want to exert control over all the layers of the building from the structure to the finishes. This exertion of what Habraken calls 'vertical control' has a number of profound effects from the political to the physical, including the restriction of flexibility, because everything is delivered together as a fixed certainty. He therefore argues for varied levels of control for user and designer. The designer is fully responsible for the permanent end of the scale (the structure) and leaves the other end of the scale (the finishes) completely to the user. The elements in between are open to control by either party on a sliding scale. Thus interior partitions, whilst often initially fixed by the designer should be able to be adapted (capable of social change) by the user over time. In the more radical projects in this book, the users have control not just of the internal partitions but also of the layout and aesthetics of the external skin. [Fig 6.9]

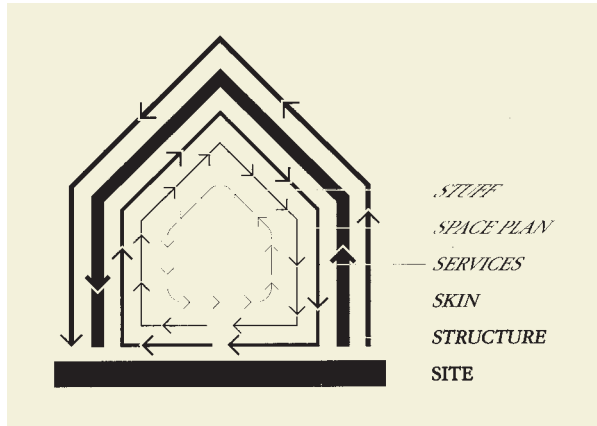


6.9 The ability to change the external skin is built into some flexible housing schemes.

As with the terminology of support / infill, there are many variations on the theme of layering. One might trace back the principles to the very origins of architecture as mythologised by Laugier. Here primitive man finds fallen branches in the forest. The strongest are shaped to form a four-square structure and this is then clad in a skin of leaves: a basic two-layer approach of structure and skin.[22] Over the course of time other potential layers are added — internal dividers, internal finishes and, finally in the nineteenth century, services. In the dominant history of construction, these layers are compounded into monolithic construction. It is with the dawn of modernism that layers re-enter the language of construction in a series of interpretations: Semper's fourfold of hearth, earthwork, roofwork and enclosure; Josef Hoffman and Otto Wagner's various takes on the skin of the building; Loos' separation of cladding from structure.[23] Of course these interpretations are not concerned with flexibility per se, but reflect the modernist tendency to first separate, and then order and categorise. It is consistent, therefore, that the language of architectural modernism should call for distinct layers as a constructional principle. Van Doesburg, for instance, writes in 1924 that: 'walls are no longer loadbearing; they have been reduced to points of support. As a result, a new open plan has been created... The new architecture is open. The whole consists of a single space, which is subdivided according to functional requirements. This subdivision is effected by means of separating planes (interior) or sheltering planes (exterior).'[24] Later the American Walter Bogner developed a house in the 1940s, whose design was broken into four divisions:

> 1. Groundwork; 2. Shell assembly; 3. Installations Unit; 4. Accessories and interchangeable parts. The Shell Assembly can be called the basic cell of an organic structure, from which development of the house takes place. In terms of building construction, this assembly consists of enclosing walls and a roof. Subdivisions measure eight feet horizontally and vertically. These units are subdivided into three parts, to make possible an interchange of doors and windows of different types.[25] 032

A more recent categorisation of layers comes from the British architect Francis Duffy who in a seminal thesis on commercial offices, identified the layers as shell (structure and skin), services, scenery (partitions) and set (furniture). Duffy's whole approach is founded on the principle of change and, together with his colleagues in the firm DEGW, he uses the principles found in the commercial office to develop a wider argument about architecture being flexible enough to cope with the dynamics of occupation.[26] Stewart Brand takes these four S's, and adds two of his own to create his memorable diagram of layers of change: Site, Structure, Skin, Services, Space Plan and Stuff.[27] [Fig 6.10] Leupen then drops the two extremes of these six (site and stuff) as not relating directly to building, and adds one back in

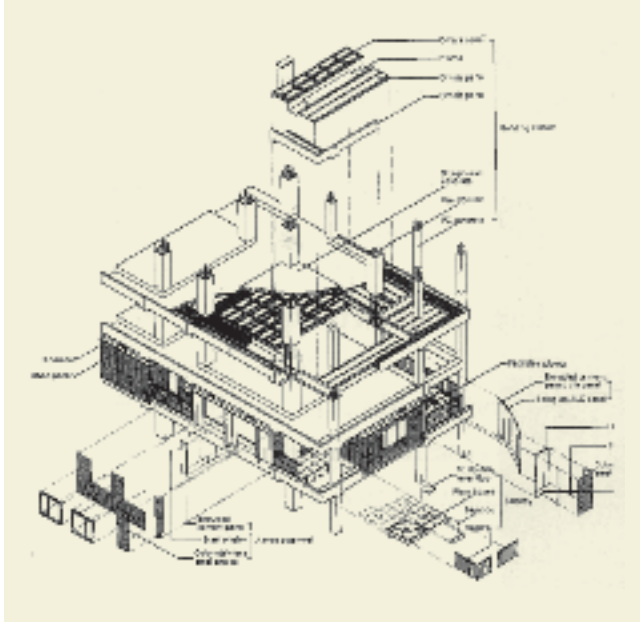


6.10 Stewart Brand's six layer diagram.

— access. The point is not which of these classification is 'correct' but rather that the basic principle of layers can lead to flexibility, both during the design process and after occupation. It is not a given that layered construction leads to flexibility; the layers have to be separable and, preferably, legible. One needs to be able to take one layer apart without disturbing the others, and to do this it is best to be able to see the articulation between the various layers.

However, the principle of layers brings with it the potential for technical determinism to take over in housing. As soon as each layer of the building becomes an entity in its own right it is available for detached technical scrutiny. In this way the making of housing, rather than being seen as synthesis of the social and physical, is conducted as an exercise in technical determinism; each layer is treated as a separate process that can be streamlined and industrialised. Specialised knowledge is employed on each layer in order to develop specialised systems. [Fig 6.11] The trajectory of Habraken's research foundation, SAR, is telling in this respect. In his own work Habraken is insistent on the connection between the methods of making and the act of dwelling. What is striking in reading *Supports* is the power and vision of the polemic concerning housing as dwelling. It is clear that far from being a technical manual, *Supports* is first a book about 'the interdependence of the dweller and dwelling'. [28] Construction is not seen as an end in itself, but as a means to an empowering end. In this way *Supports* can be read as ethics of construction.

This has been largely diluted by the subsequent focus on developing the technical aspects of the system. *Supports* introduces the notion of industrialised production



6.11 Next 21, Osaka Gas, 1993. Axonometric of the layered system. The drawing shows both the strengths and weaknesses of the scheme. It has a formidable clarity of intent, but at the same a specialised and all controlling system. 111

for housing [29] but with SAR this becomes the primary aim of the research. [30] As Bernard Leupen notes, 'it is striking that in SAR's statement of intent the word "support" has been replaced by "standardised support structures", thereby shifting attention from the support concept to standardisation and industrialisation.' [31] SAR, and the Open Building movement that grew out of it, took on issues of modularity, industrialised systems and prefabrication and in this moved from an attention to housing as a social condition to a more technically determined approach. Whilst this may have been due to the context of research funding at the time, which was dominated by scientific models and the need for the development of new products, the legacy of industrialised systems of construction remains in the Open Building movement. Open Building flips

between generous and expansive intents about the need of buildings to reflect the inherent dynamics of inhabitation, and a far more limited discourse about the specialised means of achieving that end. In the seminal Open Building projects, one gets a feeling of the open intent being overdetermined by the technical systems; the emphasis moving to the technical and constructional aspects and away from the more socially grounded implications of flexible housing. Thus it is not surprising that the initial interest in Open Building in the early 1970s waned because of the dearth of available technical solutions such as suitable infill systems.[32] The main outlet for Open Building has been in Japan where the Ministry of Construction has funded a number of experimental projects, most of which are driven by a technically determined agenda to do with promoting efficiency in the building industry.[33] 111 138

This determinist aspect of hard technology is not, of course, limited to the field of flexible housing, but can be traced in the course of modernist attitudes to technology. Architects are notoriously susceptible to the siren calls of technology; it tempts them into believing that its employment will bring with it all the aspects of progress and dynamism that a 'modern' profession aspires to. The aesthetic foregrounding of hard technology allows these delusions to be perpetuated. But, as Reyner Banham notes, 'the architect who proposes to run with technology knows now that he will be in fast company, and that, in order to keep up, he may have to emulate the Futurists and discard his whole cultural load.'[34] It is this combination of speed and forgetting (of other issues) that is so dangerous about the allure of technology. The Faustian pact with modernity can come at the price of not just cultural traditions, but also of a more general severing of architecture from social issues.

Simplicity and Legibility

This suggests that in flexible housing, as in other architecture, one should move from the determinism of hard technology to the enabling background of soft technology. Soft technology is the stuff that allows flexible housing to unfold in a manner not completely controlled by the foreground of construction techniques. In flexible housing this approach can be seen in a number of schemes, many of which exploit the layering principles of Open Building, but in a more relaxed and less determinist manner. Thus in the Genter Strasse scheme (in Munich) designed by Otto Steidle with Doris + Ralph Thut, a prefabricated frame can be filled according to users' needs and wants.[35] 067 Over the last 30 years the interiors and uses have changed considerably. This scheme, and others like it, exploit soft technology in the form of a structural and infill system that allows changes to be made at a future date. This system may be in the form of an expressed frame, as in the Genter Strasse scheme, or else simply a grid structure that does away with the need for loadbearing internal partitions, as in the Brandhöfchen scheme, Frankfurt. 115

What one learns from such schemes is that the employment of a layered approach to construction is by no means dependent on the employment of 'progressive' or specialised technological systems. Indeed, this is the third lesson to be learnt from the speculative office, namely that it generally uses relatively simple constructional systems, normally taken off-the-shelf. It is a form of catalogue architecture, in which each layer is selected from a range of standard, and not necessarily industrialised, solutions. In housing these solutions are still more basic than in the office sector, and to create a layered approach is not a matter of gaining specialised knowledge but of applying new thinking.

6.12 Honor Oak Park, Walter Segal and Jon Broome, 1987. Combining the virtues of modularity and simplicity. 097

It is in these two divergent approaches to layering, one specialised the other straightforward, that one can clearly see the difference between hard and soft technology. Hard technology typically refers to building projects where technology is the primary means of achieving flexibility and where the design strategies and tactics outlined in Chapter 5 take a back seat. Hard technology both foregrounds itself as an aesthetic and tends to act in a determinist manner to the extent that the primacy of the technological approach shapes the patterns of living within. Soft technology, on the other hand, works in the background and aesthetically is often suppressed. Soft technology is concerned with buildings that use clear constructional principles, including layers, that first of all have the user in mind. Soft technology therefore puts the occupant, the user of a building in charge, whereas hard technology dictates certain forms of organisation and change. [36]

The point with soft technology is not that the users should necessarily do the work themselves as a form of glorified DIY, but that the constructional system should be simple and legible enough for the non-expert to understand how changes might be effected. Although one of the most brilliant examples of a soft, layered, approach to construction is indeed a self-build scheme, it establishes wider principles. Walter Segal's Lewisham project is conceived around readily available materials (i.e. the module size is that of a standard ply or plasterboard sheet) put together in a direct manner that leaves clues as to how to take it apart again. 097 [Fig 6.12] Although the scheme was originally self-built by its original occupants, the constructional system has allowed all manner of people (from builders to lay people) to make copious later changes.

There is therefore a clear relationship between construction techniques and flexibility. The specialist and multi-headed approach to housing construction, particularly in the UK, limits future flexibility in so much as one needs specialised and multiple skills to make any adaptations. Just to update, say, wiring one needs to get, in addition to the electrician, a carpenter to lift floors, a plasterer to patch the ceiling and a decorator to make good. Against this many of the most successful flexible housing schemes rely on simple and robust construction techniques, which allow future intervention, or at least place the specialist elements such as services in easily accessible and separate zones so that only one set of specialists is needed to make changes.

Modularity

Walter Segal's approach is essentially modular, but his modules are simple and readily available. In this Segal may be seen as a modest reinterpretation of the traditional Japanese house, which is based on principles of simple and regular modules of construction and layout. 001 The Japanese house has long held a fascination for western modernist architects. For instance in his introduction to Heinrich Engel's influential *The Japanese House* of 1964 Walter Gropius notes: 'Our modern architectural requirements of simplicity, of outdoor-indoor relation, of flexibility, of modular co-ordination and prefabrication, and most importantly, of variety of expression, have found such fascinating answers in the classic domestic architecture of Japan that no architect should neglect its stimulating study.'[37] However, Colin Davies argues convincingly that this fascination is often misplaced: 'to see the order of the Kiwari simply as a proto-industrial process is arguably a completely false interpretation.'[38] The problem lies in the transfer of principles founded on a pre-industrial vernacular tradition to an industrialised system with specialised inputs or, to put it more directly, from the non-expert to the expert. With the exception of Segal's modesty, most contemporary modular approaches to flexible housing have been based on the development of specialised and in some cases one-off systems. As we saw in Chapter 2, there is a long history of flexible housing associated with modular and/or prefabricated technologies. The argument is a direct one of potential change being quite literally expressed in a technological system of exchangeable parts. In some instances complete constructional systems have been developed, from Walter Gropius' Haus Auerbach to Flexibo. 008 074 One of the more ambitious recent attempts at mass-produced building system designed

6.13 Industrialised Construction System, Renzo Piano Building Workshop, 1978-82. 082

to allow flexible arrangements is the Industrialized Construction System designed by Renzo Piano's Building Workshop between 1978 and 1982. 082 [Fig 6.13] The prototype itself consisted of two U-shaped structural elements 6 metres wide and 3 metres high, which were assembled to form the basic prefabricated construction module of 6 metres width and 6 metres height. Within this a simple metal stud system is used to partition the internal spaces and to make the external walls. The initial volume is 6 metres high to start with, but an extra level can be created by mounting a lightweight beam onto tracks that are built into the construction module. Whilst extremely fixed in its width and height, the actual division is completely up to the end user and can easily be changed once a new occupant moves in.

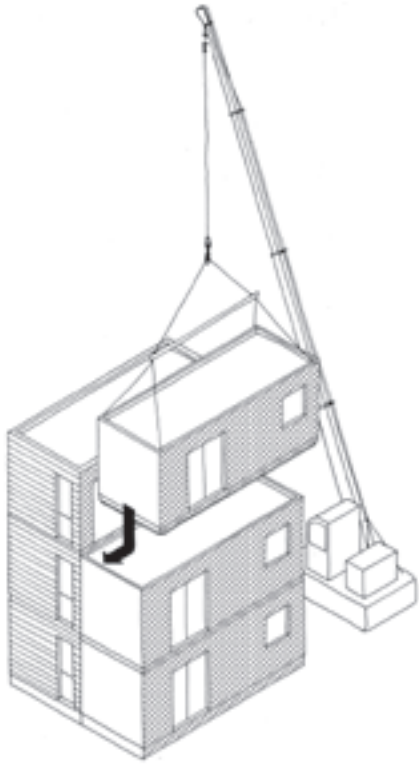
As with many such modularised systems, Piano's project got little further than prototype stage. Whilst the principles of modularity and exchangeability are of course consistent with flexibility in housing, they are not alone sufficient. First any technological solution must be considered together with the issues

6.14 Metastadt, 1974. The most idealistic of the modularised housing schemes. 069

of social occupation, otherwise one falls into the trap of technological determinism that has shadowed the history of modern architecture. Second, the tendency of architects to privilege the special over the everyday often results in solutions that rely on one-off technologies. Architects in cooperation with developers or product manufacturers have invented ever-new wall systems without fully considering their long-term sustainability. After a while, systems are discontinued which meant that replacement parts can no longer be purchased or have to be manufactured by specialist contractors; or else wall panels of a moveable partition wall may be technically so challenging that they needed a specialist contractor to move them. Effectively what starts with all the good intentions of flexibility becomes a very fixed expression of redundant technologies. In the most extreme examples, demolition is the only option; the fate of the pioneering Metastadt scheme is sobering in this respect. 069 [Fig 6.14] Devised as a modularised system with almost complete exchangeability in the parts, this housing scheme of over 120 units was demolished less that ten years after its completion. This is not to argue against modularity per se but to caution against its more extreme manifestations. At its best, in for example Avi Friedman's Next House, 120 modularity embeds the principle of exchangeability and so represents an acknowledgement of life-cycles as a direct expression of an integration of the dynamic process of living into the building process: some things simply last longer than others and therefore have to be modified, remodelled, retrofitted or completely exchanged.

Prefabrication

A modular approach is not necessarily a prefabricated one, but the two are often confused. Modularity refers to buildings that are assembled from a set of separate and repeated components. These may or may not be prefabricated off site. Prefabrication refers to buildings that are to a greater or lesser extent manufactured and assembled off site. Prefabrication has been promoted



6.15 Modules are factory-made and lifted into place on site.

as the solution to many problems: missing skills in the construction industry, safer building sites, cheaper and quicker build periods, consistent high quality, stringent production control and the minimisation of the effect of weather on the building process. None of these attributes necessarily infer flexibility, but prefabrication is often associated with choice for the consumer and more flexible methods of construction. In reality, many of the recently produced prefabricated building systems are the exact opposite of flexible or adaptable. This is for two reasons. First the panelised approach now used in most prefabricated systems tends to bind the layers of construction together, permanently joining outer layer, structure, insulation, inner layer and (sometimes) services. This is particularly the case with recent advances in structurally insulated panels (SIPs) where all the layers of construction are quite literally bonded together. The second reason is the bespoke nature of some prefabricated construction, particularly in the USA and Japan, in which the endless choice provided at design stage means that very particular spatial and aesthetic arrangements are locked in place from the start.

When prefabrication is taken to its logical conclusion, one ends up with volumetric construction in which not just parts of a building are prefabricated but whole modules are factory-made and lifted into place on site. [Fig 6.15] It is such approaches that are being encouraged in the UK under the Modern Methods of Construction initiative. Whilst these construction methods might present an innovative and high quality approach to some of the short-term issues facing house building, their long-term adaptability is questionable. For these units to include any adaptability in use or technology, flexibility has to be planned in at the time of design and built into the primary unit structure. But even then flexibility will be limited by the width of the prefabricated module, which in turn is determined by transport limitations (generally between 3.2 and 3.8 metres). Because it is difficult to break through the module walls except at the pre-formed openings, this dimension fixes the layout of the housing to the limits of the modular width.

Again, this is not to discount the use of prefabrication in flexible housing, but to warn against potential pitfalls. Some of the best examples of prefabricated methods showing the potential for flexibility are those which incorporate principles of simplicity and disassembly. For instance in an extraordinarily productive period from 1944 onwards, the office of Jean Prouvé produced a series of prototypes for prefabricated houses, many based on systems that Prouvé had used in the design of temporary huts for Second World War soldiers. All of these houses were designed according to his dictum of using the smallest possible number of parts; in the case of the most

resolved versions such as those at Meudon, the houses use interchangeable exterior wall panels produced in four different variations — solid, glass, with door, with window — which theoretically can be moved around according to the will of the user. Internal flexibility, also using the one metre module, was further enhanced by including connection points for the panels so that they could be relocated with ease. 033 Notwithstanding the inventiveness of these houses, they remained one-off experiments which never fulfilled the ambition of mass fabrication; only a handful of buildings were shipped to Africa and only a few were built in Meudon. [39]

In the end the most productive approach to prefabrication for flexible housing is probably not one that invents new systems from scratch, but one that assembles existing prefabricated elements in an adaptable manner. Indeed this may be the overall lesson of this chapter. There is a tendency among architects to always want to reinvent things. In terms of construction this means the adoption of fresh technologies, the development of specialised building systems and control of all aspects of the construction process. It is perhaps inevitable that, in a profession preoccupied with identity, the special and the one-off should be privileged over the background and generic. However, a study of the principles of construction (as opposed to the elements and objects of construction) suggests that it is exactly these background and generic approaches that have been behind the most successful flexible housing schemes. In the end, as the next chapter will show, the construction of flexible housing is much more to do with the exercise of common sense than it is the application of expert knowledge.

Chapter 6 Notes

1 As Mies says: 'Architecture begins when two bricks are carefully put together.' Mies van de Rohe, 'Architecture and Technology', *Arts and Architecture*, 67, no.10, 1950, p.30. As Beatriz Colomina pithily notes, this is 'just about the dumbest definition of architecture that I have heard.' Beatrix Colomina, 'Mies Not', in *The Presence of Mies*, ed. by Mertins, D., Princeton: Princeton Architectural Press, 1994, p.201.

2 This point is made by Sennewald: Bea Sennewald, 'Flexibility by design', *Architecture (AIA)*, 76, no.4, 1987.

3 A useful study by David Gann and James Barlow explores the potential for the conversion of redundant office blocks into apartments, outlining the various technical issues that need to be addressed. David Gann and James Barlow, 'Flexibility in building use: the technical feasibility of converting redundant offices into flats', *Construction Management & Economics*, 14, no.1, 1996, pp.55-66.

4 Rem Koolhaas and Bruce Mau, *S,M,L,XL*, Rotterdam: 010 Publishers, 1995, p.335.

5 Ibid., p.341.

6 Bernard Leupen, *Frame and Generic Space: a study into the changeable dwelling proceeding from the permanent*, Rotterdam: 010 Publishers, 2006, p.225.

7 Andrea Deplazes, ed., *Constructing Architecture: Materials, Processes, Structures*. trans. Soffker, G. and P. Thrift, Basel: Birkhäuser, 2005, p.171. Viollet writes in his Lectures, vol.1. 'It is impossible to separate the form of the architecture of the thirteenth century from its structure; every member of this architecture is the result of a necessity of that structure.' See Adrian Forty, *Words and Buildings: a vocabulary of modern architecture*, London: Thames & Hudson, 2000, p.277.

Chapter 6 Notes

8 Deplazes, ed., *Constructing Architecture*, p.171.

9 Colin Rowe, 'Chicago Frame', in *The Mathematics of the Ideal Villa and Other Essays*, Cambridge, Mass: MIT Press, 1976, p.90.

10 Ibid., p.107.

11 Peter Eisenman, 'Aspects of Modernism: The Maison Dom-ino and the Self-Referential Sign', *Oppositions*, no.15-16, 1979.

12 This is made clear in Le Corbusier, *Towards A New Architecture*, London: The Architectural Press, 1946, p.210ff.

13 Ibid., p.212.

14 As quoted in Leupen, *Frame and Generic Space*, p.162.

15 Ibid.

16 N.J. Habraken, *Supports: an alternative to mass housing*, London: Architectural Press, 1972, p.vii.

17 Ibid., p.59.

18 Deborah Gans, *The Le Corbusier Guide*, Princeton, New Jersey: Princeton Architectural Press, 1987, p.117.

19 Leupen notes that the complexities of the double partition system and the servicing arrangements suggests that Le Corbusier 'never intended these dwellings to change.' Leupen, *Frame and Generic Space*, p.158.

20 Edward Ford, *The Details of Modern Architecture: Volume 2*, Boston: MIT Press, 1996, p.187.

21 N.J. Habraken, *The Structure of the Ordinary*, Cambridge, Mass: MIT Press, 1998. pp.23-24 for introduction to layers, p.74 for idea of vertical control.

22 M-A Laugier, *An Essay on Architecture*. trans. Herrmann, W. and A. Hermann, Los Angeles: Hennessey & Ingalis, 1997.

23 David Leatherbarrow and Mohsen Mostafavi, *Surface Architecture*, Cambridge, Mass: MIT Press, 2002. Chapter 4 has a detailed interpretation of the separation of structure and surface in the course of the twentieth century.

24 As quoted in Robert Oxman, Gilbert Herbert, and Avraham Wachman, 'Hierarchical Organization as a Strategy of Flexibility in Architectural Systems', *Architectural Science Review*, 27, no.3, 1984, p.60. This article deals with the role of the hierarchical organisation of sub-systems as a general means of providing flexibility and adaptability.

25 Walter Bogner, 'The new house 194X: 4. Prefabrication', *Architectural Forum*, no.77, 1942, p.78.

26 Francis Duffy, *Design for change: the architecture of DEGW*, Basel: Birkhäuser, 1998, pp.40-41.

27 Stewart Brand, *How Buildings Learn: what happens after they're built*, New York: Viking, 1994, p.13.

28 Habraken, *Supports: an alternative to mass housing*, p.13.

29 Ibid., p.63ff.

30 The stated aims are: 'a: to explore ways pf achieving the broadest application of industrial manufacturing methods to the overall housing programme; b: to assess how architects could contribute towards integrating industrial manufacturing methods into the housing process.' As quoted in Leupen, *Frame and Generic Space*, p.162.

31 Ibid., p.163. For the history of SAR, see Koos Bosma, Dorine van Hoogstraten, and Martijn Vos, eds., *Housing for the Millions: John Habraken and the SAR (1960-2000)*, Rotterdam: NAI, 2000.

32 Andrew Rabeneck, David Sheppard, and Peter Town, 'Housing flexibility?' *Architectural Design*, 43, no.11, 1973.

33 Seiji Sawada and John Habraken, 'Experimental apartment building, Osaka, Japan', *Domus*, no.819, 1999; Stephen Kendall and Jonathan Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000, pp.24-25.

34 Reyner Banham, *Theory and Design in the First Machine Age*, London: Architectural Press, 1960, pp.329-30.

35 'Anpaßbarer Wohnungsbau', *Baumeister*, 74, no.12, 1977.

36 Our website www.flexiblehousing.org classifies projects in terms of 'hard' or 'soft' form (technology). Whilst the classification is necessarily quite crude, it does give an indication of the two differing approaches.

37 As quoted in Colin Davies, *The Prefabricated Home*, London: Reaktion Books, 2005, p.196.

38 Ibid., p.198.

39 Peter Sulzer, *Jean Prouvé: Complete Works: Vol.3: 1944-1954*, Basel: Birkhauser, 2005.

7

A MANUAL FOR

FLEXIBLE HOUSING

Introduction

The final section of the book is a guide to how one might design for flexibility, summarising the arguments made in the previous two chapters. Because housing design is so contingent on other factors — cultural, social, technical, financial or contextual — we do not propose a single solution or approach. Analysis of previous flexible housing schemes suggests that a one-fit solution will not meet the very different needs and approaches of a wide variety of clients and designers. Indeed, it may be argued that some previous approaches to flexible housing design have fallen on the sword of their own dogmatism. Or to put it another way, some flexible housing design is inflexible in its attitude, which means it may work in one context but is difficult to transfer to another. This section therefore offers a range of strategies and tactics and leaves it to the designer to choose the ones that are most appropriate to his or her particular context. Not all the approaches are compatible, and some will be inappropriate for a particular project (i.e. some of the principles are more relevant to multi-storey, apartment based, housing, whilst others are more suited to terraced housing). Whilst the guide attempts to be as directive as possible, it should be remembered that the key to flexible housing is one of attitude — of continually asking about the ability of that piece of design and construction to be adapted over time. For this reason, each section starts with a number of questions that prompt the designer and client to consider just how flexible their housing design is. If the answer to the majority of the questions is 'no', then it is likely that you are heading towards an inflexible solution. The sections then propose design and technical solutions, divided into two parts, *Plan* and *Construction* based on the previous sections, *The Design of Flexible Housing* and *The Making of Flexible Housing*. Most paragraphs refer to case studies or projects of flexible housing that demonstrate the principle discussed. Case studies are denoted thus 109 and can be found in Chapter 4, and projects are denoted thus 160 and can be found in Chapter 8.

Plan refers to particular ways that housing may be physically planned in order to promote flexibility so that it can adapt to changing social use.

Construction refers to the way that housing might be structured, constructed and serviced to enable future change.

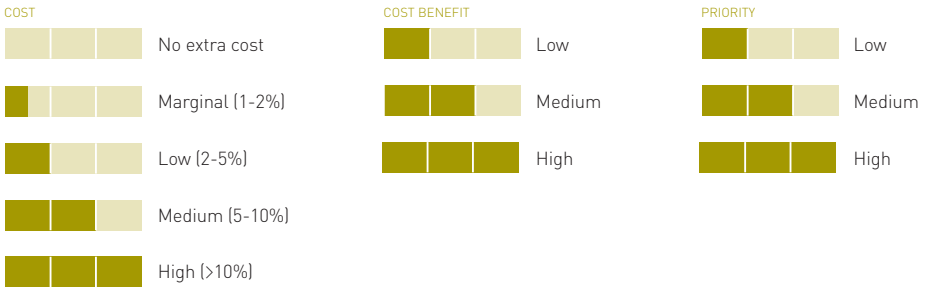
Each of the recommendations is summarised below in terms of cost and whether it is more appropriate pre- or post-occupation.

PRE-OCCUPATION AND POST-OCCUPATION

Flexibility in housing can work either prior to occupation by the residents, or post-occupation, or both. In the former, flexible housing design allows future residents to have some say over the layout and / or look of their home. Thus the use of non-loadbearing internal partitions might give a variety of possible layouts from which future tenants could choose, or else the use of modern methods of construction can allow residents to choose the way that their house looks. Post-occupation flexibility refers to the way that the design and construction of the housing allows residents and housing managers to make adaptations over time. Generally a technique to achieve pre-occupation flexibility will also enable post-occupation flexibility, and vice-versa, but the guide indicates when each of the recommended design or constructional techniques has the most effect.
As discussed in the section on financial issues [p.43], it is difficult to quantify exactly the cost of incorporation of flexible housing principles, particularly if one does not account for whole life costs. The manual gives a very rough indication of the cost of each of the recommendations, together with their potential financial benefit over time. Where the cost is identified as neutral or low, the implication is that the recommendation can be achieved for little or no cost; often it will be implementation of design intelligence rather than a direct cost. Where the cost is indicated a medium or high, the implication is that there is an upfront cost but that this should then be weighed up against the long-term cost benefits in terms of potential savings. The combination of the extent of initial cost and long-term cost benefit gives an indication of the priority of the recommendation. A high priority is one that all housing designers and managers should consider in new housing developments.

COSTING AND PRIORITY

KEY



Use

The core issue of flexible housing is that of use. How might we design housing that is flexible enough to accommodate users' desires and needs, both before and after occupation? The answer to the question lies in both how one designs the layout of the housing and in the way that one constructs it.

The question can be asked first at the level of the building as a whole, then at the level of the housing unit (apartment or house) and finally at the level of the individual room.

USE • BUILDING LEVEL

- Can the building accommodate multiple uses, i.e. residential, commercial, office, and retail?
- Can the building / unit / room be adapted by its users?

Most housing is designed solely to accommodate housing units. However, this does not mean that it may not be appropriate to consider whether the scheme may in the future be adapted for other uses. Whilst this might not appear to be a priority, accounting for potential multiple uses is a good way of embedding some of the generic principles of flexible design. Some of the most successful flexible building types are those that have been designed for other uses (i.e. warehouses, offices) and then converted to housing at a later date, so it is worth considering the reversal of this principle by incorporating some of their generic principles in the design of new housing.

USE • UNIT LEVEL

- Can the unit accommodate a variety of living patterns?
- Can the unit accept a variety of people?

These are probably the essential questions for flexible housing. They can be answered through consideration of both Plan and Construction. In the former, the deployment of circulation, the designation of rooms and the relation of rooms to one another become paramount. In the latter, open-span structures, layered construction and the location of services are important.

USE • ROOM LEVEL

- Can the room be used for more than one function?
- Can the room be furnished in a variety of ways?
- Can the room be moved around in more than one way?

These questions address the need for individual rooms to be used in a variety of manners, so that one is not tied down to a prescribed layout. The drive towards minimum standards often means that rooms are reduced to a single use and furniture layout. This specificity is further enforced by the use by some housing providers of very prescriptive room data sheets. However, through careful design and the redeployment of space some of these restrictions can be overcome.

Plan

This section deals with specific principles in terms of designing the plan. Again it starts with a series of questions, before moving down from the level of the building to the level of the room.

Ask the following questions of your proposed design. If the answers are generally 'no', then you are probably designing in an inflexible manner.

PLAN • BUILDING

- Can you add to the building horizontally and vertically?
- Can the building contain a different number of units?

PLAN • UNIT

- Can the units be joined together or divided up?
- Can the unit be used for anything other than purely residential?
- Can the unit be adapted by its users?
- Can the unit accommodate a variety of living patterns?
- Does the location of the services allow for different plan forms?
- Does the layout of the unit allow for addition in terms of extensions?

PLAN • ROOM

- Can the room be used for more than one function?
- Can the room be connected to others in more than one way?
- Can the room be furnished in a variety of ways?

Additions — Horizontal

COST | COST BENEFIT | PRIORITY

Post-occupation

028 | 030 | 065 | 131 | 140

Potential for additions should be tested at design stage, so that the initial plan form can anticipate future extensions rather than limit them. [Fig 7.1]

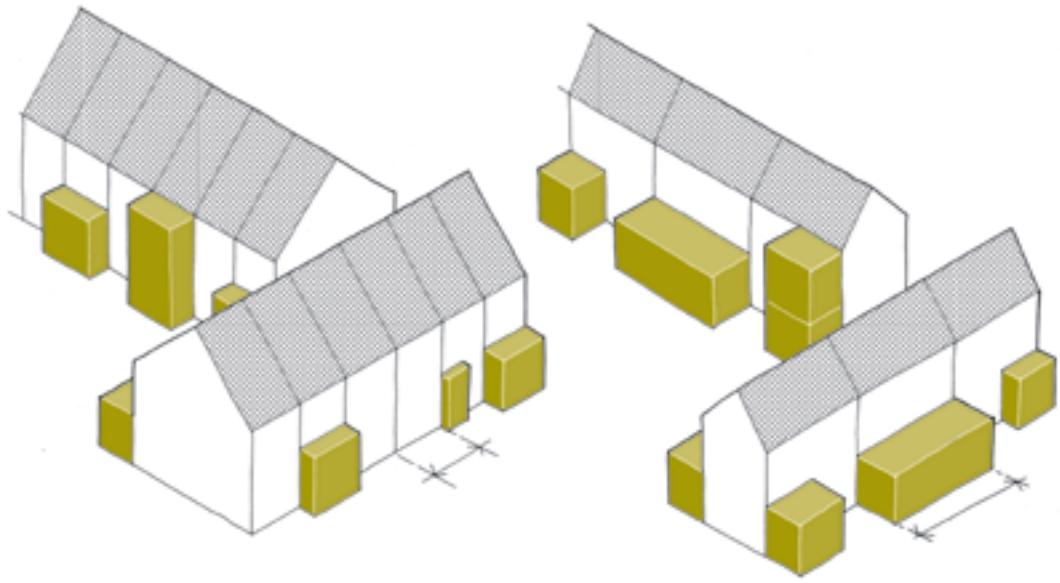
Because of the infinite variety of site layouts, it is not possible to be entirely prescriptive as to how to design buildings to allow additions to be made easily, but the following should be considered:

- Access: Ideally it should be possible to access a future addition through existing circulation space. If not then access will have to be through a room, which clearly limits the use of that room. The classic example of access from an existing circulation space is the Victorian terraced house where the staircase positioned against the rear wall has acted as a catalyst for myriad back extensions.

- Light: Does a potential addition lead to loss of light to existing windows? Generally the more complex the existing plan form, the more likely this is to be a problem — for example filling in the space in an L-shaped plan is probably going to block some light. Wide frontage housing is more accepting of addition than narrow frontage.

- Structure / Construction: Lintels and frame openings should be built in where future additions are anticipated.

- Services: Can future additions be serviced without huge disruption?



7.1 Horizontal Additions. Wide frontage houses give more potential to make additions front or rear than do narrow fronted houses.

Additions — Vertical

COST | COST BENEFIT | PRIORITY

Post-occupation

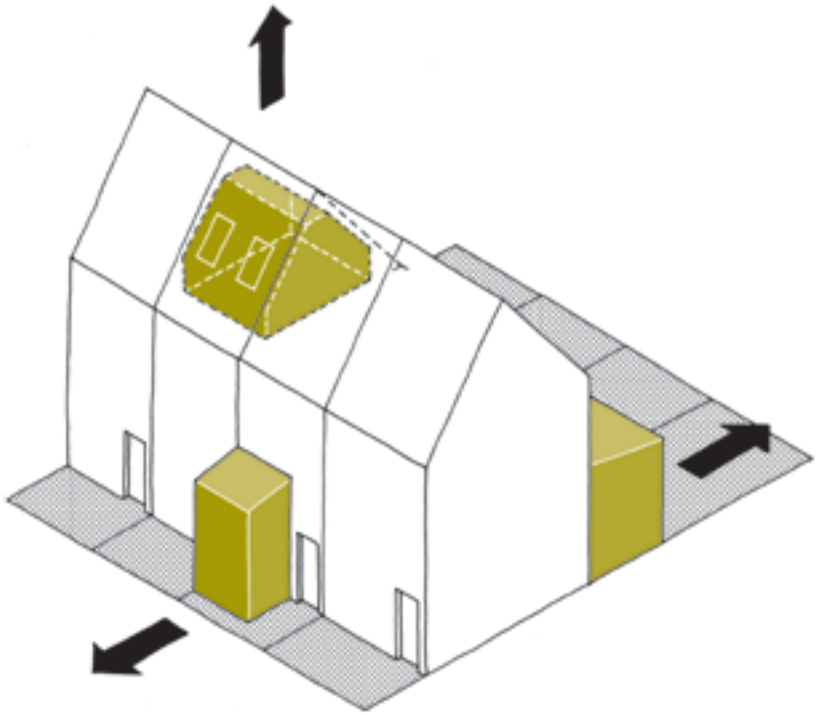
047 142

Vertical pillars expansion can be achieved either by moving up into the roofspace or else by adding space on top of existing structures. [Fig 7.2]

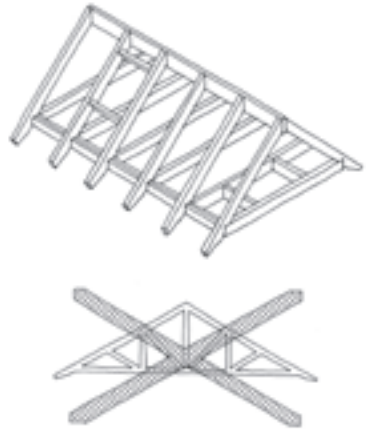
Planning for future vertical expansion effectively exploits the future potential of space that one has to build anyway. The following principles need to be followed:

- Trussed rafters that fill the majority of the roofspace should be avoided and ceiling joists sized for extra load (see below Construction) [Fig 7.3]
- The location and form of the staircase below should be considered so that it can be easily extended into the new accommodation.
- The roofspace needs to have sufficient headroom at both the ridge and the edges.
- Rooflights should either be provided in the first instance, or else framing for them provided so that they can be easily installed at a later date
- Means of escape and potential fire-lobbying on the staircase below need to be taken into account. These will be dependent on local legislation.

It is also possible to extend vertically over a flat roof, typically adding another storey to a single-storey extension, normally a garage, to provide additional space at the first floor. Again this has structural implications, as well as planning ones.



7.2 Vertical Additions. Additions can be made upwards into the roofspace or on top of existing flat roofs.



7.3 Rafters. Trussed rafters should be avoided where possible to allow the roofspace to be used at a later date.

Communal Circulation

COST | COST BENEFIT | PRIORITY

Post-occupation

109

Circulation areas might be used for other purposes.

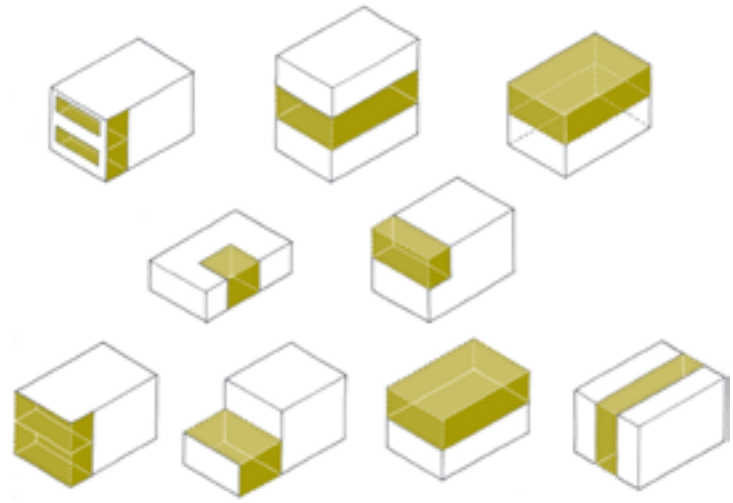
Vertical and horizontal circulation in most housing schemes is reduced to a minimum. However, a small increase in the size of communal circulation can make it much more flexible in use. Larger circulation spaces, internal and external, provide additional communal spaces for interaction and play, which take pressure off sometimes tightly fit units. For example, generous external circulation can provide spaces for eating or sitting, increasing the sociability of the scheme as a whole. [Fig 7.4] Internal circulation can provide access to shared and individual storage that would otherwise have to be included in the apartments. A slightly larger space in front of an entrance door can be occupied through planting or other territorial occupation, thereby extending the perceived area of the individual apartment.

7.4 Überbauung Hellmutstrasse, ADP, 1991. All apartments are accessed from an external staircase and balconies that are generous enough to share with others. Over time they have been populated with tables, chairs, and plants. They form communal meeting spaces. 109

Slack Space

Post-occupation

024 | 038 | 059 | 133 | 160



7.5 Slack Space.

Space that can be taken over by the residents.

Slack space is typically space outside the housing units that can be appropriated by the users over time, providing more flexibility in use. [Fig 7.5] It is not just any space, but areas which are suggestive of potential occupation: flat roofs that can be built upon, courtyards that can be occupied and even filled in, a communal stairwell that is big enough so that it can be occupied by its users, an alcove for enclosing storage. Initially slack space is left unfinished, but for it to work successfully the designer has to think of the various ways by which it might be appropriated and design it accordingly. [Fig 7.6]

7.6 Donnybrook Quarter Housing, Peter Barber Architects, 2006. Large courtyard spaces on the first floor are unprogrammed and act as an invitation to residents to appropriate them. 160

Functionally Neutral Rooms

COST COST BENEFIT PRIORITY

Pre-occupation and post-occupation

002 004 010 025 052 086 096 109 112 116

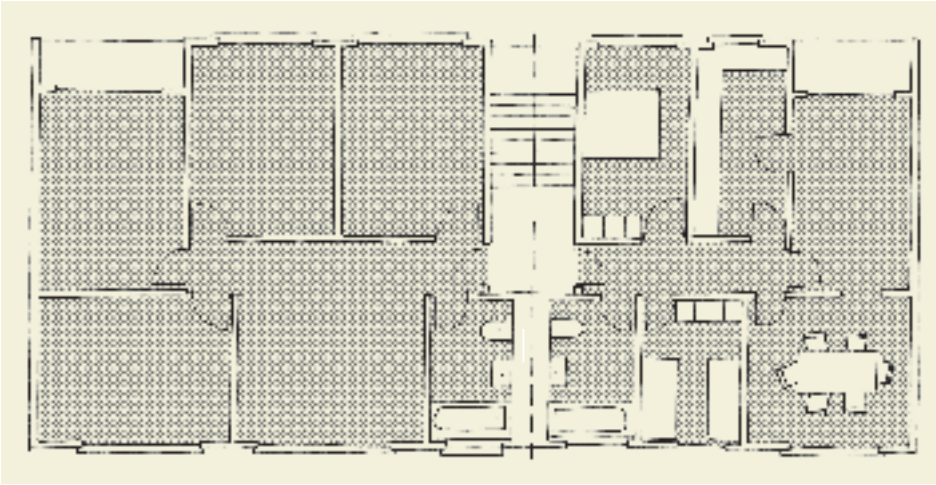
Rooms without labels, that do not have a specific use.

Because of the demands of the various design standards (in the social sector) or perceived client demand (in the private sector), it is usual in housing for rooms to be labelled and then designed to the specifics of that function; this type of tight fit functionalism leads to plan forms that dictate where and how activities should happen. An alternative approach, and one at the heart of many flexible housing projects, is to get rid of room labels. [Fig 7.7] Whilst this might fly in the face of some of the more restrictive design standards or user expectations, it is an approach that has a long and successful history.

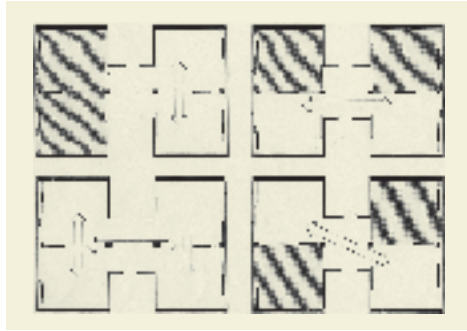
The strategy is to provide a number of equal sized rooms off a central hall or circulation spine. The kitchen may be included in one of these rooms, or defined as a separate smaller space. A unit that consists of a number of rooms of equal size invites different social interpretations that are open to diverse cultural scenarios. [Fig 7.8] By removing the hierarchical order contained in the labelling of rooms — i.e. dining room, living room, master bedroom, bedroom — each space becomes an independent entity which can be used according to the needs of the users, which inevitably change over time. It is an approach that allows successive occupants to take control of the spatial organisation of their lives.

In terms of design, this approach means that space is redeployed: the standard size of a living room is slightly reduced, whilst those of bedrooms and kitchens is increased. This means that the latter can take on other uses (i.e. work spaces, sitting in the bedroom). An added advantage of the functionally neutral approach is the same housing unit can be occupied by a variety of different user groups. A unit could, say, be used as two bedrooms and a living room for a small family, or else just as easily as a shared apartment for three adults.

As a guide, the minimum sizes of a functionally neutral room directly can be derived from various furniture layouts. Ideally it should be 3.6m wide by 4.0m deep, in order to accommodate a range of furniture layouts from bedrooms to living rooms, but this can be reduced to 3.2m wide by 3.8m.



7.7 Functionally neutral rooms. Indeterminate uses (left) versus tight-fit functionalism (right).



7.8 Grieshofgasse, Helmut Winner, 1996. A brilliant plan that allows rooms with no specific function to be combined in a number of different ways. 119

Circulation

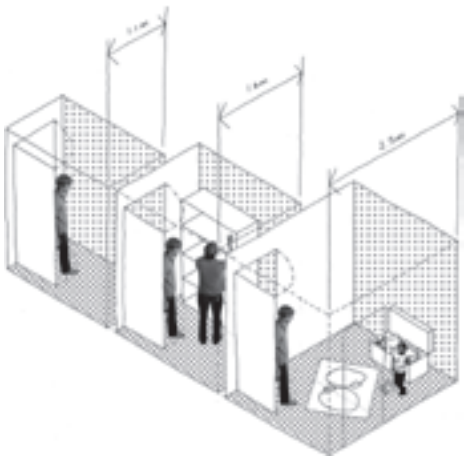
COST | COST BENEFIT | PRIORITY

Post-occupation

085 145 148

Using hallways for other uses.

In most housing, the circulation space and hallway is reduced to an absolute minimum in the name of efficiency, so that often one is left with corridors that can be used for nothing but moving around. In badly designed housing this can add up to a lot of space that is largely redundant in terms of social occupation. However, by marginally increasing the dimensions of the circulation space, it can accommodate other functions, increasing the ways that the overall unit might be used. A corridor with a width of up to 1.60m can provide space for a cupboard, the storage of a bike or a pram. Slightly wider still and the corridor effectively becomes an extra room with space for a desk for home working or for use as a children's play area. Whilst on plan these areas may look 'wasteful', in fact the overall area is only marginally increased but it provides a much greater variety of use in the unit as a whole. [Fig 7.9]



7.9 More than just circulation. A small increase in the width of the circulation space will allow other uses to take place.

Joining

COST | COST BENEFIT | PRIORITY

Pre-occupation and post-occupation

003 012 048 083 090 094 146

Combining two small units to form a larger one.

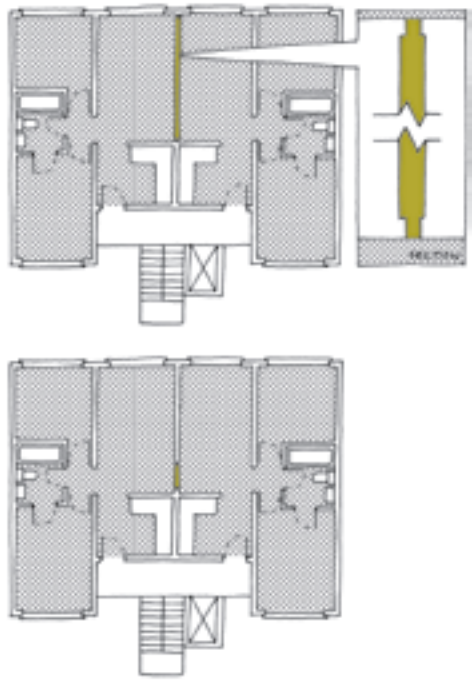
In both private and social sectors each housing unit is generally designed and considered in isolation from the next. This often precludes combining units at a later date, at least in a convenient or efficient manner. However, there are schemes that take into account the possibility of joining units together either horizontally or vertically. This allows, say, two one-bed apartments to be joined together to form a three-bedroom apartment, allowing a family to stay in place as it grows. The potential to form larger units also addresses the demands of extended families that arise in some ethnic and social contexts. The potential to join units together is a long-term strategy, but one which offers greatly increased flexibility, particularly in the social sector where the ability to change the size of units provides a variety of rental opportunities. [Fig 7.10]

There are no hard and fast rules as to how the potential to join units may be achieved, but the following points should be considered:

- If joining together horizontally, any future openings should be planned and where necessary lintels and framing provided for ease of opening up in the future. This is the case for both timber framed and masonry housing. Some housing projects have been designed around the principle of multiple 'soft panels' — sections in the dividing walls that can be easily knocked through at a later date: an increased number of potential connection points allows units to be joined in a variety of manners.

- When joining together horizontally, the key design issue is that of access. The provision of a more generous shared access space generally facilitates later joining and subdivision.

- When combining units, one has to deal with the potential duplication of bathrooms and kitchens. Generally the duplication of bathrooms is not a problem, even if one ends up with an excess of actual baths. However, duplication of kitchens is less sensible. Consideration should therefore be given to the use of the room if the kitchen is removed. If it is in a separate room, then is that big enough to be used as an additional bedroom. If it is part of the living area, then can that room be either divided when the kitchen is removed, or else does it work functionally without the kitchen in it?



7.10 Joining up. To anticipate the later joining-up of units is both a design and a technical issue. In technical terms the provision of 'soft' sections of walls that can be easily removed is good practice.

Dividing Up

COST COST BENEFIT PRIORITY

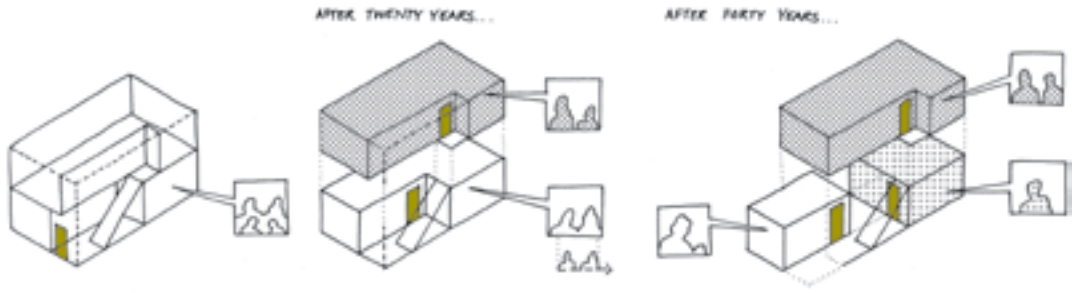
Pre-occupation and post-occupation

003 012 043 044 045 055 058 079 083 089 094 107 115 146 152 155 163

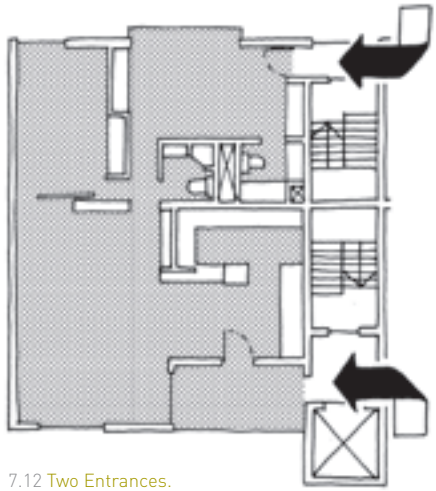
The potential to divide a larger unit.

The reverse of joining up units is the design of single large units so that they can be divided up at a later date. [Fig 7.11] In the private sector this allows the owner to stay in place once they have outgrown their house or apartment. This can be done in two ways:

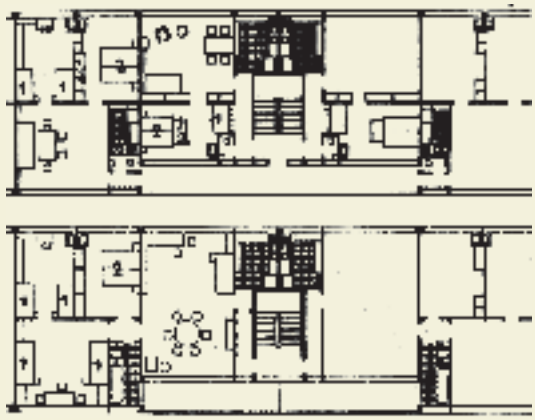
- A large unit designed to be split into two self-contained units. This usually demands that two entrances are designed-in at design stage. [Fig 7.12] [Fig 7.13]
- A large unit that can provide a small separate area for a granny flat, home-office, unit for a carer, or rooms for rent. In these cases completely separate access may not be necessary.



7.11 Joining and Dividing.



7.12 Two Entrances.



7.13 Verwandelbare Kleinwohnung, Karl Schneider, 1927. The plan shows four apartments that can be combined into two units. 012

PLAN • UNIT LEVEL

Shared Room

COST | COST BENEFIT | PRIORITY

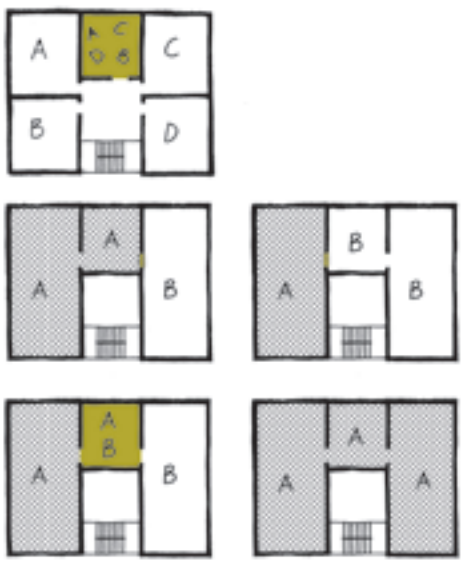
Pre-occupation and post-occupation

064 103 146

A room that can be switched from one unit to another.

The idea of the shared room comes from the German concept of Schaltzimmer (literally 'switch rooms'); this is a non-specific room that lies between two units and can be allocated to either one or the other. In a typical arrangement of say two basic one-bedroom apartments, the shared room gives the possibility for one of the apartments to gain an extra bed or work room, and then give it over to the other when it is no longer needed. Whilst this has obvious management implications, the shared room gives flexibility over time, potentially allowing tenants to stay in the same place and have an apartment of the size and rent that suits them. It also gives housing managers some flexibility in the allocation of the shared room when tenants move out. [Fig 7.14]

A more elaborated version of this type of room incorporates a bathroom and services to plug-in a kitchen. This room can then be used as a small but independent apartment / small office or can be rented by one of the adjacent units if additional space is required. In this instance, separate access is crucial.



7.14 Shared Room.

PLAN • UNIT LEVEL

Service Core

COST | COST BENEFIT | PRIORITY

Pre-occupation (mainly) and post-occupation

046 093 108 109 114 115 132 143 144 155

The position of the service core is critical in determining flexibility of a unit, since it often defines the most permanent elements in plan, the kitchen and bathroom.

Because the kitchen and the bathroom are the least likely rooms to be moved over the lifetime of the housing, it is best to consider them first in the design process, and to draw the unit plan empty of anything but the service core. One can then see how the space around it can be divided up and whether there are different ways of achieving this division. How much space is there to each side of the service core? What room layouts and combinations are possible? Can rooms with sensible sizes be created? Or, do they become too wide, too deep, too large or too small?

PLAN • UNIT LEVEL

Raw Space

Pre-occupation and post-occupation

066 091 113 129 130 136

The provision of unfinished space but more of it.

One of the most used approaches in flexible housing is to provide more space but this space is not completely finished. This is the principle of the loft or the speculative office, where the tenants take on an empty space with basic services and then fit it out themselves. The bigger spaces are easier to sub-divide and to re-arrange than small apartments. They also allow users to fashion their home in their own manner. Because more space also costs more to start with, the trade-off for the user is to accept that less money is spent on the fit-out. In return, however, users get larger apartments often with higher ceiling heights that can be used to create a mezzanine level in the future. This approach is, right from the start, flexible in that anything that is placed within the basic shell should be adaptable or movable. However, the placing of services and the entrance position needs to be carefully considered in order to give the widest possible range of potential layouts.

Clearly the transferring of this principle from the private to social sector has financial implications. In the directly rented sector, tenants would not get a return on any investment they made in fitting out or adapting their unit. The principle has been used in French social housing where the initial cost of fitting out was covered by reduced rent. In these cases, technical and design rules need to

Probably the greatest scope for flexibility lies in the design of the plan of the unit as whole, but further flexibility can be provided by consideration of flexibility at the level of the individual room. It should be recognised that some of these design devices bring cost implications that may not be beyond the limits of the housing provider.

Connections Between Rooms

COST COST BENEFIT PRIORITY

Pre-occupation and post-occupation

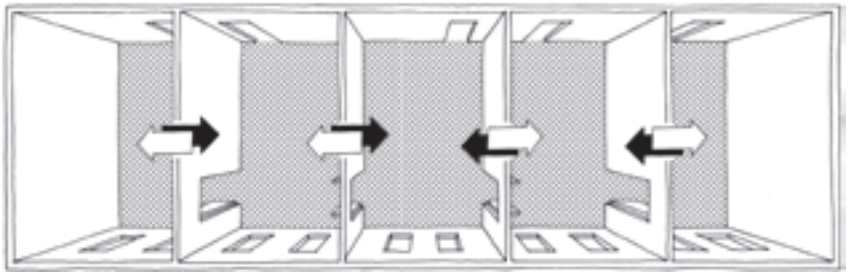
001 098 114 119 122 123 134

Do rooms always have to be separated?

This strategy refers back to the traditional system of 'Enfilade', whereby a series of adjacent rooms can be connected through sliding wall panels or doors. [Fig 7.15] The connection can be temporary (i.e. on a daily cycle) or else more permanent. It allows the user to connect rooms with one another, for example a kitchen and dining room with a living room, or a study with a bedroom. If two adjacent children's rooms have an intermittent door, this door could provide a connection amongst them when wanted or closed when more privacy is required. In all cases the extra connection allows the user to occupy the rooms in an increased variety of ways, particularly if a sliding wall is used that allows big openings to be formed.

In tight spatial conditions, the opening up of rooms to one another increases the perceptual size of a dwelling. This is particularly the case in one-bedroom apartments, where privacy between the living room and the bedroom is not necessary all of the time, and a sliding door between the two can open up the space.

However, an additional door per room can decrease the actual space for activities within it. The position of the door is therefore crucial. Moving the door away from the façade by, for example, 0.90m leaves enough space for a desk along the façade without disturbing too much of the remaining space.



7.15 Enfilade.

Foldable Furniture

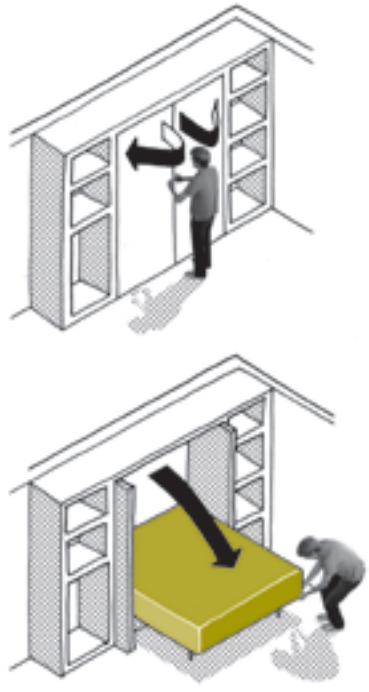
COST COST BENEFIT PRIORITY

Post-occupation

016 023 120 128

Where space is limited, built-in furniture allows the user to change the use of the room on a daily basis.

Typically this may be a foldaway bed, so that a room may be used in one way during the day and then converted into a bedroom at night. [Fig 7.16] However, for foldable furniture to be accepted, it is vital that it is properly designed into the fabric of the unit, so that it does not appear as an afterthought. This means including recesses for when the bed or other item is folded up, and designing the layout of the room so that it works when the furniture is both up and down.



7.16 Fold Down Bed.

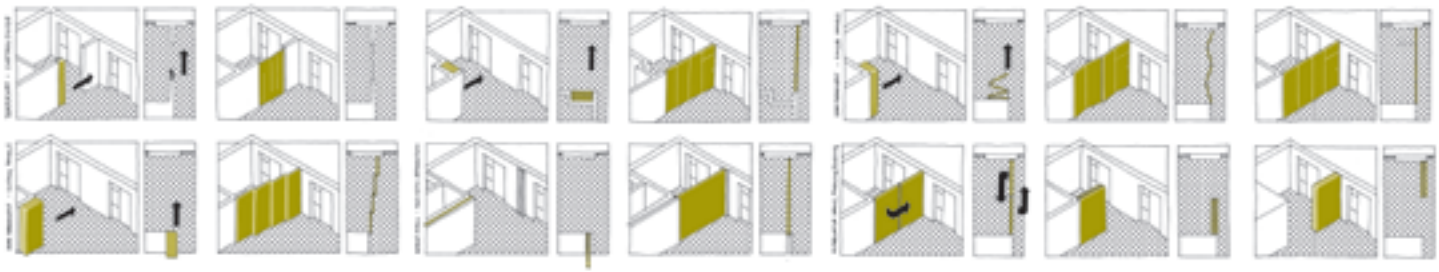
Movable and Sliding Walls

COST | COST BENEFIT | PRIORITY

Pre-occupation (mainly) and post-occupation

009 016 031 039 046 068 102 106 114 119 122 124 137 143 156

One of the most common features in architect-designed flexible housing in the twentieth century is the use of sliding and folding walls. These range from solutions in which all walls can be slid or folded away to provide a completely open plan space to solutions in which folding walls are used to divide a kitchen area from a living room. [Fig 7.17] In other designs more robust and acoustically isolating sliding walls are used to allow different layouts on semi-permanent basis. Even small sections of folding or sliding partitions can greatly increase the options as to the way that a room or a combination of rooms might be used. A good approach to the design of sliding walls is to ensure that the basic layout of the housing first works without the inclusion of sliding walls, and then to add them in. This ensures that the sliding walls add something to the spatial quality and usage of the dwelling.



7.17 Sliding walls. Sliding walls can take on a wide variety of forms from the simple curtain to the folding / sliding door.

The Divisible Room

COST | COST BENEFIT | PRIORITY

Pre-occupation and post-occupation

017 018 022 117

Can a room be divided up temporarily or permanently?

Over time it is sometimes useful to divide larger rooms into two. Thus a large double bedroom might be divided into two small rooms, or a bedroom may be temporarily divided to provide a space for working and a space for sleeping. The former could be achieved with a semi-permanent division, the latter with something as simple as a curtain to divide the two parts. In all cases the shape and access to the room(s) needs to be considered. Generally these rooms will have a proportion closer to 2:1 than 1:1. If the division is permanent, the original rooms will need two points of access. The latter principle has been used successfully in the London Flexhouse, where a room designated initially as a large bedroom is divided to form two small but acceptable single bedrooms for children. For rooms to be divisible, the number and location of windows is crucial. At a basic level, the more windows, the more potential for subdivision or relocation of partitions. A single wide window in a wide room prevents future division, whereas two narrower ones will make it possible. 117

Construction

011 013 032 035 050 051 056 060 066 073 147

If one way that flexibility can be achieved is through the design of the building, unit or room in plan, the other way is through the methods by which the housing is constructed. To achieve real flexibility both plan and construction have to be considered together. As with the design of the plan, the starting point for the construction of flexible housing is to design out inflexibility. Much of the standard construction in the UK house building industry is inherently inflexible: cavity walls, loadbearing internal partitions, roofs full of trussed rafters, buried services: all these and more hinder future changes. With the advent of modern methods of construction, there is a perfect opportunity to reconsider the way that our housing is put together, and with it to build-in flexibility at no greater cost.

Again, this section of the guide starts with some generic questions that you should ask of your housing design. If the answer to all or most of these is 'no', then it is likely that the housing you are designing is less flexible than it could be.

CONSTRUCTION • QUESTIONS

The overall question is:

- Does the construction enable change?

Subsequent questions are:

- Does the structure and construction allow different floor plans to be realised?
- Does the construction consider the different lifespans of the construction elements?
- Can the elements of construction be separated?
- Are the constructional and structural systems legible and accessible?
- Are the structural dimensions determined by patterns of occupation?
- Can the structure accept addition?

CONSTRUCTION • PRINCIPLES

When considering the construction of flexible housing at the building level, the following principles are useful:

- The Frame
- Layers
- Simplicity and Legibility

CONSTRUCTION • PRINCIPLES

The Frame

Pre-occupation and post-occupation

026 027 036 042 066 076 092 095 110 125 126 135 138 146 153 159

A support system to allow a variety of infill and layouts.

Construction for flexible housing accepts that the particular design solution at any one time may be changed in the future. Rather than working out from the specific, flexible construction starts with the generic, first by providing a background frame. Constructionally and conceptually, the frame should be separate from the infill of partitions, services and fittings, and preferably also the external wall (so that it can be changed at a later date as well). The frame does not overdetermine what goes into it, but provides a support structure, and a skeleton for services to be attached to. The frame is conceived as permanent, whilst the infill elements have different and shorter life spans, and can be adapted over time or parts replaced wholesale.

The frame can take a number of forms, from the basic column and beam construction in steel or concrete, through to a version of the American Balloon frame in timber. Generally the more open the frame, the more scope there is for the infill to be flexible and adapted over time. Thus the timber framing of a standard stud wall, with the structural members at close centres tends to restrict flexibility, whereas the balloon frame which is generally oversized and allows openings to be cut subsequently.

Although the word frame suggests a column and beam construction, the generic principle of the frame can be adapted across wall-based constructional systems, as long as one keeps a separation between the permanent structural elements and the flexible infill elements, and allows a generous free span between the walls. An example of this is 'tunnel' construction, which is commonly used in the Netherlands. Here the overall enclosure of the individual dwelling unit is cast as a permanent supporting structure with clear spans across the width of the unit. This means that joining units horizontally or vertically is generally restricted (unless soft infill panels are included) but there is great flexibility in the layout of internal partitions.

Layers

Pre-occupation and post-occupation

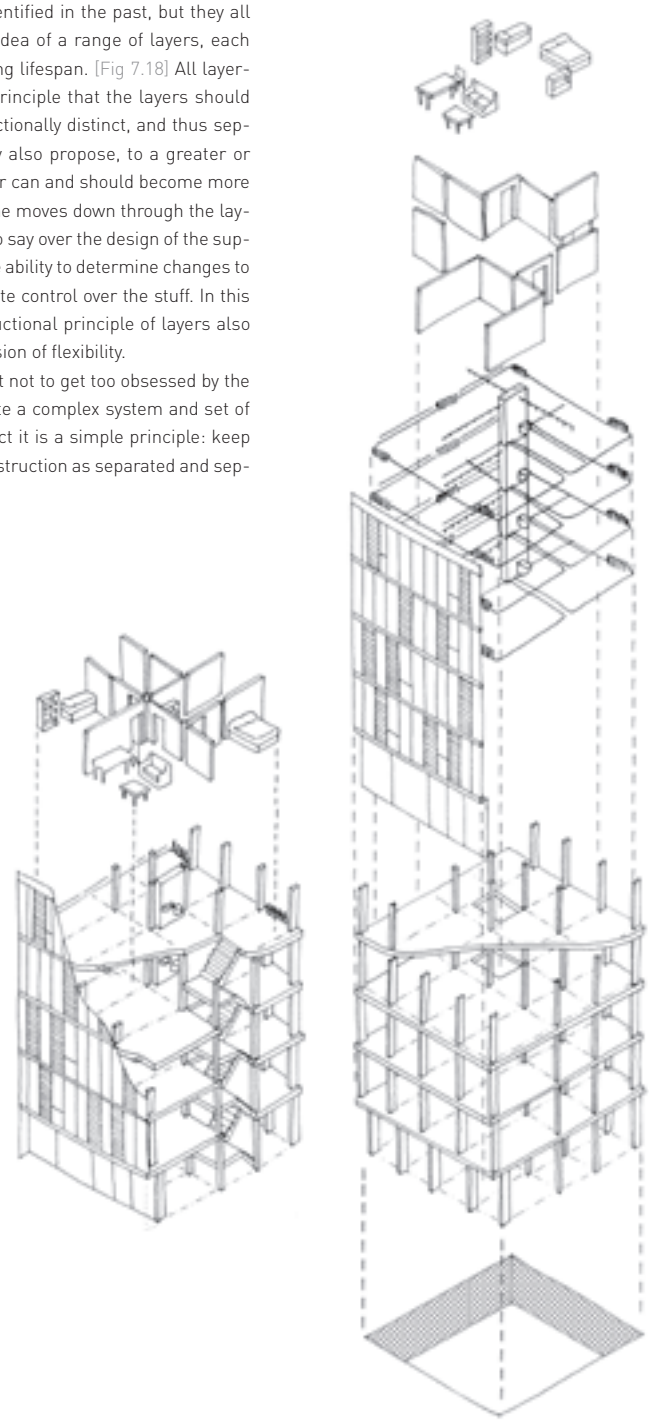
006 040 077 078 080 083 084 087 088 111 118 127 151 157

Separating out the elements of construction to acknowledge different life spans and degrees of adaptability.

Following on from the principle of the generic frame comes the idea of building in layers. Different building elements inevitably have different life spans, either because of their construction or use. Thus the structural frame will have a long life span, whilst kitchen units will typically have a relatively short one. It is therefore best to separate these elements out constructionally in order that one layer of the system can be adapted or exchanged without affecting the others. Normal construction tends to bind all the levels together, so that changing one layer means dealing with all the other layers. Anyone who has attempted to add an electrical socket or move a radiator in a cavity walled house knows the range of tradesmen needed to achieve these relatively simple tasks, and also the way that they need to be coordinated to work in a particular order that often necessitates multiple visits.

It is therefore best to follow the principle of layers in flexible housing. A number of different layering approaches have been identified in the past, but they all follow roughly the same idea of a range of layers, each with a gradually decreasing lifespan. [Fig 7.18] All layering systems rely on the principle that the layers should be considered as constructionally distinct, and thus separable in the future. They also propose, to a greater or lesser extent, that the user can and should become more involved in decisions as one moves down through the layers, from having little or no say over the design of the support structure, through the ability to determine changes to the space-plan, to complete control over the stuff. In this we can see that a constructional principle of layers also leads to a wider, social, vision of flexibility.

However, it is important not to get too obsessed by the idea of layers and to create a complex system and set of rules for them when in fact it is a simple principle: keep the various aspects of construction as separated and separable as you can.



7.18 Layers. There are multiple approaches to layers. On the left, the basic system of base support and infill. On the right the six S's developed by Stuart Brand: (from bottom to top) Site, Structure, Skin, Services, Space Plan, Stuff.

- The first layer, the site, is always there.
- The second layer, the structure, is the most durable part of the building, which will be there for on average more than 100 years. It contains the structure (columns, beams, loadbearing walls, trusses and structural floors) as well as the long-term provision for services (risers, cut-outs)
- The third layer, the skin, envelope is less permanent. Parts of the façade will have to be changed over time, with an expected lifespan of between 30 and 60 years. Flexibility is enabled if the external skin is designed to be adaptable, so that an old part can be taken out and be replaced by a new one.
- The fourth layer, the services, is about wiring and pipes. Essential parts will need to be maintained, changed and added to as new technologies emerge.
- The fifth layer, the space-plan, is about the internal partitions which need to be moved / adapted on a 5-30 year cycle.
- The final layer, which Brand calls the stuff, is about the interior fit-out and the finishes.

Simplicity & Legibility

Post-occupation

005 021 033 057 066 097 140 149 161

If housing is to be adapted in the future, it is important that the constructional system is legible and simple.

Simplicity and legibility in construction means that future changes can be made without forensic examination and specialist input. Is it clear, for example, what is load-bearing and what is non-loadbearing? In most new housing, the answer is probably no. Built examples of flexible dwellings have often failed for the simple reason of technical over complication, leading for difficulties amongst new generations of users to distinguish between what could or could not be altered. Clearly the principle of layers begins to provide the logic for legibility, but even layered systems have in the past been so overcomplicated that their initial promise has failed; for example at the level of space-planning one-off partitioning systems have been used that have either become obsolete or else needed specialist tradesmen to alter.

Whilst tenants getting involved in construction is explicitly ruled out by some housing managers, the degree to which a layperson could make physical changes is still a good method of evaluating the legibility and simplicity of construction. A key example of this Walter Segal's approach developed over a number of self-build housing schemes, in which a simple, modular, building system allowed tenants not only to build their own homes but also to adapt them after. [Fig 7.19]

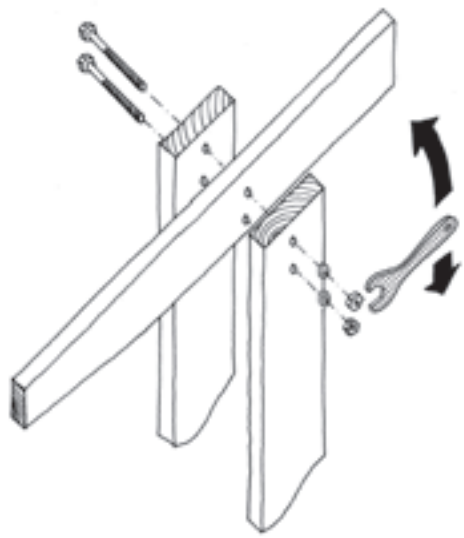
7.19 Honor Oak Park, Walter Segal, 1987. Plans showing the way that a simple and legible method of construction allows a wide variety of plan forms to be developed by the self-builders. 097

CONSTRUCTION • PRINCIPLES

Disassembly & Exchangeability

In keeping with the tenets of layering, simplicity and legibility is the idea of design for disassembly in which housing is designed and constructed with a view to its potential disassembly at a later date. This is not only a sustainable approach (in so much as materials can be separated, reused, recycled or replaced in the long term) but also a flexible one (in so much as it allows changes to be easily made at a later date). Design for disassembly works with the principle of layers, allowing each layer to be cleanly separated when replacements or changes are needed. However, its main tenet is one in which the methods of fixing allow later separation; this suggests simple mechanical fixing or proprietary systems that allow the various elements to be removed or exchanged without damaging their host. [Fig 7.20]

Related to the idea of design for disassembly is that of exchangeability. Exchangeability of parts — on a building, a dwelling or a room level — is one of the most intrinsic elements of future proofing and therefore long-term flexibility. A building should be designed in a way that allows the exchange of parts without disturbing other parts — on a large as well as a small scale.



7.20 Design for Disassembly. An approach that foregrounds the potential to take the structure apart and either reassemble or disassemble it.

These principles of generic frame, layering, and simplicity set the background for a number of constructional design decisions that will increase the scope for future flexibility.

CONSTRUCTION • BUILDING

Clear Spans

COST COST BENEFIT PRIORITY

Pre-occupation and post-occupation

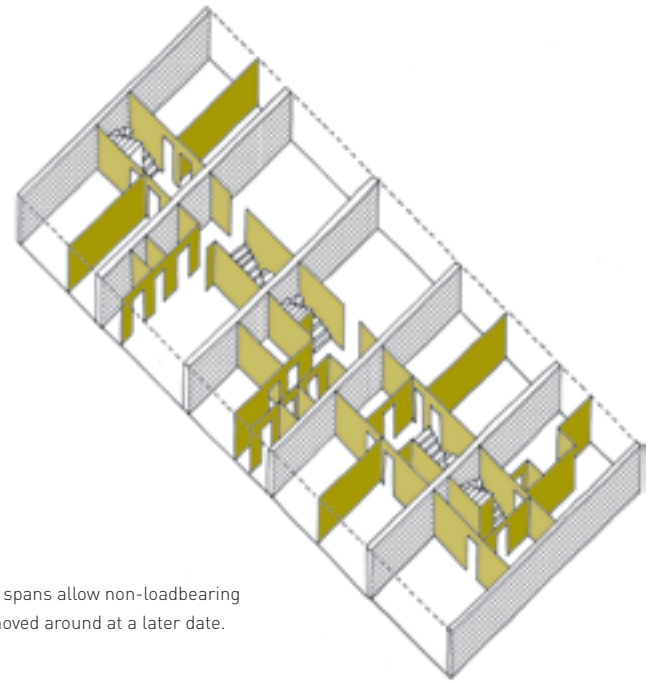
014 019 020 029 034 041 049 061 062 063 071 075 081 082 150 154 162

Of all the constructional principles to achieve flexibility in housing, probably the most important is that of clear spans across the width of an individual unit.

Clear spans mean that internal partition walls are then non-loadbearing, facilitating future internal re-modelling. [Fig 7.21] Technically, clear spans are easy to achieve with modern technical advances, but are still not the norm, particularly in low-rise terraced housing. There is no reason why all housing should not have clear span floors.

The choice of material to achieve clear spans of a typical housing unit (i.e. typically plus or minus six metres) is open to the developer and client. Most flexible of all will be a steel or concrete beam and column frame, in which only the position of the columns affects the internal layouts. [Fig 7.22] If the position of the party wall is set, then blockwork or other masonry walls can be used as the main loadbearing structure, but it is worth considering building in predefined openings with lintels in the party walls so that units can be joined together in the future (see above under 'Joining Up').

The use of concrete 'fin' walls is becoming more common. These set a pattern for the infill walls without overdetermining them, and thus allow a degree, if not complete, flexibility. Increasingly new timber technologies are being used, particularly in other European countries, to achieve clear spans. Lightweight panel construction or composite joist structures can now span 6.0m or more.



7.21 Clear Spans. Clear spans allow non-loadbearing partitions that can be moved around at a later date.

7.22 Consort Road, Walter Menteth Architects, 2007. Unusually for most UK housing, this scheme exploits the benefits of clear span construction, giving the potential for later rearrangement both within the individual units and also across units. 162

Foundations

Foundations are out of sight and therefore often out of mind, but as the most permanent element of all in a building badly designed foundations can stop future change. This is particularly the case if strip foundations are used, following the lines of internal walls, and thus effectively freezing the initial plan as a structural system. Although expensive, it is also worth considering building excess capacity into the foundation design, so that in future extra storeys can be added to the housing. Extra investment upfront may have a long term benefit, as the foundations are one part of the building that cannot be changed or retrofitted in the same way as other parts of the building can be.

External Walls

The adaptability of the external walls normally assumes a lower priority than the ability to change or move the internal walls. This is probably correct, in so much as the internal layout fundamentally affects long-term living patterns. However, the adaptability of the external wall is worth considering for a number of reasons. First, in terms of providing user choice prior to occupation. Second, on the principle of layers, the external wall may need to be upgraded or replaced over time. Thirdly, the external wall needs to be adapted when horizontal extensions are made to the housing.

A panelised external wall system will provide most flexibility and choice prior to construction. Theoretically it will also provide long-term flexibility, especially if its fixing is designed for disassembly. However, the actual flexibility of such a system will be entirely dependent on the availability of replacement parts. As described in Chapter 6, many of the more specialised panel systems have proved redundant over time of their very complexity.

Partitions

COST | COST BENEFIT | PRIORITY

Pre-occupation and post-occupation

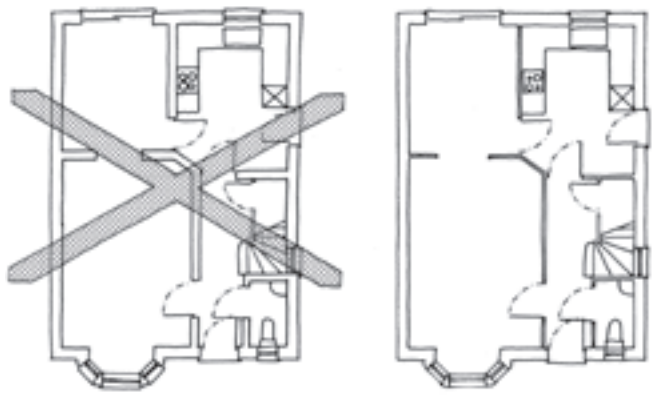
015 | 037 | 054 | 074 | 101 | 105 | 120 | 141

One of the principles of flexible housing design is that, with the exception of the service core one should start the design with the assumption that partitions may be moved at a future date.

This is dependent on having non-loadbearing partition walls that can be moved to vary room sizes. This variability can be employed pre-occupation, with the user collaborating on the design of the layout of a unit, or as a post-occupation strategy in which later tenants can adapt the layout of their dwellings.

It is advisable to follow a few simple principles in order to minimize cost and effort when walls are to be moved post-occupation:

- Partition walls should not be loadbearing. [Fig 7.23]
- Partition walls should wherever possible not contain electrical or other services.
- Modular wall elements may contribute to flexibility by providing a kit of parts (doors, wall panels, framed openings) that can be flexibly deployed. Prefabricated panel systems contribute to future flexibility because they are inherently separated from the structure and thus form part of a layered approach. Throughout the twentieth century, architects have experimented with such systems to varying degrees of success. The more successful projects employ only a small number of elements and the dimensions of the building are coordinated throughout. The method of connecting the elements is also crucial; it should be loose and easily demountable without damaging any other part of the interior. The more successful schemes employ readily available materials instead of high maintenance and cost intensive systems — some flexible housing schemes that have started with modular panel systems have rapidly become inflexible as these systems have become obsolete.
- Knock-out panels. Some of the design strategies covered above in the plan section are facilitated if walls include knock out panels in pre-framed openings. These allow: units to be joined together without major structural work; a variety of door positions to be included; the potential for rooms to be joined together in various ways. The latter principle has great advantages when combined with Rooms Without Labels, where the wall panels may act as connections between rooms and therefore allow users to interconnect these to create for example a large kitchen and dining room or a combined study and living room.
- The continuation of wall and floor finishes past or under any removable partitions should be considered.



7.23 Non Loadbearing Walls.

CONSTRUCTION • BUILDING

Roof Construction

COST | COST BENEFIT | PRIORITY

Post-occupation

047 079

The construction of the roof is a major consideration in allowing for vertical expansion.

Flat roofs give the most potential for additions, but the structure of both the roof and the foundations have to be sized to allow for additional loads. Thus the roof has to be capable of taking both dead loads and the live load of any future rooms.

If the roof is pitched, then one needs to avoid the use of trussed rafters that completely fill the roofspace. It is far preferable to use an open roof structure using either plain rafters, trusses with ties at head level or above, or SIP's (structural insulated panels). This allows the space in the pitched roof to be taken over at a later date. In this case the following should be taken into account:

- The structure at ceiling level (joists or otherwise) should be sized to take any future live and dead loads
- The plan designed so that the staircase can be easily extended
- The opening for the staircase should be pre-framed in order to reduce structural work at a later date
- Openings for future rooflights should be pre-framed
- Fire escape and protection should be considered at initial design stage

CONSTRUCTION • BUILDING

Over-capacity

COST | COST BENEFIT | PRIORITY

Post-occupation

059 067

In order to future-proof a building, it is sometimes sensible to over-size certain structural elements; this of course involves upfront investment that has to be balanced against long-term potential benefits of such an approach. This might mean over-sizing foundations and vertical supports in order to allow a roof extension or an extension above a garage.

Services

A major consideration in the design of flexible housing is the location and design of the services. [Fig 7.24]

Whilst the provision of basic services in housing is not a major part of the initial cost, the upgrading or replacing of obsolete services can form a considerable part of refurbishment costs. We have all seen housing that is structurally sound torn apart in order to accommodate new services. These costs can be greatly reduced if the initial design of the services takes into account future flexibility. Thinking about services at an early stage of the design has possibly the greatest effect of all in terms of life-cycle costing; a small investment up front will save over the long-term.

SERVICES • QUESTIONS

The overall question is:

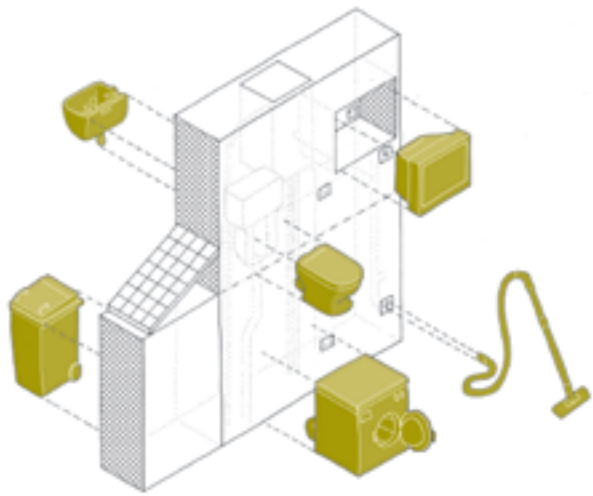
- Can the services be upgraded in the future?

Building Level:

- Does the location of services allow different plan layouts?
- Can future technologies be added?
- Can the services be accessed for maintenance and renewal?

Unit Level:

- Can the services be adapted for different occupants?



7.24 Zoned Services.

The key principle in any servicing strategy for flexible housing is how the services are distributed.

In many new housing developments the services appear to have been designed in a back to front manner. A plan is drawn, sockets and radiators located and then lines traced back to the junction box or boiler. Services are then run along those lines, cajoling pipes and wires through places that they do not really belong. They are placed without a view as to how they might be changed in the future and with little chance of being easily accessed. The rewiring of such a house means just that, a total operation from scratch. Services are too often designed without a view to future upgrading, alteration or addition.

Vertical Distribution

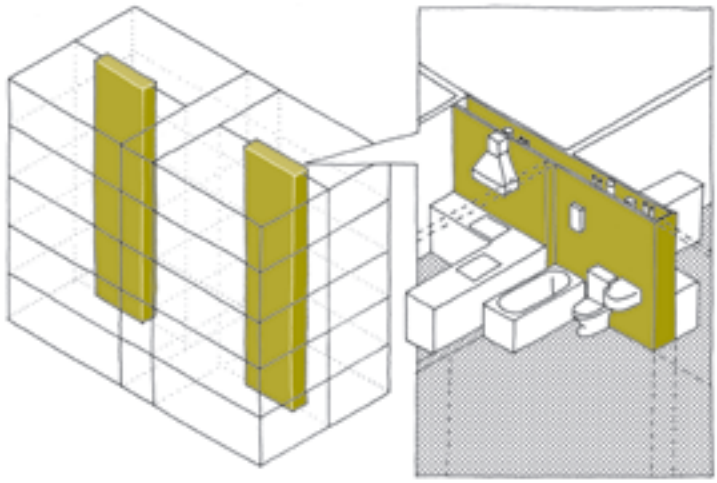
Pre-occupation and post-occupation

072 077 099 100 104 113 115 158

Services should be collected in vertical stacks or risers, and the main serviced rooms should be grouped around these stacks. As important is that these stacks should be accessible for future upgrading. [Fig 7.25]

As the service strategy in itself is almost as permanent as structural decisions, the position of vertical stacks is crucial if flexible layouts are to be enabled. If a unit is served by one vertical stack only, the position of kitchen and bathroom is to a large extent determined by the position of this stack, and this in turn affects the layout and future flexibility of the other rooms (see service core strategy above).

Whilst one might be able to predict the type of technology typical residential units will need within the next 10 years, it is important to try to future proof a building beyond this period. One of the most practicable options is to provide extra space, even a zone, within or adjacent to the vertical riser that can be taken over by technological developments as they come along. When not taken up by services, this extra space can be used as extra storage within the housing unit. In any case, it is vital that service risers are accessible for future upgrading, a principle that is developed in the Living Wall concept by PCKO Architects. 158



7.25 Vertical Services Distribution.

Horizontal Distribution

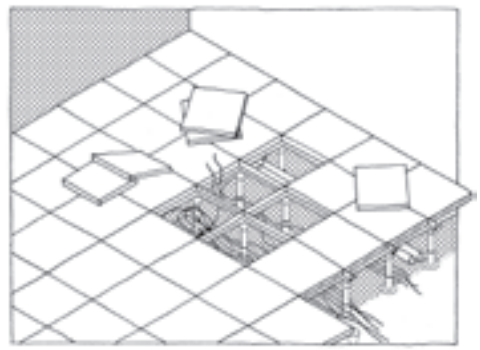
Pre-occupation and post-occupation

072 099 104

In keeping with the overall principle of layering and legibility, horizontal runs of services need to be easily accessible, maintainable and exchangeable. In order to facilitate adaptations of the plan, pipes and wiring should not, wherever possible, be fixed to internal non-loadbearing partition walls.

Pipes and wires tend to get buried in the horizontal service runs in housing construction, making it difficult both to locate them and then to adapt them. There are a number of approaches to mitigate against this:

- The most obvious way to do this is to surface mount everything, but this is sometimes not acceptable for aesthetic reasons. However, the development of slimline dado and skirting access systems has made surface wiring systems more reasonable in terms of both cost and look. There are also clear benefits in terms of coordination of the installation.
- Another way, although expensive, is to employ a raised floor or ceiling within which installations are led. This is effectively the approach of the speculative office with distributed services. Some housing schemes have used a distributed grid of multiple service outlets, allowing walls and furniture to be freely located. [Fig 7.26]
- Concentrating the horizontal service runs on permanent walls or structure allows them to remain in place if the non-loadbearing walls are altered.
- An approach is to dedicate to services a layer of the wall construction that is separate from the structural and insulative layer of the wall. This can be achieved by running small (38mm) battens horizontally on the face of the structural walls and fixing the final plasterboard / drywall to the battens. Services can then be run in the void, and collected in ducts that run horizontally behind the skirting board (which if screw or mechanically fixed can be easily removed to upgrade the services).



7.26 Horizontal Services Distribution.

Heating

A major hindrance to flexibility in housing has been the norm of using a wet system of radiators as the primary means of heating. Radiators are not only difficult to move when adaptations need to be made, but also restrict the way that a room may be furnished and thus used. However, with increasing insulation requirements and decreasing heating loads, alternatives to wet systems are becoming increasingly viable.

Lifetime Considerations

094 117 138 155

At the detailed level, lifetime housing considerations come to the fore, so that services are accessible to a wide range of people. In order to guarantee that a unit can be used by anyone, it should be ensured that switches, sockets, ventilation and service controls are at a height usable by all, a minimum of 0.45m and no more than 1.20m from the floor.

Knowledge Transfer

Many flexible housing schemes have not fulfilled their potential for the simple reason that later users and managers were not aware of the flexible design features that had been incorporated. In a recent survey of one of the most influential flexible housing schemes in the UK, Adelaide Road, it was found that the majority of residents interviewed were unaware that their dwellings had been designed for flexibility. One respondent commented that the internal appearance of the dwellings did not suggest that they could be adapted. If the knowledge of flexibility is not passed on, then a building that holds the potential for change will end up just like any other building, wasting all the effort that has gone into the design. It is therefore vital that the design of the building is documented and explained in a manual that can be passed to the building owners and users. This is common in the commercial sector, but not always done for residential buildings.

8

PROJECTS OF

FLEXIBLE HOUSING

Projects of Flexible Housing

What follows is a selection of examples of flexible housing organised chronologically. The list is intended to give an overview of the more significant examples of flexible housing, nearly all from the twentieth century. The most important projects are expanded upon in Chapter 4 of the book, *Case Studies in Flexible Housing*. This appendix can be read in conjunction with www.flexiblehousing.org, where more images of the schemes can be found, together with a timeline and the ability to search by date, country, type, architect and hard / soft plan or form.

KEY

001 Project of flexible housing shown as a case study (see Chapter 4 of this book for full details)

002 Additional project of flexible housing (not shown as case study)

[53] Number of dwelling units in project

001–005

001 Traditional Japanese House

DATE
1850/1995

REFERENCES
'Acht einfache Wohnhäuser von Yoshiyuki Nishimiya, Yuzo Osumi, Kazuhiko + Kaoru Obayashi, Yumiko Kobayashi, Kazutaka Wakamatsu, Soichiro Kawabata, Yoiciro Miyamori', *Bauwelt*, 86, 1995, pp.2444-51.

002 Weißes Schloss

DATE
1893

COUNTRY
Switzerland

TYPE OF PROJECT
Multi-storey apartment block

PROJECT DESCRIPTION
The scheme illustrates a typical continental European example from around the turn of the last century. Each unit has a series of equally sized rooms, which can be interlinked via an enfilade system.

REFERENCES
Berger, P., 'Für die Zukunft planen.' *Wohnen*, 1-2, 2003, pp.43-44.

003 Mietsblock Muskauer Str. 33

DATE
1896

COUNTRY
Germany

TYPE OF PROJECT
Multi-storey apartment block

PROJECT DESCRIPTION
This apartment block represents a generic building typology, which was developed in the late C19 and early C20 in Berlin. It consists of a front building, two side-wings and one cross-building. The construction, positioning of load-bearing walls and location of staircases allows for a great variety of number and sizes of apartments. Whilst in this case one storey is subdivided into 10 apartments, the same storey could also be partitioned into 2 very large apartments or a variety of smaller and larger apartments.

REFERENCES
Geist, J.F., *Das Berliner Mietshaus 1862-1945*, München: Prestel-Verlag, 1984.

004 Cottages

DATE
1901

REFERENCES
'Roadside Cottages, Walton-on-Thames', *The Builder*, 14 September, 1901, p.232.

005 Rue Franklin, Paris

DATE
1903

COUNTRY
France

ARCHITECT
Auguste Perret

TYPE OF PROJECT
Multi-storey apartment block

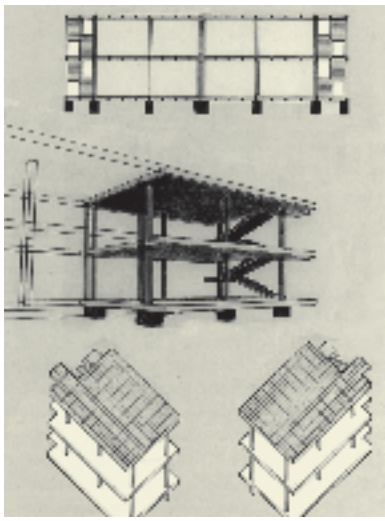
PROJECT DESCRIPTION
The floor plans of the apartment block directly anticipate the plan libre. Rooms are accessible independently from each other and amongst one another. The concrete skeleton allows large openings, which in turn enables multiple combinations of functions and activities.

REFERENCES

Bressani, M., 'The Spectacle of the City of Paris from 25 bis rue Franklin', *Assemblage*, 12, 2000, pp.84-107.

Zanoni, T., 'Wohnraum in der Stadt. Stadt-Architekturen und Wohnungsbau: Programme, Pläne, Entwürfe', *werk, bauen + wohnen*, 3, 1984, pp.18-27.

006 Maison Dom-ino



DATE

1914

ARCHITECT

Le Corbusier

TYPE OF PROJECT

Unrealised

PROJECT DESCRIPTION

The layout of the plan is completely independent from the structural system providing endless variations in the arrangement of the interiors. The skeleton consists of free-standing pillars and rigid floors. Maison Dom-ino was designed as a building prototype for mass-production. It can be seen as the precursor to the clear separation of support from infill in housing.

REFERENCES

Eisenman, P., 'Aspects of Modernism: The Maison Dom-ino and the Self-Referential Sign', *Oppositions*, 15-16 , 1979, pp.118-28.

Gans, D., *The Le Corbusier Guide*, Princeton, New Jersey: Princeton Architectural Press, 1987.

Fassbinder, H., and J. v. Eldonk, 'Flexibilität im niederländischen Wohnungsbau', *ARCH+*, 100/101, 1989, pp.65-73.

Gregh, E., 'The Dom-ino Idea', *Oppositions*, 15-16, 1979, pp.74-87.

Jencks, C., *Le Corbusier and the Continual Revolution in Architecture*, New York: The Monacelli Press, 2000.

007 Hydrostone

DATE

1921

COUNTRY

Canada

ARCHITECT

Thomas Adams

TYPE OF PROJECT

Mixed use with single-, semi-detached and terraced house [326]

PROJECT DESCRIPTION

The layout of the blocks is based upon a module of 120ft that can be subdivided into two 60ft, three 40ft, four 30ft or six 20ft units. Housing types include semi-detached duplexes, row and stacked terrace housing, as well as apartments.

There are six separate types of four-unit buildings, each varying in size, internal layout, exterior treatment in design and use of materials. Further variety was created by variations in setback, building height, use of dormers and the addition of entry porches.

REFERENCES

Atlantic Planners Institute, 'Planning the Hydrostone Neighbourhood', 2000, *http://www.atlanticplanners.org/whatnew/reports/hydrostone/hydrostone_toc.htm* [Accessed 23 March 2005].

Clarke, E., 'The Hydrostone Phoenix: Garden City Planning and the Reconstruction of Halifax, 1917-21', in *Ground Zero: A Reassessment of the 1917 Explosion in Halifax Harbour*, ed. by Ruffman, A. and C. D. Howell Nimbus Publishing Ltd. & Gorsebrook Research Institute at Saint Mary's University, 1994.

Simpson, M., *Thomas Adams and the modern planning movement: Britain, Canada and the United States 1900-1940*, London: Mansell, 1984.

008 Haus Auerbach

DATE

1924

COUNTRY

Germany

ARCHITECT

Walter Gropius + Adolph Meyer

TYPE OF PROJECT

Single-detached house [1]

PROJECT DESCRIPTION

Haus Auerbach was built according to a system developed by Walter Gropius and Adolf Meyer in 1923. The individual elements of the 'Baukasten' (building blocks or meccanoo), a standardised housing system consisting of various cubic parts, could form — according to number and needs of inhabitants — different volumetric combinations.

REFERENCES

Tafel, C., 'Rehabilitation of the Auerbach house (1924) and the Zuckerkandl House (1927-29) by Walter Gropius in Jena', *Detail*, 38, 1998, pp.543-46.

Happe, B., and M. S. Fischer, *Haus Auerbach: von Walter Gropius mit Adolf Meyer*, Tübingen: Wasmuth, 2003.

'Haus Auerbach in Jena: Denkmalgerechte Instandstetzung und Rekonstruktion', *Deutsche Bauzeitschrift*, 10, 1997, pp.103-05.

009 Schröder Huis

DATE

1924

REFERENCES

Badovici, J., 'Entretiens sur l'architecture vivante', *L'Architecture Vivante*, Fall & Winter, 1925.

Brown, T. M., *The work of G. Rietveld architect*, Utrecht: A.W. Brune & Zoon, 1958.

Friedman, A.T., *Women and the Making of the Modern House*, New York: Harry Abrams, 1998.

Periàñez, M., *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.

Wattjes, J. G., 'Moderne bouwkunst in Utrecht', *Bowubedriif*, 2:9, 1925, pp.315-32.

010 Hufeisensiedlung

DATE

1925-1931

REFERENCES

Huse, N., ed., Vier Berliner Siedlungen der Weimarer Republik-Britz, Onkel Toms Hütte, Siemesstadt, Weiße Stadt, Berlin: Argon, 1987.

Kähler, G., 'Kollektive Struktur, individuelle Interpretation', *ARCH+*, 100/101, 1989, pp.38-45.

011 Quartiers Modernes Frugès

DATE

1926

COUNTRY

France

ARCHITECT

Le Corbusier + Pierre Jeanneret

TYPE OF PROJECT

Mixed use with single-, semi-detached and terraced house [53]

PROJECT DESCRIPTION

The entire development is based on one plan and one cell prototype from which numerous variations were developed. The plan as such is open, the staircase is independent, bathrooms small, and interior walls are non-loadbearing. The project is famous for the way that it has been adapted over time by its occupants, overwhelming the modernist orthodoxy with an everyday architecture, as documented by Boudon. More recently parts of it have been 'restored' back to its original state

REFERENCES

Boudon, P., *Pessac de Le Corbusier 1927-1967: étude socio-architecturale*, Paris: Dunod, 1985.

Boudon, P., and G. Onn, *Lived-In Architecture. Le Corbusier's Pessac Revisited*, Cambridge, Mass.: MIT Press, 1979.

Ferrand, M., J.-P. Feugas, B. Le Roy, and J.-L. Veyret, *Le Corbusier: Quartiers Modernes Frugès*, Basel: Birkhäuser, 1998.

Jencks, C., *Le Corbusier and the Continual Revolution in Architecture*, New York: The Monacelli Press, 2000.

Matthews, T., 'Le Corbusier's Pessac: an experiment in urbanism continues', *Architectural Record*, 13 (11), 1987, pp.87, 89.

Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.

012 Verwandelbare Wohnung

DATE

1927

REFERENCES

Kähler, G., 'Kollektive Struktur, individuelle Interpretation', *ARCH+*, 100/101, 1989, pp.38-45.

'Karl Schneider (1892-1945). Architekt, Städtebauer und Designer', *werk, bauen + wohnen*, 10, 1992, p.76.

Koch, R., 'On Schneider and building in Hamburg 1921-1953. Attempt at a new architecture', *Bauwelt*, 25, 1988, pp.1079-83.

Koch, R., and E. Pook, eds., *Karl Schneider: Leben und Werk (1892-1945)*, Hamburg: Dölling und Galitz, 1992.

013 Weißenhofsiedlung, Haus 16 and 17

DATE

1927

COUNTRY

Germany

ARCHITECT

Walter Gropius

TYPE OF PROJECT

Single-detached house [2]

PROJECT DESCRIPTION

These two houses, which were both demolished during World War II, demonstrate Gropius' abiding interest in the issue of prefabrication. Here, industrially produced components can be put together in an infinite number of ways to allow a degree of choice for the user as well as the developer.

REFERENCES

Kirsch, K., *Die Weißenhofsiedlung: Werkbund-Ausstellung »Die Wohnung« – Stuttgart 1927*, Stuttgart: Deutsche Verlags-Anstalt GmbH, 1987.

014 Wohnzeile, Weißenhofsiedlung

DATE

1927

REFERENCES

Berger, P., 'Für die Zukunft planen', *Wohnen*, 1-2, 2003, pp.43-44.

Kähler, G., 'Kollektive Struktur, individuelle Interpretation', *ARCH+*, 100/101, 1989, pp.38-45.

Kirsch, K., *Die Weißenhofsiedlung: Werkbund-Ausstellung »Die Wohnung« – Stuttgart 1927*, Stuttgart: Deutsche Verlags-Anstalt GmbH, 1987.

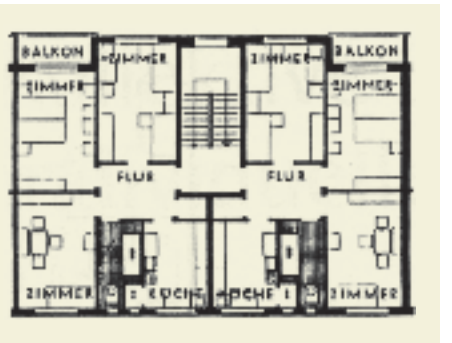
Periàñez, M., *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.

Schneider, F., ed., *Grundrißatlas Wohnungsbau – Floor plan atlas: housing*, Basel: Birkhäuser, 1994.

Simon, C., and T. Hafner, eds., *WohnOrte – 50 Wohnquartiere in Stuttgart von 1890 bis 2002*, *Stuttgarter Beiträge*, Stuttgart: Landeshauptstadt Stuttgart, 2002.

Stankard, M., 'Re-covering Mies van der Rohe's Weißenhof: The Ultimate Surface', *Journal of Architectural Education*, 4, 2002, pp.247-56.

015 Apartment, Hamburg



DATE

1928

COUNTRY

Germany

ARCHITECT

Schneider, Elingius, Schramm

TYPE OF PROJECT

multi-storey apartment block

PROJECT DESCRIPTION

Example of an early twentieth century apartment that is arranged around a central hall from which a number of similar sized rooms are separately accessible. Although planned for family occupation, the unit could also be shared by, for example, students.

REFERENCES

Werner, J., 'Alltags-Anpassungen', *ARCH+*, 100/101, 1989, pp.50-59.

016 Maisons Loucheur

DATE

1928/29

REFERENCES

Benton, T., 'Le Corbusier and the Loi Loucheur', *AA files*, 7. 1984, pp.54-60.

Ford, E. R., *The Details of Modern Architecture, Volume 2: 1928 to 1988*, Cambridge, Massachusetts: Massachusetts Institute of Technology, 1996.

Werner, J., 'Alltags-Anpassungen', *ARCH+*, 100/101, 1989, pp.50-59.

017 Housing Block Erasmuslaan

DATE

1931

REFERENCES

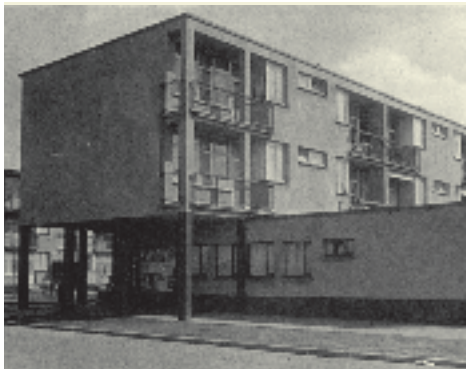
Brown, T. M., *The work of G. Rietveld architect*, Utrecht: A.W. Brune & Zoon, 1958.

Fassbinder, H., and J. v. Eldonk, 'Flexibilität im niederländischen Wohnungsbau', *ARCH+*, 100/101, 1989, pp.65-73.

018 Kleinwohnung

DATE
1938
REFERENCES
Kähler, G., 'Kollektive Struktur, individuelle Interpretation', *ARCH+*, 100/101, 1989, pp.38-45.

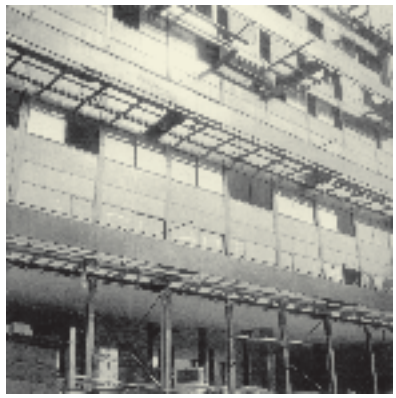
019 Siedlung Hellerhof



DATE
1931
COUNTRY
Germany
ARCHITECT
Mart Stam
TYPE OF PROJECT
Mixed use with multi-storey apartment block [1200]
PROJECT DESCRIPTION
The internal structure consists of crosswalls and floors that span from party wall to party wall. This allows for the free arrangement of façades, loggias, and balconies as well as a high degree of variability in the plans. None of the internal walls are load-bearing.
REFERENCES
Dreysse, D. W., *May-Siedlungen: Architekturführer durch acht Siedlungen des neuen Frankfurt 1926-1930*, Köln: Verlag der Buchhandlung Walther König, 1994.
Höpfner, R., and V. Fischer, *Ernst May und das Neue Frankfurt 1925-1930*, Berlin: Ernst und Sohn, 1986.
Rümmele, S., *Mart Stam*, Basel: Birkhäuser, 1994.

020 L'Immeuble Clarté

DATE
1932
COUNTRY
Switzerland
ARCHITECT
Le Corbusier
TYPE OF PROJECT
Mixed use with multi-storey apartment block
PROJECT DESCRIPTION
The steel skeleton of the Immeuble Clarté frees internal walls of any load-bearing function, thus allowing great freedom in the subdivision of each storey and each individual apartment.



REFERENCES
Lamuniere, I., and P. Devanthery, 'L'Immeuble Clarté' à Geneve (1930-1932)', *Moniteur architecture AMC*, 65, 1995, pp.68-72.
Sumi, C., *Immeuble Clarté Genf 1932 von Le Corbusier & Pierre Jeanneret*, Zürich: Institut für Geschichte und Theorie der Architektur, Eidgenössische Technische Hochschule, 1989.

021 Werfthaus

DATE
1932
REFERENCES
Ludwig, M., *Mobile Architektur: Geschichte und Entwicklung transportabler und modularer Bauten*, Stuttgart: Deutsche Verlags-Anstalt GmbH, 1998.
Mayer, H. K. F., *Der Baumeister Otto Bartning und die Wiederentdeckung des Raumes*, Heidelberg: L. Schneider, 1951.

022 Woningenkomplex

DATE
1934
REFERENCES
Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.
Stroink, R., ed., *Ir J.H. Van Den Broek – Projekten uit de Periode 1928-1948*, Delft: Delftse Universitaire Pers, 1981.
Vanstiphout, W., *Maak een stad: Rotterdam en de architectuur van J. H. Van den Broek*, Rotterdam: 010, 2005.

023 Lawn Road Flats

DATE
1934
COUNTRY
Britain
ARCHITECT
Wells Coates
TYPE OF PROJECT
Live / work
PROJECT DESCRIPTION
Lawn Road consisted of twenty-two apartments of 24m² accessed via an open gallery, four two-room apartments at the south end of each storey and three studio apartments. The building and apartments were designed as minimum dwellings 'with special reference to the circumstances of the bachelor or young married professional or businessperson'. Wells Coates used sliding internal partitions and built-in storage to maximise space and functional efficiency. The apartments had only rudimentary kitchens; eating, as well as laundry, were meant to be shared activities in be carried out in communal areas.

Columns and floors are structurally integral with the external walls, which meant that the plan of each of the apartments remained flexible within the outer shell. In a recent refurbishment of the building, some of the units were combined into larger apartments.

REFERENCES
Blackler, Z., 'Isokon returns to former glory', *Architects' Journal*, 7, 2004, p.11.
Cantacuzino, S., *Wells Coates*, London: Gordon Fraser, 1978.
Carr, R., 'Lawn Road Flats', The Studio Trust, 2004, <http://www.studio-international.co.uk/architecture/lawn_road_flats_7_6_04.htm> [Accessed May 2005].
Yorke, F. R. S., and F. Gibberd, *The modern flat*, London: Architectural Press, 1937.
Zeidler, C., 'Restaurierung der Isokon Flats, London', *Bauwelt*, 8, 2005, p.4.

024 Zomerdijkstraat Atelier Apartments

DATE
1934
COUNTRY
The Netherlands
ARCHITECT
Zanstra, Giesen and Sijmons
TYPE OF PROJECT
Live / work
PROJECT DESCRIPTION
A large 1½ height space with several supporting smaller spaces — bedrooms, kitchen, bathroom — give a cer-

tain neutrality and ambiguity as to how to use the apartments, as has been successfully shown over time. The space could also be used with two small studios upstairs and living and sleeping spaces downstairs. Furthermore, a mezzanine level could provide additional room.

REFERENCES

MacCreanor, G., 'Adaptability', *a+t*, 12, 1998, pp.40-45.

Stralen, M. v., *Atelierwoningen Zomerdijkstraat 1932-1934*, Rotterdam: 010, 1989

025 Letohradská

DATE

1937

REFERENCES

Kohout, M., and V. Slapeta, *Prague, 20th Century Architecture*, New York: Springer Guide Books, 1999.

Peichl, G., and V. Slapeta, *Czech Functionalism 1918-1938*, London: Architectural Association, 1987.

Svácha, R., *The Architecture of New Prague 1895-1945*, Cambridge, Mass: MIT Press, 1995.

Teige, K., *Modern Architecture in Czechoslovakia*, Los Angeles: Getty Research Institute, 2000.

026 Arbeitersiedlung Gwad

DATE

1938/1952

COUNTRY

Switzerland

ARCHITECT

Hans Fischli

TYPE OF PROJECT

Terraced house [28]

PROJECT DESCRIPTION

The upper storey of the houses in Wädenswil can be extended from a basic gallery with bathroom and bedroom to a fully developed upper level that contains a bathroom and up to four bedrooms.

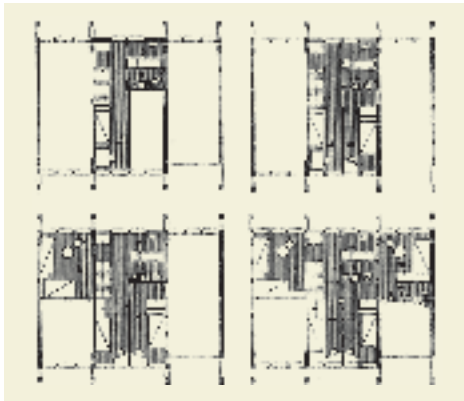
REFERENCES

Bissegger, P., 'Holzhäuser müssen konstruiert werden': die Siedlung Gwad von Hans Fischli und Oskar Stock im Umfeld der Schweizer Holzarchitektur der 30er und 40er Jahre', *Architheses*, 5, 1985, pp.34-41.

Jost, K., *Hans Fischli. Architekt, Maler, Bildhauer*, Zürich: gta verlag, 1992.

Mühlestein, E., '"Gwad" Siedlung in Wädenswil (1943/44)', *Bauen & Wohnen*, 12, 1972, pp.560-62.

Zeller, C., '"Die Zeit der Baukünstler ist vorbei" Zum architektonischen Werk von Hans Fischli', *werk, bauen + wohnen*, 6, 1989, pp.14-15.



027 Highpoint II

DATE

1938

COUNTRY

Britain

ARCHITECT

Lubetkin & Tecton

TYPE OF PROJECT

Multi-storey apartment block

PROJECT DESCRIPTION

Flexibility is enabled by the regular structural grid, which creates generously sized rooms of similar dimensions.

REFERENCES

'Wohnraum in der Stadt. Stadt-Architekturen und Wohnungsbau: Programme, Pläne, Entwürfe', *werk, bauen + wohnen*, 3, 1984, pp.18-27.

028 AA-System Houses

DATE

1941-45

COUNTRY

Finland

ARCHITECT

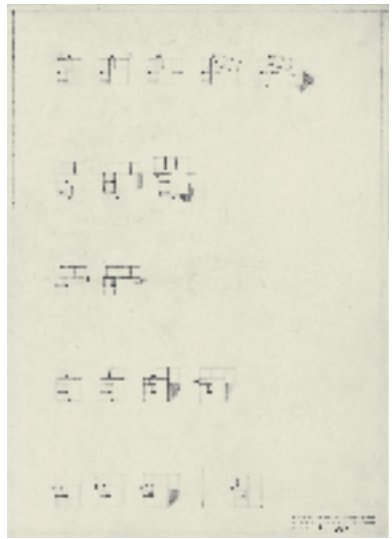
Alvar Aalto

TYPE OF PROJECT

Detached Houses

PROJECT DESCRIPTION

A design for prefabricated housing in association with the Ahlström Company, designed to address the housing needs of people left homeless by the war. The AA-System is an example of what Aalto termed 'flexible standardisation', with a basic core supplied that could then be added to over time. The project used standard building parts described by Aalto as 'living cells' that could grow in multiple ways. A number of these houses were built.



REFERENCES

Pallasmaa, J., and T.Sato, *Alvar Aalto through the eyes of Shigeru Ban*, London: Black Dog Publishing, 2007, pp.152-57.

029 Flexible Space

DATE

1942

REFERENCES

Wurster, W. W., 'The new house 194X... : 29. Flexible Space', *The Architectural Forum*, 77, 1942, pp.140-42.

Wurster, W. W., *A flexible house for happier living*, New York: Revere Copper and Brass, 1943.

030 Foundation Saver

DATE

1938

COUNTRY

USA

ARCHITECT

Victorine + Samuel Homsey

TYPE OF PROJECT

Unrealised

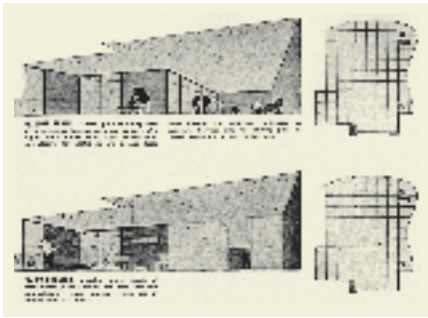
PROJECT DESCRIPTION

The project develops the idea of a small house with only one interior partition, which contains all necessary plumbing. All other partitions are movable, to take care of changes in family requirements.

REFERENCES

Homsey, V., and S. Homsey, 'The new house 194X... : 1. Foundation saver, prefabricated parts', *The Architectural Forum*, 77, 1942, pp.71-73.

031 Movable Space Dividers



DATE

1942

COUNTRY

USA

ARCHITECT

Fred James MacKie, Jr. + Karl Fred Kamrath

TYPE OF PROJECT

Unrealised

PROJECT DESCRIPTION

One large open space, based on a modular grid, can be divided into a number of smaller spaces by means of movable partition walls, which are stored in closets if not used.

REFERENCES

MacKie, F., and K. Kamrath, 'The new house 194X... : 20. Movable Space Dividers', *The Architectural Forum*, 77, 1942, pp.120-21.

032 Prefabrication

DATE

1942

REFERENCES

Bogner, W., 'The new house 194X... : 4. Prefabrication', *The Architectural Forum*, 77, 1942, pp.78-81.

033 Meudon

DATE

1949-51

COUNTRY

France

ARCHITECT

Jean Prouvé

TYPE OF PROJECT

Single-detached house [25]

PROJECT DESCRIPTION

A project for standardised housing commissioned by the French Ministry of Reconstruction, the Meudon houses use a kit of parts, and have been compared to a Citroën 2CV car. The houses are planned on a 1m module with all panels interchangeable; the initial scheme shows 14 variations on two unit types.

REFERENCES

Ellis, C., 'Prouvé's prefabs: the story of his Meudon prefabricated houses', *Architects' journal*, 14, 1985, pp.46-51.

Enjolras, C., E., *Jean Prouvé, les maisons de Meudon 1949-99*, Paris: éditions de la Villette, 2003.

Ford, E. R., *The Details of Modern Architecture, Volume 2: 1928 to 1988*, Cambridge, Massachusetts: MIT Press, 1996.

Ludwig, M., *Mobile Architektur: Geschichte und Entwicklung transportabler und modularer Bauten*, Stuttgart: Deutsche Verlags-Anstalt GmbH, 1998.

'Metallic housing development, Route des Gardes, Meudon', *A&U*, 9, 1990, pp.134-39.

Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.

Sulzer, P., *Jean Prouvé: Complete Works Vol.3*, Basel: Birkhäuser, 2005.

034 Movable Boxes

DATE

1949

ARCHITECT

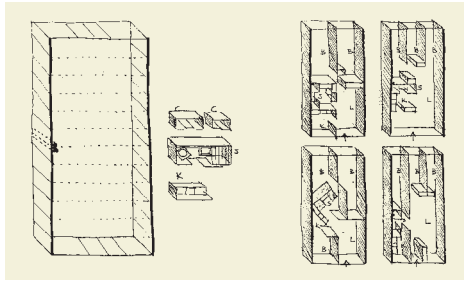
Yona Friedman

TYPE OF PROJECT

Unrealised

PROJECT DESCRIPTION

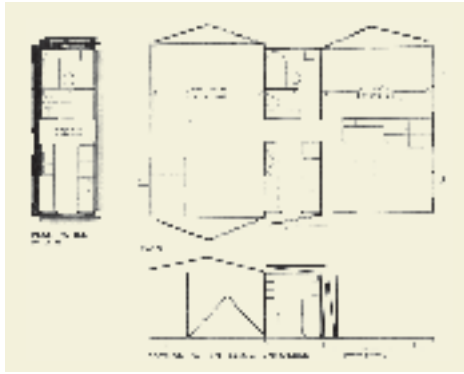
Based on the architect's experiences during the Second World War, where two or more families had to share a single room that was commonly divided with furniture, this project is based on a shell whereby the interior layout of the home was left to the inhabitants to determine. All sanitary and kitchen units and closet partitions in the house were lightweight boxes that could be positioned by the inhabitants as desired.



REFERENCES

Lebesque, S. and H. Fentener, *Yona Friedman.Structures serving the unpredictable*, Rotterdam: NAi Publishers, 1999.

035 Prefabricated House



DATE

1950

COUNTRY

USA

ARCHITECT

Carl Koch

TYPE OF PROJECT

Single-detached house [1]

PROJECT DESCRIPTION

The house consists of a central core containing kitchen, bath, utility room, and all wiring, plumbing, heating and kitchen accessories. Panels that constitute walls, floor and roof of the rooms are hinged and folded against the core. Once positioned on site, these panels are unfolded and bolted into position.

REFERENCES

'Prefabricated house in the USA', *Architects' Journal*, 5 January, 1950, pp.18-23.

036 Kristalbouw

DATE

1952

REFERENCES

Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.

Trapman, J., 'Kristalbouw', *Bouw*, 1957, pp.230-40.

Trapmann, J., 'Kristalbouw, Essential Possibilities of Flexibility in Housing', *Forum XVIII*, 4, 1964, p.15.

037 Järnbrott Experimental Housing

DATE

1953

REFERENCES

Caldenby, C., 'Tage William-Olsson: planner and polemicist', *ARQ*, 7, 2003, pp.295-309.

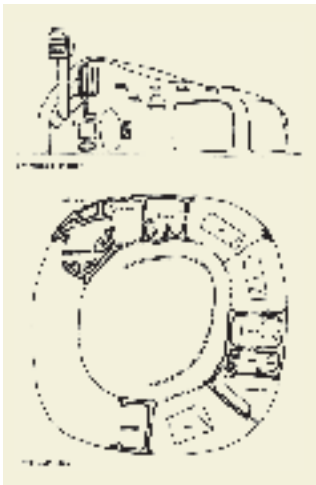
Periàñez, M., *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.

Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.

Schneider, F., ed., *Grundrißatlas Wohnungsbau – Floor plan atlas: housing*, Basel: Birkhäuser, 1994.

Statens institut for byggnadsforskning, *Flexible flats: an investigation in an experimental block of flats in Järnbrott, Gothenburg*, Stockholm: Statens institut for byggnadsforskning, 1966.

038 Appliance Houses



DATE

1956-58

COUNTRY

Britain

ARCHITECT

Alison Smithson

TYPE OF PROJECT

Grouped Houses (unrealised)

PROJECT DESCRIPTION

A series of projects which were intended for mass-production. The houses are designed to be grouped in a variety of ways. Internally the appliance houses consist of a series of 'appliance' cubicles — updated versions of bathrooms and kitchens — with service connections and storage. These are the only fixed elements in the plan and 'define the architectural form.' The service connections are seen as 'growth points' for constantly changing appliances. Other activities occur between and around these appliance cubicles. The plans of the earliest Appliance Houses show it as a contemporary equivalent of an African village compound. A later version, the Strip House of 1957-8, is a looser reworking of the modernist open plan with 4 appliance cubicles and 2 dressing rooms freely arranged in a large open space, in which activities can flexibly occur.

REFERENCES

Smithson, A and P. Smithson., *The Charged Void: Architecture*, New York: Monacelli Press, 2001.

Smithson, A and P. Smithson., 'The Appliance House', *Design*, 113, 1958, pp.43-47.

039 Single-Space House for Four People

DATE

1957

REFERENCES

Galfetti, G. G., *Pisos Piloto – Model Apartments: Experimental domestic cells*, Barcelona: Editorial Gustavo Gili, 1997.

040 Point-Block, Birmingham

DATE

1958

COUNTRY

Britain

ARCHITECT

A.G. Sheppard Fidler

TYPE OF PROJECT

Multi-storey apartment block

PROJECT DESCRIPTION

Designed on the plate floor system, floors have uninterrupted ceilings without beams, which enables a relatively free system of floor plan subdivision.

REFERENCES

Barr, A. W. C., *Public Authority Housing*, London: Batsford, 1958.

041 Alton Gardens

DATE

1960

ARCHITECT

Galberg & Weal

COUNTRY

Britain

TYPE OF PROJECT

Terraced house [13]

PROJECT DESCRIPTION

The houses were constructed with brick crosswalls and 5.5m clear-span timber floors, single stack plumbing and plasterboard on stud partitions, in order to provide a 'home for all seasons'. A survey after 6 years of occupation found that most people had made modifications to the layout, for example changing the number of bedrooms, adding a library, boxing-in the staircase, or removing built-in wardrobes between bedrooms.

REFERENCES

'Housing, Beckenham Place Park, Kent', *Architect & Building News*, 1966, pp.300-302.

Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.

042 Kallebäck Experimental Housing

DATE

1960

REFERENCES

Johansson, J., 'det radikala: Regeln och undantaget', in *Revision: mama skriver om historien*, ed. by Arkitekturmuseet, Stockholm: Arkitekturmuseet, 2004, pp.5-16.

Periàñez, M., *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.

Schneider, F., ed., *Grundrißatlas Wohnungsbau – Floor plan atlas: housing*, Basel: Birkhäuser, 1994.

Weiß, K.-D., 'Highrise in Göteborg: Etagengrundstücke von Erik Friberger', Deutsche Bauzeitung, 8, 1990, pp.98-103.

043 Köln-Zollstock Grünzug Süd

DATE

1962

COUNTRY

Germany

ARCHITECT

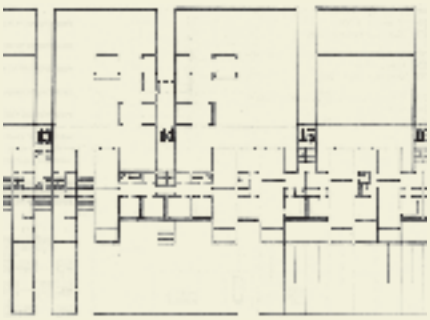
Oswald Matthias Ungers, K. L. Dietzsch

TYPE OF PROJECT

Multi-storey apartment block

PROJECT DESCRIPTION

The layout allows for the division of the apartment into more or less independent parts which can then be used in different ways: Live / work, parents / children, owners / tenant or family / relatives.



REFERENCES

Deilmann, H., J. C. Kirschenmann, and H. Pfeiffer, *Wohnungsbau. The Dwelling. L'habitat.* 3rd edn, Stuttgart: Karl Krämer Verlag, 1973.

Freiberg, J., 'Quel habitat, pour qui?' *Architecture d'aujourd'hui*, 225, 1983, pp.1-34.

044 The Adaptable House

DATE

1962

REFERENCES

Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.

045 West Plaza Condominium Apartments

DATE

1962

COUNTRY

USA

ARCHITECT

MLTW / William Turnbull Associates

TYPE OF PROJECT

Multi-storey apartment block

PROJECT DESCRIPTION

The dwelling unit offers two means of access and consequently a larger unit can be subdivided into two smaller ones, fully and separately usable. In owner-occupied apartments, this offers the opportunity of adjusting the size of the apartment, i.e. by temporarily letting one part of it or selling off a section.

REFERENCES

Deilmann, H., J. C. Kirschenmann, and H. Pfeiffer, *Wohnungsbau. The Dwelling. L'habitat.* 3rd edn, Stuttgart: Karl Krämer Verlag, 1973.

046 Neuwil

DATE

1962-65

REFERENCES

'Anpassungsfähige Grundrisse. Überbauung "Neuwil" in Wohlen AG', *Werk*, 2, 1966, pp.41-46.

Kendall, S., and J. Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000.

Kurth, H., 'Anpassungsfähige Grundrisse oder anpassungsfähige Mieter? Reportage über das Metron-Haus in Wohlen AG (Neuwil)', *Werk*, 6, 1970, pp.409-11.

Kurz, D., ed., *Metron: Planen und Bauen 1965-2003*, Zürich: gta Verlag, 2003.

Zeller, C., ed., *Schweizer Architekturführer Band 2*, Zürich: Werk Verlag, 1994.

047 Extendible houses 't Hool

DATE

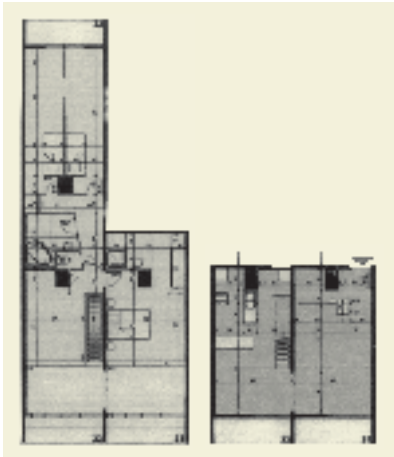
1963

REFERENCES

Architectengemeenschap Van den Broek en Bakema, *Architektur-Urbanismus*, Stuttgart: Karl Krämer Verlag, 1976.

Bakema, J. B., *Thoughts about architecture*, London: Academy Editions, 1981.

048 Unité d'habitation at Firminy



DATE

1963

COUNTRY

France

ARCHITECT

Le Corbusier

TYPE OF PROJECT

Multi-storey apartment block [414 in 1963]

PROJECT DESCRIPTION

A project based on the 'bottle-rack principle', in which an open structural frame (the rack) could be infilled with different unit types (the bottles). The building, which was refurbished in 1996 to suit today's space requirements, has seen a number of alterations including the combining of two adjoining units into one.

REFERENCES

Gans, D., *The Le Corbusier Guide*, Princeton, New Jersey: Princeton Architectural Press, 1987.

Leupen, B., *Frame and Generic Space*, Rotterdam: 010 Press, 2006.

Loach, J., 'Le Corbusier at Firminy-Vert', in *Le Corbusier: Architect of the Century*, London: Arts Council of Great Britain, 1987.

'Renovation de la partie nord et de la façade', *L'Architecture d'aujourd'hui*, 354, 2004, pp.134-36.

Schaffer, S., 'Firminy retrouvé son Unité d'habitation', *D'architectures*, 64, 1996, pp.30-31.

049 Diset – Flexible Apartment Units

DATE

1964

COUNTRY

Sweden

ARCHITECT

Axel Grape

TYPE OF PROJECT

Multi-storey apartment block

PROJECT DESCRIPTION

The open plan of this building (2 dwelling units per flight of stairs: 60 and 90m^2, or 90 and 120m^2) is only interrupted by intermediate columns. Services such as ventilation, water supply and drainage are arranged along the wall backing on the stairwell. The columns serve as space-defining elements and as 'anchors' for movable cupboards and partitions.

REFERENCES

Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.

Statens institut forbyggnadsforskning, *Flexible dwellings in blocks of flats: a study of an experimental block in Diset, Uppsala*, Stockholm: Statens institut forbyggnadsforskning, 1970.

050 Square L-Type System

DATE

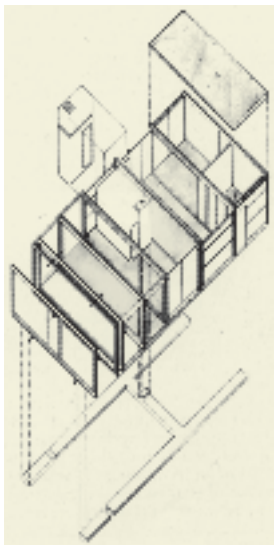
1967

REFERENCES

Bakema, J. B., *Thoughts about architecture*, London: Academy Editions, 1981.

Deilmann, H., J. C. Kirschenmann, and H. Pfeiffer, *Wohnungsbau. The Dwelling. L'habitat.* 3rd edn, Stuttgart: Karl Krämer Verlag, 1973.

051 Steelhouse



DATE

1967

COUNTRY

UK

ARCHITECT

Cedric Price

TYPE OF PROJECT

Unrealised

PROJECT DESCRIPTION

Cedric Price designed the Steelhouse as a response to the increasing requirements for less definitive space. He argued that the main design criterion should be for the provision of space with maximum variation of possible uses. Features of the plan are: a shared activity area that is variable over a 24-hour cycle; alternative access routes (internal and external); capacity for subdivision into 2 homes; possibility of permanently fragmented 'home' with self-contained units and separate external access.

REFERENCES

Price, C., *Cedric Price*, London: Architectural Association, 1984.

052 Eastfields

DATE

1968

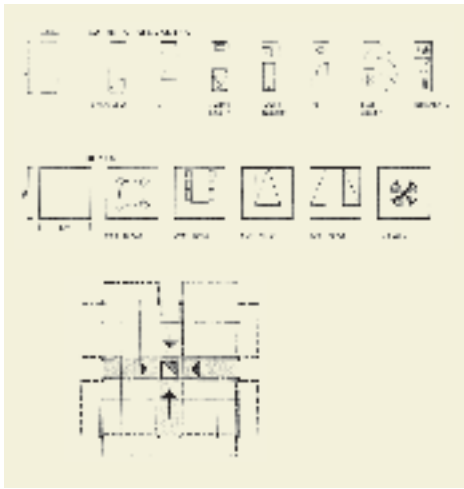
REFERENCES

'Eastfields, Acacia Avenue, Mitcham', *Architects' Journal*, 4, 1974, pp.177-79.

MacCormac, R., 'Redefining Densities', *Built Environment Quarterly*, 2, 1976, p.320-326.

'Pains Factory, Acacia Rd, Mitcham, Surrey', *Architectural Design*, January, 1968, p.13.

053 Habitations industrialisées par éléments modulés en bois



DATE

1968

COUNTRY

France

ARCHITECT

Jean Fatosme with Aloïs Bachmann

TYPE OF PROJECT

Residential and other uses

PROJECT DESCRIPTION

The idea behind the design for industrialised houses with standardised timber units was to create a system for varied uses providing maximum adaptability and possibilities for extension. The system is based on a cross-shaped plan with a central installation core, and is divided into 'cabines servantes', i.e. WC, bathroom, cupboards and kitchenette, and boxes, i.e. dining room, bedroom, living room or terrace.

REFERENCES

'Habitations industrialisées par éléments modulés en bois', *L'Architecture d'aujourd'hui*, 1968, p.59.

054 Sutton Dwellings

DATE

1968 (competition)

REFERENCES

'Sutton Dwellings, Plough Way, London, SE16', *Architectural Design*, January, 1968, p.8.

055 Kronsberger Strasse

DATE

1969

REFERENCES

Deilmann, H., J. C. Kirschenmann, and H. Pfeiffer, *Wohnungsbau. The Dwelling. L'habitat.* 3rd edn, Stuttgart: Karl Krämer Verlag, 1973.

056 Sigma System

DATE

1969

COUNTRY

France

ARCHITECT

Maurice Silvy

TYPE OF PROJECT

Multi-storey apartment block

PROJECT DESCRIPTION

Based on the Danish Conbox system — a framework in which prefabricated concrete units are integrated — this prefabricated system relies on a similar process where units are delivered to site almost finished with only joints and mains to be connected.

REFERENCES

'Vers une industrialisation de l'habitat', *Architecture d'aujourd'hui*, 148, 1970.

057 Wohnhaus Schärer

DATE

1969

REFERENCES

Gauchel, J., 'Intelligent Buildings', *Bauwelt*, 22, 1990, pp.1106-09.

Lautenschläger, R. R., 'Im Rausch der Systeme', *Deutsche Bauzeitung*, 5, 1990, pp.68-70.

Steinmann, M., 'Fritz Haller * 1924', *Baumeister*, 11, 1994, pp.36-39.

Wichmann, H., *System-Design, Fritz Haller*, Basel: Birkhäuser Verlag, 1989.

058 Alexandra Road

DATE

1969-78

REFERENCES

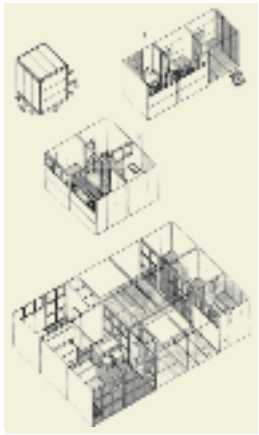
Freear, A., 'Alexandra Road: the last great social housing project', *AA Files*, 30, 1995, pp.35-46.

Henny, A., 'Camden, Last of the Big Spenders', *RIBA Journal*, 6, 1980, pp.43-45.
Maxwell, R., 'Alexandra Road: housing, school and community centre, Camden', *Architectural Review*, 990, 1979, pp.76-92.
McKean, C., and T. Jestico, *Guide to Modern Building in London*, London: Academy, 1976.
Sharp, D., 'Controversy in Camden', *Building*, 238, 1980, pp.38-43, 'Striking design for concrete housing at Alexandra Road, Camden', *Concrete*, 7136 (17), 1978, p.29.

059 Diagoon Houses

DATE
1971
REFERENCES
Hertzberger, H., 'Maisons "Diagoon", Delft', *Architecture d'aujourd'hui*, 169, 1978, pp.20-23.
Hertzberger, H., 'Diagoon houses, Delft', *A&U*, 4, 1991, pp.66-71.
Hertzberger, H., *Lessons for Students in Architecture*, Rotterdam: Uitgeverij 010 Publishers, 1991.
Schneider, F., ed., *Grundrißatlas Wohnungsbau – Floor plan atlas: housing*, Basel: Birkhäuser, 1994.

060 Building kit for summer houses

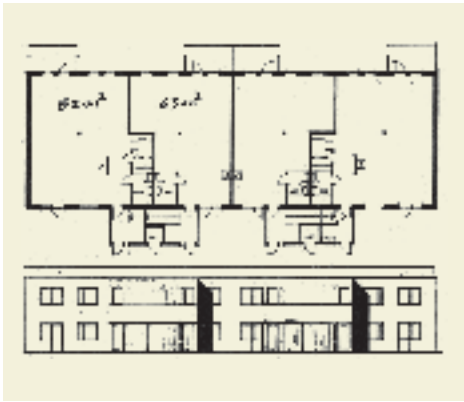


DATE
1971
COUNTRY
Finland
ARCHITECT
Kristian Gullichsen and Juhani Pallasma
TYPE OF PROJECT
Single-detached house
PROJECT DESCRIPTION
Around 60 summer houses were designed and built using this building kit, which consists of horizontal, vertical and equipment components that can be arranged in numerous combinations.
REFERENCES
Gullichsen, K., 'Massenproduktion, eine Illusion: Ein Sommerhaus für den Selbstbau', *werk, bauen + wohnen*, 4, 1998, pp.56-59.

061 Montereau

DATE
1971
REFERENCES
Arsène-Henry, L., and X. Arsène-Henry, 'La Défense, Immeuble, Montereau, Bordeaux le Lac', *Techniques et Architecture*, 292, 1973, pp.94-98.
Deilmann, H., J. C. Kirschenmann, and H. Pfeiffer, *Wohnungsbau. The Dwelling. L'habitat.* 3rd edn, Stuttgart: Karl Krämer Verlag, 1973.
Periàñez, M., *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.
Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.
Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility / adaptability?' *Architectural Design*, 2, 1974, pp.76-91.

062 Norrliden



DATE
1971
COUNTRY
Sweden
ARCHITECT
Skanska Cement AB Architects' Department
TYPE OF PROJECT
Multi-storey apartment block [500]
PROJECT DESCRIPTION
Units of 82m^2 or 63m^2 can be designed according to users' needs. Each unit has a fixed bathroom (the larger units also have a storage room) and a service duct to which the kitchen can be connected. Party walls (large cavity double skinned plasterboard on double steel studs plus rockwool) are non-load bearing and demountable; the party walls are also used for the distribution of services. Partitions are precast panels assembled by means of folding plastic wedges at floor level compressing a foam friction strip at the head, vertical joints are hardboard tongues.
REFERENCES
Periàñez, M., *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.
Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.

063 Orminge

DATE
1971
COUNTRY
Sweden
ARCHITECT
Joran Curman & Ulf Gillberg
TYPE OF PROJECT
Multi-storey apartment houses [550]
PROJECT DESCRIPTION
Each apartment starts as an open shell with two or three structural columns, within which the bathroom, a separate toilet and the kitchen are the only fixed items. The internal partition wall system of vinyl faced plasterboard (Skarne 66 system) comes in sizes of 1.20m, 90cm, 70cm, 60cm, 50cm, 45cm, 40cm and 20cm widths, with the smallest module containing electrical installations. Partitions are fixed by means of a locating batten laid over the floor finish and friction bolt against the ceiling.

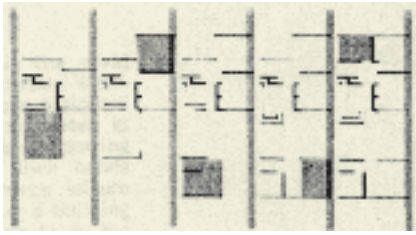
The housing estate employs project maintenance staff and electricians to help with alterations occupants want to make to the layout of their apartment.
REFERENCES
Dinelli, F., 'Residential quarter in Nacka, near Stockholm', *Industria delle costruzioni*, 156, 1984, pp.44-47.
Periàñez, M., *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.
Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.
Wallenstam, 'Västra Orminge – ovanlig del av miljonprogrammet', *Stamgästen*, 2, 2004, p.10.

064 Asemwald

DATE
1972
REFERENCES
Hafner, T., B. Wohn, and K. Rebholz-Chaves, *Wohnsiedlungen*, Berlin, 1998.
Jäger, O., and W. Müller, 'Wohnhäuser am Asemwald bei Stuttgart', *Deutsche Bauzeitung*, 7, 1964, pp.504-07.

Planungsgesellschaft mbH URBA, ed., *Leben in einer Hochhausanlage: Die Wohnstadt Asemwald aus Sicht ihrer Bewohner*, Stuttgart, 1975.
Simon, C., and T. Hafner, eds., *WohnOrte – 50 Wohnquartiere in Stuttgart von 1890 bis 2002*, *Stuttgarter Beiträge*, Stuttgart: Landeshauptstadt Stuttgart, 2002.

065 Extendible Houses



DATE
1972
COUNTRY
Britain
ARCHITECT
Derek Walker, Bill Berrett, Will Pope
TYPE OF PROJECT
Terraced house
PROJECT DESCRIPTION
The basic unit consists of bathroom / kitchen and living / sleeping areas and can be extended within a 1.20 metre planning module.
REFERENCES
'Extendible Houses', *Architectural Design*, June, 1972, p.371.
Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility / adaptability?' *Architectural Design*, 2, 1974, pp.76-91.

066 Immeubles Lods

DATE
1972
COUNTRY
France
ARCHITECT
Groupe Jean-Philippe Rameau
TYPE OF PROJECT
Multi-storey apartment block [500]
PROJECT DESCRIPTION
The blocks were built with the Système Industrialisé GEAI (Groupement d'Et. pour une Architecture Industrialisée), a system that transfers office building technology and planning to housing, with a central service core and clear spans. Due to the high degree of industrialisation, the subdivision of the building could be modified during assembly, i.e. adjacent 5 room apartments could be changed to 7- and 3-room in response to local demand.
REFERENCES
Lods, M., 'GEAI System', *Architectural Record*, 8, 1972, pp.123-26.
'500 Logements H.L.M. in 'Rouen Système Industrialisé GEAI', *werk, bauen + wohnen*, 4, 1970, pp.126-131.
Ministère de l'Equipement, 'Réactions des usagers à un habitat novateur, le groupe J.-Ph. Rameau à la Grand'Mare Rouen', Paris: Ministère de l'Equipement, 1974.

067 Wohnanlage Genter Strasse

DATE
1972
REFERENCES
'Anpaßbarer Wohnungsbau', *Baumeister*, 12, 1977, pp.1163-66.
Johann, W., 'Structuralisme in Prefab Beton: Variabele Woonstructuur München', *De Architect*, 12, 1981, pp.55-59.
Kossak, F., *Otto Steidle: bewohnbare Bauten = structures for living*, Zürich: Artemis, 1994.
Periàñez, M., *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.
'Wohnanlage in München', *Detail*, 4, 1985, pp.375-78.

068 Frey Haus

DATE
1973
COUNTRY
Austria
ARCHITECT
Ernst Plischke
TYPE OF PROJECT
Single-detached house [1]
PROJECT DESCRIPTION
Large sliding screens open up or close down different parts of the building's ground floor, so that they can be used independently from each other or as one continuous space in order to meet changing requirements and circumstances. When open, each of the storey-high screens is contained within a fixed piece of wall, and, when closed, they always close against a wall or column.
REFERENCES
Allison, P., 'Mobile elements in social housing in Austria', *ARCH+*, 134/135, 1996, pp.104-05.

069 Metastadt

DATE
1974
COUNTRY
Germany
ARCHITECT
Richard Dietrich
PROJECT DESCRIPTION
As with the Square L-Type system by the architects Van den Broek and Bakema, the Metastadt building system was supposed to provide a concept for a flexible model of urbanism. A pilot scheme supported by the Federal Government, the system behind the Metastadt development is that of a space plan that is supposed to be capable of unlimited horizontal and vertical growth. The main structural module is 4.2 by 4.2m and 3.6m high, with an interior module of 0.6m. Main column support is every 16.8m, and cantilever spans can measure up to 8.4m. Within this frame, enclosure can be created as needed.

The various elements of the system such as the load-bearing structure, non-loadbearing panels and services were kept independent. The space frame structure itself is bolted to allow easy assembly and disassembly — everything remains changeable and adaptable. The infill system is separate from structural system: the office spaces have demountable walls whilst partition walls in apartments are made of plasterboard. The façade panels are based on a small set of interchangeable parts with a vertical and horizontal module of 0.3m held in position by 'push buttons'. One further aspect that contributes to the system's flexibility is the servicing system, which is accommodated in raised floors with a clearance of 0.45m.

Even the name, Metastadt, hints at the idealism and uncompromising nature of the scheme. In the end, due to technical faults that resulted from cost cutting measures, the building was demolished in the 1980s.

REFERENCES
Cox, K.-H., 'Aus der Traum: Zehn Jahre Metastadt und was nun?' *Stadtbauwelt*, 24, 1985, pp.959-63.
Deilmann, H., J. C. Kirschenmann, and H. Pfeiffer, *Wohnungsbau. The Dwelling. L'habitat.* 3rd edn, Stuttgart: Karl Krämer Verlag, 1973.

Janssen, M., 'Interview mit dem Metastadt-Architekten Richard J. Dietrich: Man hätte uns nicht in Richtung Wulfen treiben dürfen', *Bauwelt*, 46, 1988, pp.1990-95.
Janssen, M., 'Metastadt, Wulfen: Eine Studentin von heute über eine Utopie von gestern', *Bauwelt*, 46, 1988, pp.1990-91.
Kuhnert, N., and P. Oswalt, 'Für eine Architektur des Gebrauchs', *ARCH+*, 100/101, 1989, pp.22-23.

070 Housing Estate Olari

DATE
1975
COUNTRY
Finland
ARCHITECT
Eero Valjakka + Simo Järvinen
TYPE OF PROJECT
Mixed use with multi-storey apartment block
PROJECT DESCRIPTION
Three-, five- and eight-storey building clusters, all based on the same constructional system, are arranged around garden courtyards. The module of 3.6 by 3.9 metres defines both the apartment sizes as well as block dimensions.
REFERENCES
Schwalb, G., *Differenzierte Wohnanlagen. Differentiated Housing Estates. Ensembles d'habitations différenciées*, Stuttgart: Karl Krämer Verlag, 1975.

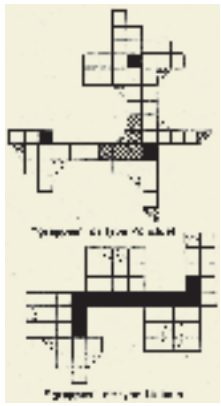
071 Les Anticonformes

DATE
1975
REFERENCES
'Les Anticonformes', *Construction moderne*, 3, 1975, pp.28-33.
Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.

072 Les Marelles

DATE
1975
REFERENCES
Georges Maurios, Paris: Editions du Moniteur, 1990.
Herrou, M., and G. Maurios, 'Les Marelles une structure servante irriguée de fluides', *les Cahiers du CSTB*, 1976.
Periàñez, M., *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.
Rabeneck, A., 'Adaptable Housing by Georges Maurios', *Architectural Design*, 9, 1975, pp.567-70.
Vernez-Moudon, A., 'Les Marelles: Lessons in Dwelling Design', *Industrialisation Forum*, 1, 1976.

073 Combinatoires Urbaines



DATE
1975
COUNTRY
France
ARCHITECT
Henri-Pierre Maillard
TYPE OF PROJECT
Unrealised
PROJECT DESCRIPTION
Any number of 4.5 by 4.5m structural modules (partition planning module: 900 by 900mm) can be connected to form one residential unit. These units can then be arranged along a linear corridor or multiple-loaded interior stairwells. Several forms of construction are possible; for a second project, the intent was for users to participate in the cluster-planning stage.
REFERENCES
Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.

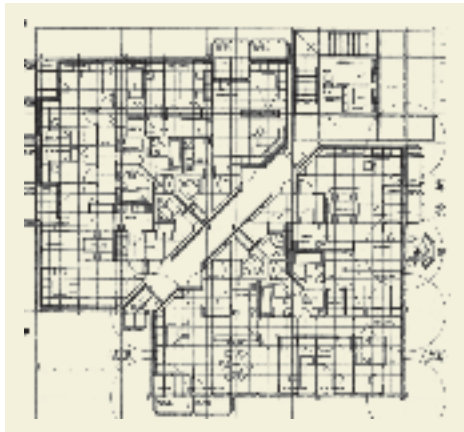
074 Flexibo

DATE
1976
REFERENCES
Duelund Mortensen, P., H. G. Welling, M. Livø, K. Utoft Christensen, and L. Wiell, 'Dwellings Defined by Situations – Dwellings Suitable for Changing Life Conditions', in *Housing in Europe: New Challenges and Innovations in Tomorrow's Cities*, Reykjavik, 2005.
'Flexibo, Amager: Arkitekter: Fællestegnestuen, with Viggo Møller-Jensen, Tyge Arnfred and Jørn Ole Sørensen.' *Arkitektur DK*, 6, 1979, pp.232-39.

075 Housing Group in Purkersdorf

DATE
1976
REFERENCES
Prader, H., *Partizipation im sozialen Wohnhausbau. Modell Purkersdorf*, Wien: Selbstverlag der Architekten Prader Fehringer Ott, 1977.
Prader, H., F. Fehringer, and E. Ott, 'Wohnhausanlage Purkersdorf, Dr.Hild-Gasse (Österreich). Ein Partizipationsmodell in sozialen Wohnungsbau', *werk · archithese*, 11/12, 1977, pp.14-18.
Schwalb, G., *Differenzierte Wohnanlagen. Differentiated Housing Estates. Ensembles d'habitations différenciées*, Stuttgart: Karl Krämer Verlag, 1975.

076 Linz-Haselgraben



DATE
1976
COUNTRY
Austria
ARCHITECT
Werkgruppe Linz
TYPE OF PROJECT
Multi-storey apartment block
PROJECT DESCRIPTION
The construction of the experimental buildings in Linz-Haselgraben was developed within the context of a government programme on flexible living. The buildings were conceived as three levels (similar to layers): structure (level 1), services (level 2), and individual infill according to requirements and desires of users (level 3). The number of possible plans within the given structure is, as a result of this division into three levels, virtually unlimited. All units within the owner occupied dwelling are different. Changes proposed by the future occupants (incorporated into the later plan) were: a maisonette instead of an apartment,

adjustment of unit size, changes in number of rooms and size, functional relations between rooms, position and size of balconies, number and size of windows, and the position of wet areas and kitchens. The layered system has allowed changes to be made over time.

REFERENCES

Linz Werkgruppe, 'Flexibles Wohnen', *werk · archithese*, 11/12, 1977, pp.19-20.

'Living in apartments planned to order in Linz-Haselgraben', *AC*, 1 (105), 1982, pp.20-23.

077 Hollabrunn

DATE

1976

REFERENCES

'A plan-it-yourself experiment: future occupants participate in designing their own homes in Wohnen Morgen, a new residential district of Hollabrunn', *Domus*, 559, 1976, pp.9-16.

Dirisamer, R., F. Kuzmich, O. Uhl, and W. Voss, 'Überbauung "Wohnen morgen" in Hollabrunn, Niederösterreich', *werk · archithese*, 11/12, 1977, pp.21-24.

Froyen, H.-P., 'A review of 3 projects: Wohnen Morgen in Hollabrunn, architects Ottokar Uhl and Jos P Weber; support-infill project for tenants in Vienna, architect Ottokar Uhl; and an examination of existing mass housing as support', *Openhouse*, 4, 1977, pp.21-29.

Johann, W., '"Wohnen Morgen" in Hollabrunn', *Architect (The Hague)*, 11, 1981, pp.68-71.

'Wohnhausanlage ""Wohnen Morgen"", *Bauforum*, 111, 1985, pp.19-23.

Wulz, F., 'Partizipation im Wohnungsbau', *Deutsche Bauzeitung*, 4, 1980, pp.51-58.

078 Molenvliet

DATE

1977

REFERENCES

Fassbinder, H., and J. v. Eldonk, 'Flexibilität im niederländischen Wohnungsbau', *ARCH+*, 100/101, 1989, pp.65-73.

Fritz-Haendeler, R., 'Sozialwohnungsbau in den Niederlanden – Fünf Beispiele', *Bauwelt*, 8, 1982, pp.256-67.

Kendall, S., and J. Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000.

Minami, K., 'Open building in the Netherlands – an evaluation.' *open house international*, 4, 2001, pp.59-66.

Werf, F. v. d., and H.-P. Froyen, 'Molenvliet-Wilgendonk: experimental housing project, Papendrecht', *Harvard Architecture Review*, 1, 1980, pp.161-69.

079 Brockley Park Estate

DATE

1978

COUNTRY

Britain

ARCHITECT

Lewisham Architects Department

TYPE OF PROJECT

Terraced Houses [89]

PROJECT DESCRIPTION

Brockley Park Estate comprises of 89 residential units on two to three storeys. The housing scheme was designed by the London Borough of Lewisham's architects department and can, though simple in plan, accommodate both large and small families and also respond to changes in family size. The standard type is a two-storey house, in which the 2 large upper rooms are designed so that they can be divided to give up to four small bedrooms. The front extension, or 'granny pod' can be used either as an independent or semi-independent unit, since it shares a hallway. In the architects' plans it is shown successively as a children's room, a study bedroom for a teenager, a bedsitter that can be rented out and a granny flat. The pod also came with planning permission to build a second storey on top of it.

REFERENCES

''Granny pod' flexible housing', *Architects' Journal*, 8, 1978, p.333.

Pike, R., and C. Powell, 'Housing Flexibility Revisited', *MADE*, 1, 2004, pp.64-71.

'Roof and External Walls: Housing Lewisham Architects' Dept', *Architects' Journal*, 15, 1990, pp.63-65.

080 Lunetten

DATE

1978

COUNTRY

The Netherlands

ARCHITECT

Frans van der Werf with Werkgroep Kokon Architecten

TYPE OF PROJECT

Multi-storey apartment block [431]

PROJECT DESCRIPTION

The housing development of 431 units was realised using SAR open building methods, with the loadbearing structure based on a grid of 5.4 by 5.4 metres. Within this grid, future residents were free to develop their respective apartments.

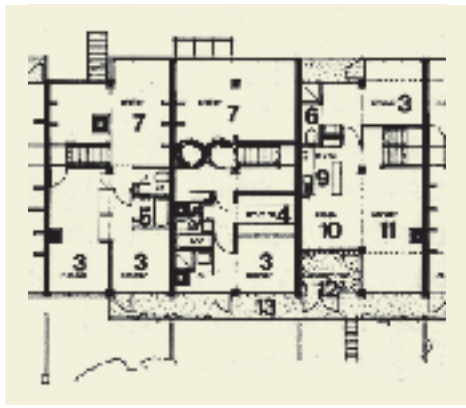
REFERENCES

Digitaal Museum van de Volkshuisvesting, 'Lunetten', Internationaal Instituut voor Sociale Geschiedenis, 2001, <http://www.iisg.nl/volkshuisvesting/p28.html>

'Housing project Lunetten', *Architect (The Hague)*, 9, 1982, pp.56-65.

Zwinkels, C., 'Een niewe Loot aan de Sar-Stam: Drager-Inbouwproject Lunetten', *De Architect*, 9, 1982, pp.56-65.

081 Wasterkingen



DATE

1978

COUNTRY

Switzerland

ARCHITECT

Walter Stamm

TYPE OF PROJECT

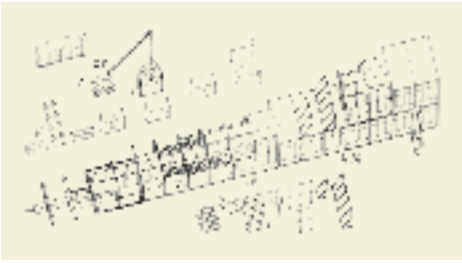
Terraced house

PROJECT DESCRIPTION

Crosswalls at regular intervals divide the buildings into separate areas. Within the perimeters of these two walls, there are no restrictions as to the subdivision of the units.

REFERENCES
Gmur, O., 'Reihenhaussiedlung in Wasterkingen ZH', *Archithese*, 6, 1981, pp.62-63.
Kuhnert, N., P. Oswalt, and W. Stamm, 'Die Wohnung für den Zweitmieter', *ARCH+*, 100/101, 1989, pp.30-33.
Ullmann, G., 'Wohngenossenschaft "Im Spitz": Auf der Suche nach neuen Lebensformen', *Deutsche Bauzeitung*, 4, 1982, pp.16-21.

082 Industrialized Construction System



DATE
1978-82
COUNTRY
Italy
ARCHITECT
Renzo Piano Building Workshop
TYPE OF PROJECT
Terraced house
PROJECT DESCRIPTION
The project is a plan for a public housing project (100 homes) based on the idea of evolving home-units. The project for Perugia grew out of an earlier study conducted for the Vibro-cemento company, to create a mass-production building system allowing freedom of layout of the interiors by the occupants themselves. The experimental prototype consisted of two U-shaped factory-made components forming a tunnel 6 metres high and 12 metres long, permitting various different layouts on either one or two floors. The interior is partitioned both horizontally and vertically by a simple metalwork system, using trusses and movable panels for walls and windows.

REFERENCES
Renzo Piano Building Workshop 1964-1988, Tokyo: a + u Publishing co., Ltd., 1989.

083 Adelaide Road Estate

DATE
1979

REFERENCES
GLC, 'Das Projekt PSSHAK', *werk · archithese*, 11/12, 1977, pp.11-13.
Kendall, S., and J. Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000.
Moseley, R., 'New drivers for fit-out development in the UK', *open house international*, 3, 2001, pp.47-50.
Pike, R., and C. Powell, 'Housing Flexibility Revisited', *MADE*, 1, 2004, pp.64-71.
'PSSHAK Mark 2: flexible GLC housing takes a step forward', *Architects' Journal*, 21, 1975, pp.1070-73.
Rabeneck, A., 'The new PSSHAK', *Architectural Design*, 10, 1975, pp.629-33.
Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' *Architectural Design*, 11, 1973, pp.698-727.
Worthington, J., 'Breakthrough in flexible housing', *Official architecture and planning*, 8, 1971, pp.595-97.

084 Feßtgasse Housing

DATE
1980

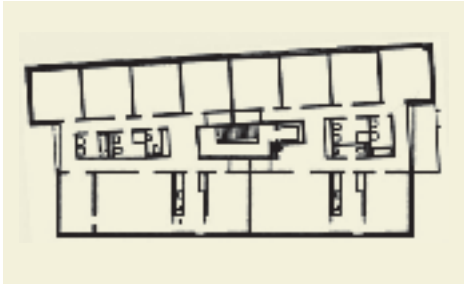
REFERENCES
Bielicki, J. S., 'Wohnhaus der Gemeinde Wien' <http://www.jsbielicki.com/uhl/Projekte/Fesstgasse/fesstgasse.html> [Accessed 3 September 2004].
Froyen, H.-P., 'A review of 3 projects: Wohnen Morgen in Hollabrunn, architects Ottokar Uhl and Jos P Weber; support-infill project for tenants in Vienna, architect Ottokar Uhl; and an examination of existing mass housing as support', *Openhouse*, 2, 1977, pp.21-29.
Kamleithner, C., J. Porsch, and B. Steger, eds., *Ottokar Uhl*, Salzburg: Anton Pustet, 2005.

085 Wohnhaus

DATE
1982

REFERENCES
Freiberg, J., 'Quel habitat, pour qui?' *Architecture d'aujourd'hui*, 225, 1983, pp.1-34.
Kühn, C., ed., *Anton Schweighofer: a quiet radical: buildings, projects, concepts*, Wien: Springer, 2001.
Sartoris, A., 'Anton Schweighofer: Arbeiten aus den Jahren 1984-1989', *Bauforum*, 134, 1989, pp.7-40.
'Zentralraum und Kreuzgrundriss', *werk, bauen + wohnen*, 5, 1989, pp.40-41.

086 Wohnhäuser im St. Alban Tal



DATE
1982
COUNTRY
Switzerland
ARCHITECT
Diener & Diener
TYPE OF PROJECT
Multi-storey apartment block
PROJECT DESCRIPTION
No differentiation in terms of size or hierarchy was made between the individual rooms to allow for different uses. The generous amount of circulation space adds to this concept, making all rooms separately accessible.

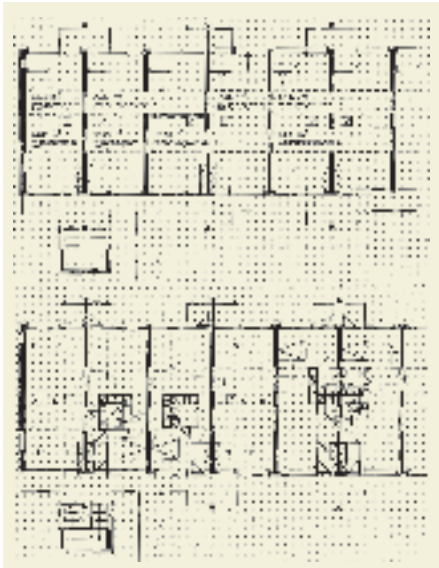
REFERENCES
Jehle-Schulte Strathaus, U., 'Modernism of a most intelligent kind: a commentary on the work of Diener & Diener', *Assemblage*, 3, 1987, pp.72-107.
Schett, W., 'Swiss City-Blindness', *Daidalos*, 60, 1996, pp.62-73.
'Three constructed buildings', *werk, bauen + wohnen*, 12, 1987, pp.50-57.

087 Flexibele Woningbouw

DATE
1984

REFERENCES
'Flexibele woningbouw te Rotterdam', *Bouw*, 7, 1985, pp.35-37.
Stoutjesdijk, H., 'Proefproject Honingerdijk', *Architect (The Hague)*, 2, 1985, pp.26-31.

088 Keyenburg



DATE
1984
COUNTRY
The Netherlands
ARCHITECT
Frans van der Werf
TYPE OF PROJECT
Multi-storey apartment block

PROJECT DESCRIPTION

A project that develops Open Building principles used by van der Werf in previous schemes. The structural framework of pierced crosswalls allows free internal subdivision as well as connections between the structural segments.

REFERENCES

Minami, K., 'Open building in the Netherlands – an evaluation.' *open house international*, 4, 2001, pp.59-66.

Monroy, M. R., and R. P. Geraedts, 'May we add another wall, Mrs Jones?' *open house international*, 3, 1983, pp.3-9.

089 Projekt Wohnhaus

DATE

1984

REFERENCES

Kühn, C., ed., *Anton Schweighofer: a quiet radical: buildings, projects, concepts*, Wien: Springer, 2001.

Lampugnani, V. M., 'Un Immeuble Berlinois', *Architecture d'aujourd'hui*, 225, 1983, pp.33-34.

Sartoris, A., 'Anton Schweighofer: Arbeiten aus den Jahren 1984-1989', *Bauforum*, 134, 1989, pp.7-40.

Schweighofer, A., 'Zentralraum als "Küchenwerkstatt"', *werk, bauen + wohnen*, 3, 1984, pp.28-35.

090 Kruisplein

DATE

1985

COUNTRY

The Netherlands

ARCHITECT

Mecanoo

TYPE OF PROJECT

Multi-storey apartment block [54]

PROJECT DESCRIPTION

The competition brief asked for a housing scheme that could easily be grouped or modified to give different levels of collectiveness. The individual units are undifferentiated in relation to possible use, although a difference is made between units mainly used by individuals and units where facilities are shared with others.

REFERENCES

Houben, F., P. Vollaard, and L. Waaijers, *Mecanoo architecten = Mecanoo architects*, Rotterdam: Uitgeverij 010 Publishers, 1998.

'Housing, Kruisplein, Rotterdam', *Process: architecture*, 112, 1993, pp.90-93.

'Mecanoo – agricultural research institute, Wilhelminadorp / Galerie Bebert, Rotterdam / social housing, Kruisplein, Rotterdam', *Architecture mouvement continuite*, 23/24, 1988/1989, pp.100-07.

Rodermond, J., 'Housing competition for Kruisplein, in the centre of Rotterdam, brings some surprising results', *Architect (The Hague)*, 11, 1981, pp.34-41.

Stoutjesdijk, H., 'Mecanoo verheft Kruisplein te Rotterdam', *Architect (The Hague)*, 7/8, 1985, pp.40-47.

'Woongebouw te Rotterdam', *Bouw*, 1, 1986, pp.23-26.

091 Nemausus

DATE

1985

REFERENCES

Aldersey-Williams, H., 'A chip off the old block: Hugh Aldersey-Williams compares two iconic public apartment blocks in the south of France – one by Le Corbusier, the other by Jean Nouvel', *Building Design*, 958, 1989, pp.40-41.

Duroy, L., 'Le Quartier Nemausus [1]', *Architecture d'aujourd'hui*, 252, 1987, pp.2-10.

Lucan, J., '"Nemausus 1" Wohnüberbauung mit Lofts, Nîmes, 1985', *werk, bauen + wohnen*, 3, 1990, pp.56-58.

Schneider, F., ed., *Grundrißatlas Wohnungsbau – Floor plan atlas: housing*, Basel: Birkhäuser, 1994.

Zaera, A., and J. Nouvel, 'Nemausus experimental scheme', *El Croquis*, 65/66, 1994, pp.94-112.

092 Quartier Saint-Christophe

DATE

1985

COUNTRY

France

ARCHITECT

Archiplus (Jean Bernard + Francis Soler)

TYPE OF PROJECT

Multi-storey apartment block [103]

PROJECT DESCRIPTION

In this project, only stairs, bathrooms and kitchens are fixed in plan. Individual rooms carry no labels and their proportion and size enable different interpretations as to the way the apartments are used.

REFERENCES

'Entre Loger et Habiter', *Architecture d'aujourd'hui*, 225, 1983, pp.30-32.

093 Wohnüberbauung Riehenring

DATE

1985

COUNTRY

Switzerland

ARCHITECT

Diener & Diener

TYPE OF PROJECT

Mixed use with multi-storey apartment block [74]

PROJECT DESCRIPTION

Apartments consist of a zone of equally sized rooms, individually accessed from a central hall, which contains entrance, bathroom and kitchen. Thereby, apartments can be used by three unrelated people sharing or a family.

REFERENCES

Jehle-Schulte Strathaus, U., 'Hofraum als Ergänzung der Stadt', *werk, bauen + wohnen*, 4, 1985, pp.47-56.

Jehle-Schulte Strathaus, U., 'Modernism of a most intelligent kind: a commentary on the work of Diener & Diener', *Assemblage*, 3, 1987, pp.72-107.

Schneider, F., ed., *Grundrißatlas Wohnungsbau – Floor plan atlas: housing*, Basel: Birkhäuser, 1994.

'Three constructed buildings', *werk, bauen + wohnen*, 12, 1987, pp.50-57.

094 Fleksible Boliger

DATE

1986

REFERENCES

Christiansen, J. H., 'Fleksible boliger', Arkitekten (Copenhagen), 18, 1988, pp.A484-A90.

'Om fleksible boliger for unge og aeldre', Arkitekten (Copenhagen), 20, 1986, pp.461-68.

095 Wohnregal

DATE

1986

REFERENCES

Davey, P., and D. Clelland, 'Self-build housing, Admiralstrasse (Luisenstadt)', *Architectural Review*, 1082, 1987.

'Haus der 12 Häuser: das Wohnregal', *MD*, 11, 1987, pp.54-59.

Schneider, F., ed., Grundrißatlas Wohnungsbau – *Floor plan atlas: housing*, Basel: Birkhäuser, 1994.

Stürzebecher, P., 'Selbstbau', *Aktuelles Bauen*, 5, 1985, pp.28-48.

Stürzebecher, P., '"Wohnregal"', *Bauwelt*, 8, 1985, pp.264-67.

Stürzebecher, P., '"Wohnregal"', Internationale Bauausstellung Berlin', *Detail*, 5, 1986, pp.459-65.

096 Funktionsneutrale Räume

DATE

1987

REFERENCES

Kuhnert, N., P. Oswalt, and W. Stamm, 'Die Wohnung für den Zweitmieter', *ARCH+*, 100/101, 1989, pp.30-33.

097 Honor Oak Park

DATE

1987

REFERENCES

Ellis, C., 'Do-it-yourself vernacular', *Architects' Journal*, 51, 1980, pp.1185-205.

Ellis, C., 'Self-Build Selection', *Architects' Journal*, 4, 1984, pp.36-39.

McKean, J., Learning from Segal: Walter Segal's Life, Work and Influence. ed. by Schilling, R., Architektur im Zusammenhang, Basel: Birkhäuser, 1989.

098 Wohn- und Geschäftshaus

DATE

1987

COUNTRY

Germany

ARCHITECT

Brenner + Tonnon

TYPE OF PROJECT

Mixed use with multi-storey apartment block

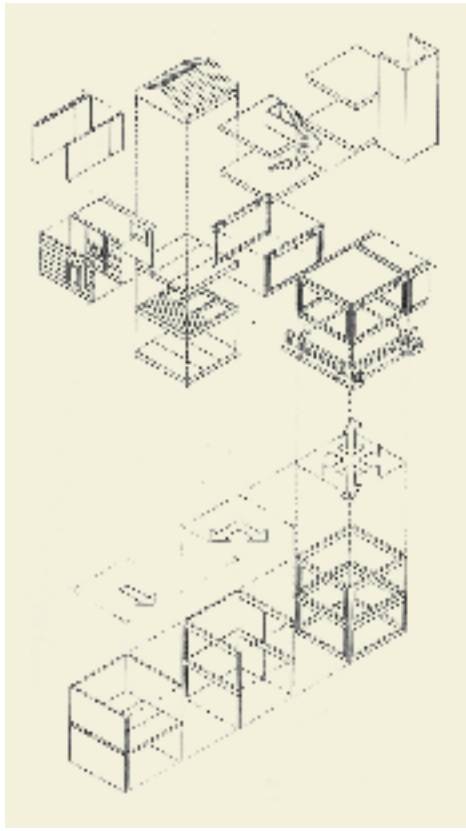
PROJECT DESCRIPTION

A variation on the cross-shaped plan: rooms of equal size can be linked in different ways by opening or closing specific connections.

REFERENCES

Tonon, B., N. Kuhnert, and P. Oswalt, 'Interpretierbare Räume', ARCH+, 100/101, 1989, pp.24-29.

099 Ålekistevej



DATE

1988

COUNTRY

Denmark

ARCHITECT

Hvidt + Mølgaard

TYPE OF PROJECT

Mixed use with multi-storey apartment block [18]

PROJECT DESCRIPTION

This apartment building in Copenhagen was the winning scheme in a competition set out by the Danish Ministry of Housing for entirely industrialised residential buildings. The 4-storey scheme accommodates a supermarket on the ground floor and 18 apartments, some of which are arranged over two storeys.

The structural frame of the building is a concrete column and beam system with all joints dry finished. Flexibility is provided by the modularity of the exterior and interior building elements and their easy de- and remountability. Horizontal conduits and pipes lie in the floor / ceiling elements and vertical shafts within the layer of the façade, which allows an entirely free disposition of partition walls. Façade elements can be removed and floor modules disassembled, thus enabling low cost and relatively easy adjustments of a building in accordance to changing housing needs.

REFERENCES

Skriver, P. E., 'Etagehus, Ålekistevej', *Arkitektur* DK, 8, 1988, pp.360-65.

100 Habitat Industriel 'La Faye'

DATE

1989

COUNTRY

Switzerland

ARCHITECT

Rudolphe Luscher

TYPE OF PROJECT

Mixed use with live / work and terraced houses

PROJECT DESCRIPTION

Each unit consists of two zones: a narrow zone with staircase and servicing rooms and a wider zone comprising of rooms of equal size over three storeys (one room to the front, one room to the back — separated by a courtyard / atrium).

REFERENCES

Brookes, A., and M. Stacey, 'Rodolphe Luscher in La Faye',

Architectural Review, 1105, 1989, pp.58-63.
Fumagalli, P., 'Immer neu erfinden? Projektwettbewerb für ein industrielles Wohnquartier in Givisiez, Fribourg', *werk, bauen + wohnen*, 12, 1986, pp.4-8.
Luscher, R., 'The 'La Faye' industrial housing estate in Givisiez', *werk, bauen + wohnen*, 4, 1988, pp.34-40.

101 Ingolstadt [Europan 1989]

DATE
1989
REFERENCES
Conrads, U., 'Die acht ausgezeichneten Arbeiten: EUROPAN 1989 Bundesrepublik Deutschland', *Bauwelt*, 24, 1989, pp.1168-77.
Modes de vie. *Architectures du logement*, Paris: Techniques & Architecture, 1989.

102 Dapperbuurt

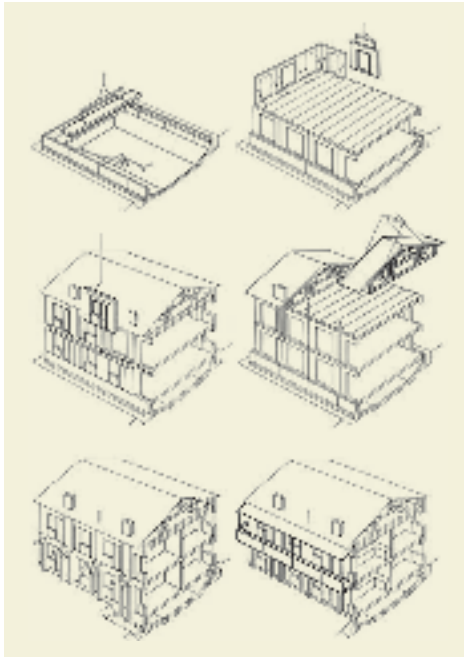
DATE
1989
REFERENCES
Galfetti, G. G., Pisos Piloto – *Model Apartments: Experimental domestic cells*, Barcelona: Editorial Gustavo Gili, 1997.
Periàñez, M., *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.
Priemus, H., 'Flexible housing: fundamentals and background', *open house international*, 4, 1993, pp.19-26.

103 Am Steinberg / Röthenbach

DATE
1990
REFERENCES
Marschall, W., 'Siedlung in Röthenbach', *Baumeister*, 7, 1992, p.38.
Ryffel, T., 'Some observations on the outside open spaces', *Anthos*, 1, 1993, pp.9-12.

104 The Dynamic House

DATE
1990
COUNTRY
Sweden
ARCHITECT
SKARNE Group
TYPE OF PROJECT
Multi-storey apartment block
PROJECT DESCRIPTION
The Dynamic House is a building system with a large degree of flexibility to facilitate future reconfiguration as needs change with time. Basic factory-made components (concrete load-bearing external wall units + hollow-core concrete floor slabs) allow for total internal planning flexibility and convertibility. The installation of water, heat, ventilation and electricity is integrated with and part of the system. The electrical system is installed in one single operation once the floor covering and wallpapering work has been completed. If the room layout of the apartment is subsequently changed the electrical installations can be easily moved. Internal drainage pipes in the hollow-core floor slabs and in the cladding panels on the entrance side of the building are easily accessible.



REFERENCES
Skarne, 'The Dynamic House' <http://www.skarne.com/> [Accessed 5 April 2005].

105 Davidsboden

DATE
1991
COUNTRY
Switzerland
ARCHITECT
Erny, Gramelsbacher and Schneider
TYPE OF PROJECT
Multi-storey apartment block [160]
PROJECT DESCRIPTION
The load-bearing structure of the complex is reduced to a minimum so that internal walls can be placed in a variety of positions. Davidsboden also represents an innovative approach in residential developments as it seeks to apply existing experience of community-oriented, co-determined and self-managed housing to a large rental housing complex in an urban context.
REFERENCES
Gysi, S., 'Lernen vom Davidsboden. Ein innovatives Wohnmodell im Rückblick', *Wohnen*, 10, 2001.
Henz, A. and H. Henz, *Anpassbare Wohnungen*, Zürich: ETH Wohnforum, 1997.
Meyer-Meierling, P. (ed.), *Davidsboden. Wohnüberbauung in Basel-St. Johann 1989-1991*, Zürich: vdf Hochschulverlag AG an der ETH Zürich, 1994.

106 Hinged Space

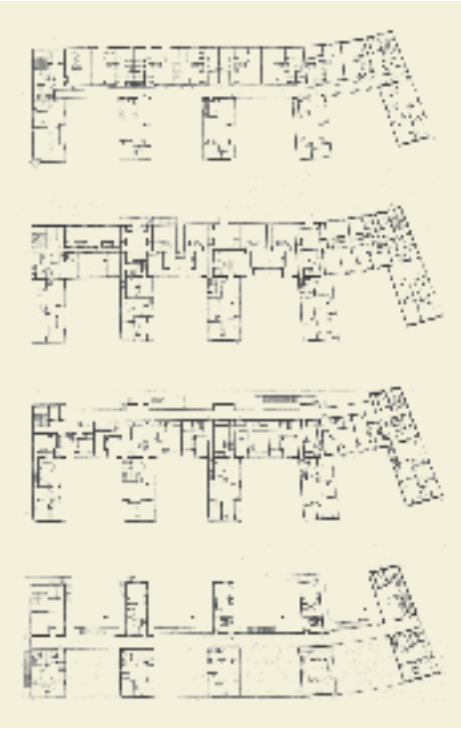
DATE
1991
COUNTRY
Japan

ARCHITECT

Steven Holl

TYPE OF PROJECT

Multi-storey apartment block [28]



PROJECT DESCRIPTION

During the day, hinged panels and doors allow the expansion of the living area, which can be reclaimed as a bedroom at night.

REFERENCES

Jacques, M., and A. Nève, eds., *Steven Holl*, Basel: arc en rêve centre d'architecture / Birkhäuser, 1993.

107 The Convertible House

DATE

1991

COUNTRY

Canada

ARCHITECT

Dovertel Construction Ltd.

TYPE OF PROJECT

Single detached house [1/2]

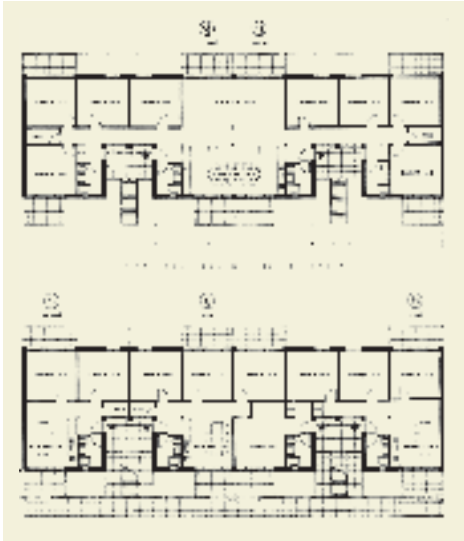
PROJECT DESCRIPTION

The goal was to construct an affordable house that can be converted from a one-dwelling unit into two-dwelling units and vice versa. The project was aimed at first-time buyers, who would rent out one half and live in the other, but have the potential to join the two together as income increased. The price, including construction and land, is around Canadian $275,500 (c.£115,000).

REFERENCES

CMHC, 'The Convertible House – Vancouver, British Columbia' <http://www.cmhc-schl.gc.ca/en/imquaf/afho/afadv/cohode/deflho/case2.cfm> [Accessed 20 December 2004].

108 Überbauung Brahmshof



DATE

1991

COUNTRY

Switzerland

ARCHITECT

Kuhn und Fischer und Partner

TYPE OF PROJECT

Multi-storey apartment block

PROJECT DESCRIPTION

Only the entrance, toilet, bathroom and kitchen, are fixed within an otherwise undefined space. The function of individual rooms is not pre-determined. The building is designed to allow for horizontal and vertical connection between adjacent dwelling units. All rooms are 14m in size and all are square.

REFERENCES

'Brahmshof Zürich', *werk, bauen + wohnen*, 12, 1993, Werk-Material pp.1-6.

Caduff, C., and J.-P. Kuster, eds., *Wegweisend wohnen. Gemeinnütziger Wohnungsbau im Kanton Zürich an der Schwelle zum 21. Jahrhundert*, Zürich: Scheidegger & Spiess AG, Verlag, 2000.

109 Überbauung Hellmutstrasse

DATE

1991

REFERENCES

Leupen, B., R. Heijne, and J. v. Zwol, eds., *Time-based Architecture*, Rotterdam: 010 Publishers, 2005.

'Uberbauung Hellmutstrasse Zürich (Wogeno), im Bau', *werk, bauen + wohnen*, 5, 1989, pp.50-51.

110 Clemensänger

DATE

1993

COUNTRY

Germany

ARCHITECT

Hermann Hertzberger

TYPE OF PROJECT

Mixed use with residential (unbuilt competition entry)

PROJECT DESCRIPTION

Hertzberger submitted this scheme as part of an invited competition commissioned by the Stadt Freising, Germany, which was looking to accommodate residential and office accommodation. All buildings and possible uses are based on the same structural grid, which can be filled according to demand and need of the end user. Submitted plans for parking, different types of offices and residential use illustrate this potential.

REFERENCES

Hauptmann, D., and H. v. Bergeijk, 'Structuur en gebaar: recent werk van Herman Hertzberger', *Architect (The Hague)*, 2, 1994, pp.20-47.

Vermeulen, P., 'Het hiernamaals van het structuralisme', *Archis*, 12, 1993, pp.17-27.

111 Next 21

DATE
1993
REFERENCES
Habraken, J., 'Making Urban Fabric Fine Grained: A Research Agenda', in *International conference on open building*, ed. by Beisi, J., Hong Kong: University of Hong Kong, Faculy of Architecture, 2003, pp.27-32
Kamo, M., 'Construction System and Remodeling Experiments at Experimental Housing Next21', in *Continuous Customization in Housing*, Tokyo, 2000, pp.87-94.
Kendall, S., and J. Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000.
Leupen, B., R. Heijne, and J. v. Zwol, eds., *Time-based Architecture*, Rotterdam: 010 Publishers, 2005.
Sawada, S., and J. Habraken, 'Experimental apartment building, Osaka, Japan', *Domus*, 819, 1999, pp.18-25.

112 Social Housing

DATE
1993
COUNTRY
Switzerland
ARCHITECT
Morger + Degelo
TYPE OF PROJECT
Multi-storey apartment block [26]
PROJECT DESCRIPTION
This is a variation on the nineteenth century apartment block. Each unit features a series of equally sized rooms, all of which can be accessed independently.
REFERENCES
Schett, W., 'Swiss City-Blindness', *Daidalos*, 60, 1996, pp.62-73.
Schneider, F., ed., *Grundrißatlas Wohnungsbau – Floor plan atlas: housing*, Basel: Birkhäuser, 1994.

113 Banner Building

DATE
1994
REFERENCES
'AIA Honor Awards', *Architecture (AIA)*, 5, 1996, pp.185-211, 80.
'Banner Building', *Architectural Record*, 1, 1995, pp.86-89.
Kendall, S., and J. Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000.

114 Housing Graz-Straßgang

DATE
1994
REFERENCES
Allison, P., 'Architectuur uit Graz', *Archis*, 9, 1995, pp.62-63.
Bott, H., and V. v. Haas, *Verdichteter Wohnungsbau*, Stuttgart, Berlin, Köln: Kohlhammer, 1996.
Leupen, B., R. Heijne, and J. v. Zwol, eds., *Time-based Architecture*, Rotterdam: 010 Publishers, 2005.
Schneider, F., ed., *Grundrißatlas Wohnungsbau – Floor plan atlas: housing*, Basel: Birkhäuser, 1994.
'Wohnbauten', *AIT*, 1/2, 1995, pp.27-35.

115 Brandhöfchen

DATE
1995
REFERENCES
Bott, H., and V. v. Haas, *Verdichteter Wohnungsbau*, Stuttgart, Berlin, Köln: Kohlhammer, 1996.
Weiß, K.-D., 'Am Burghof, Bonames, Frankfurt', *Bauwelt*, 28, 1995, pp.1572-77.

116 Single family house

DATE
1995
COUNTRY
Japan
ARCHITECT
Kazutaka Wakamatsu
TYPE OF PROJECT
Single House
PROJECT DESCRIPTION
This single-family house illustrates a generic principle of a house that is organised around a central staircase with a series of rooms coming off at various levels. The house is entered from the street, into a small hall and via a sliding door into long narrow room that accommodates the kitchen, lit from above by a lightwell. The vertical circulation rises directly out of the kitchen and, together with the space taken up by the light well, divides the house into two parts. Also on the ground floor, towards the rear of the plan, is a storage room and a space for a car.

Going up one level, there are two rooms, one immediately to the left of the staircase and another one that is accessed from the small gallery, open to below, that runs past the lightwell. The next level up has two more rooms, again to the left of the staircase and another one at the end of the corridor and also has a row of storage cupboards along one side of the corridor. Whilst some rooms have specific functions attached to them, one could easily imagine the house being used by a group of unrelated adults, or two couples sharing or even as a live / work unit with the garage converted into an office space.
REFERENCES
'Acht einfache Wohnhäuser von Yoshiyuki Nishimiya, Yuzo Osumi, Kazuhiko + Kaoru Obayashi, Yumiko Kobayashi, Kazutaka Wakamatsu, Soichiro Kawabata, Yoichiro Miyamori', *Bauwelt*, 42/43, 1995, pp.2444-51.

117 London Flexhouse

DATE
1996
REFERENCES
CMHC, *FlexHousing: Homes That Adapt to Life's Changes*, Montreal: Canada Mortgage and Housing Corporation, 1999.

118 Gespleten Hendrik Noord

DATE
1996
COUNTRY
The Netherlands
ARCHITECT
de Jager & Lette Architecten
TYPE OF PROJECT
Multi-storey apartment block
PROJECT DESCRIPTION
The apartment block was developed by a group of people who found each other through an advertisement in a newspaper. Once all future residents were chosen, the planning process evolved issues of flexibility and potential for further development. The subsequent apartments are simple shells, which could be fitted out according to personal taste and requirements.
REFERENCES
Kendall, S., and J. Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000.

Minami, K., 'Open building in the Netherlands – an evaluation.' *open house international*, 4, 2001, pp.59-66.

119 Grieshofgasse

DATE

1996

REFERENCES

Brinkmann, U., 'Flexibel wohnen', *Bauwelt*, 31, 1998, pp.1720-41.
Kühn, C., 'Keine Mauern mehr: Helmut Wimmers jüngste Wohnbauprojekte', *Architektur- und Bauform*, 2, 1996, pp.35-54.
Leupen, B., R. Heijne, and J. v. Zwol, eds., *Time-based Architecture*, Rotterdam: 010 Publishers, 2005.

120 Next Home

DATE

1996

REFERENCES

Cramer, N., 'New housing prototype built in Montreal', *Architecture*, 11, 1996, p.37.
Friedman, A., 'Design for flexibility and affordability: learning from the post-war home', *Journal of Architectural & Planning Research*, 2, 1997, pp.150-70.
Friedman, A., 'The Next Home: Affordability Through Flexibility and Choice', *open house international*, 4, 1997, pp.59-64.
Friedman, A., 'Ten years old & growing', *Canadian Architect*, 5, 2001, pp.18-19.
Friedman, A., *The Grow Home*, Montreal, London: McGill-Queen's University Press, 2001.
Friedman, A., *The Adaptable House: Designing Homes for Change*, New York: McGraw-Hill, 2002.

121 The Transformable Apartment

DATE

1996

REFERENCES

Bell, J., and S. Godwin, eds., *The Transformable House*, London: Wiley-Academy, 2000.
'The transformable apartment', *A+T*, 12, 1998, pp.132-35.

122 Wulzendorfstrasse, Vienna

DATE

1996

COUNTRY

Austria

ARCHITECT

Helmut Wimmer

TYPE OF PROJECT

Mixed use with multi-storey apartment block [51]

PROJECT DESCRIPTION

Helmut Wimmer has consisitently investigated ways in which housing may be adaptable. Here, all apartments feature sliding panels, which can be employed to change relationships between rooms but also to create different degrees of openness during use.

REFERENCES

Dworschak, G., and A. Wenke, *Neue Wohnexperimente – Internationale Projektbeispiele*. WEKA Baufachverlage GmbH, 1997.
Kühn, C., 'Keine Mauern mehr: Helmut Wimmers jüngste Wohnbauprojekte', *Architektur- und Bauform*, 2, 1996, pp.35-54.
Leupen, B., R. Heijne, and J. v. Zwol, eds., *Time-based Architecture*, Rotterdam: 010 Publishers, 2005.

123 Atelierhaus Sigle

DATE

1998

COUNTRY

Germany

ARCHITECT

Architekten Linie 4

TYPE OF PROJECT

Single House

PROJECT DESCRIPTION

The timber structure of this building, which combines residential functions with an artist's studio, is inherently flexible. The loadbearing elements, which are relatively closely spaced, are placed on a regular grid along the long edges of the building. Timber beams span across the width of the building so that no further structural columns interrupt the floor area.

The resulting open interior space can therefore be divided freely. Short wall panels and furniture units, none of which touch the perimeter walls, articulate rooms were needed. Sliding doors at the end of each of these partitions can close relationships between rooms or enable them. The appearance of each storey can thereby vary between one of corridor with rooms or open plan one-room space.

REFERENCES

'Atelier und Wohnhaus in Deißlingen', *Architektur Wettbewerbe*, 183, 2000, p.20.
'Verbindung aufgenommen. Atelier- und Wohnhaus in Deißlingen', *Deutsche Bauzeitschrift*, 7, 1999, pp.55-58.

124 Estradenhaus

DATE

1998

REFERENCES

Hoetzel, D., 'Das Estradenhaus. Wohnungsbau mit beweglicher Kiemenwand in Berlin-Prenzlauer Berg', *Bauwelt*, 31, 1998, pp.1726-27.
Leupen, B., R. Heijne, and J. v. Zwol, eds., *Time-based Architecture*, Rotterdam: 010 Publishers, 2005.

125 Office and Residential Building

DATE
1998
COUNTRY
Austria
ARCHITECT
Baumschlager and Eberle
TYPE OF PROJECT
Mixed use including residential
PROJECT DESCRIPTION

In this mixed used scheme, the residential units are built on the same structural grid as the offices below, implying that offices could become apartments and vice versa. Office spaces and public service areas of an Austrian Bank are on the ground floor, part of the first floor and the fourth floor are combined with residential units on parts of the first floor and the second/third floors. The elongated floor plan is divided into eight spans, the fourth of which contains two staircases, one for exclusive use by the bank an the other one as vertical circulation system and access to the apartments, as well as elevators, one for internal bank use and the other one attached to the public stairs.

The staircase core, which extends beyond the otherwise clear-cut box, is the only physical dissection of the building's floor area. Crossbeams span the entire width of the spaces; the barely articulated vertical load-bearing members suggest possible points of connection and anticipate rooms which can be divided into any number of layouts.

REFERENCES

'Bank at Wolfurt, Austria', *Architecture d'aujourd'hui*, 323, 1999, pp.60-61.
'BTV bank, Wolfurt', *Architectural Review*, 1281, 2003, pp.90-91.
'Popsicle-stick façade sweetens a simple cube', *Architectural Record*, 3, 2000, pp.61-62.
Stock, W. J., 'Baumschlager Eberle', *A PLUS*, 172, 2001, pp.66-69.

126 Regal

DATE
1998
COUNTRY
Germany
ARCHITECT
Guido Jax
TYPE OF PROJECT
Multi-storey apartment block

PROJECT DESCRIPTION

Shelf principle allows for the plug-in of various apartment layouts, horizontally and vertically; allowing for apartments, maisonettes and triplex apartments.

REFERENCES

Jax, G., 'Wohnen im Wohnregal: Flexibles Wohnsystem, Koblenz', *Deutsche Bauzeitschrift*, 5, 1999, p.22.

127 Pelgromhof

DATE
1998/2001
REFERENCES

Cate, G. t., 'Pelgromhof housing for the elderly, Zevenaar (Frans van der Werf)', *Bouw*, 11, 1999, pp.6-67.
Kendall, S., and J. Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000.
Minami, K., 'Open building in the Netherlands – an evaluation.' *open house international*, 4, 2001, pp.59-66.

128 Fred

DATE
1999
REFERENCES

'Mobiles Haus – Fred', *Detail*, 3, 2001, pp.408-11.

129 Kölner Brett

DATE
1999
REFERENCES

'Experimentelles Wohnen', *Detail*, 8, 2001, pp.1517-20.
Fischer, L., 'New Loft, *Bauwelt*, 33, 2000, pp.20-25.
Grimm, F. B., 'Wohn- und Atelierhaus in Köln', *Architektur Wettbewerbe*, 183, 2000, pp.40-43.

130 Kronsberg Karrée

DATE
1999
COUNTRY
Germany
ARCHITECT
Fink + Jocher
TYPE OF PROJECT
Multi-storey apartment block [87]
PROJECT DESCRIPTION

The floor plans for the housing scheme were envisaged to be individually adaptable; the positions of kitchen and bathroom units were also variable. Each unit would be individually divisible and allow for various differing forms of spatial organisation (loft, entrance hall, multifunctional room, etc.).

REFERENCES

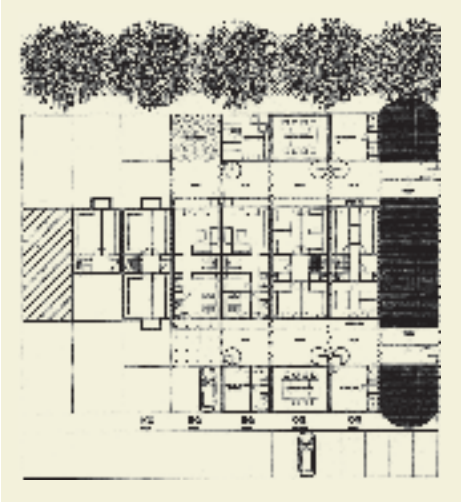
'Fink + Jocher, Housing Estate in Hannover', *A&U*, 373, 2001, pp.106-13.
Gunßer, C., *Neuer Geschoßwohnungsbau. Aktuelle Beispiele*, Stuttgart: Deutsche Verlags Anstalt, 2000.
Weiß, K.-D., 'Stein und Ziegel. Sozialer Wohnungsbau, Hannover-Kronsberg', *Bauwelt*, 7, 2000, pp.78-87.
Wüstenrot Stiftung, *Wohnbauten in Deutschland*, Stuttgart + Zürich: Karl Krämer Verlag.

131 Vario-Haus-System

DATE
1999
COUNTRY
Germany
ARCHITECT
Schmitges + Partner
TYPE OF PROJECT
Unrealised
PROJECT DESCRIPTION

Additive 'wagon' system on a 1 by 1m grid allows for any form of subdivision. One would purchase first a core house

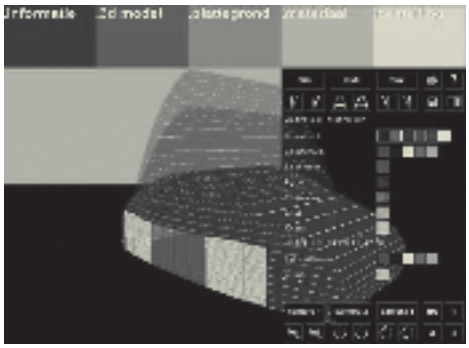
of 100m^2, which is extendable via a courtyard with 2-storey units (only the face walls contain windows and can therefore not be added onto directly).



REFERENCES

'Projekt: Vario-Haus-System', *AW Architektur + Wettbewerbe*, 183, 2000, pp.32-34.

132 Variomatic nl – Programmable housing



DATE

1999

COUNTRY

The Netherlands

ARCHITECT

ONL

TYPE OF PROJECT

Project for single-detached house

PROJECT DESCRIPTION

The house is designed to be elastic in all directions: height, depth and width. Clients determine the final form of curves and overall dimensions, position of services, and materiality. Variomatic also comes as Classic S (two floors with roof) and Cabrio L (ground floor with convertible rooftop). Only the position of the staircase, toilet and technical room are fixed and the architects state that 'in principle' the house could be subdivided.

REFERENCES

Oosterhuis, K., 'Variomatic.nl' 1999, <http://www.oosterhuis.nl/variomatic/> [Accessed 10 January 2005].

Oosterhuis, K., 'Agora: dreams and visions – Kas Oosterhuis', *Arca*, 172, 2002, pp.36-49.

133 Westferry Studios

DATE

1999

COUNTRY

Britain

ARCHITECT

CZWG

TYPE OF PROJECT

Live / work

PROJECT DESCRIPTION

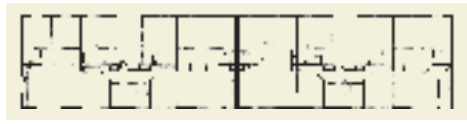
The development provides undivided and double height studio spaces of around 70m^2 which are marketed as live / work units — rare in the social sector in the UK. The bare shell enables residents to create their own environment.

REFERENCES

Dwelly, T., *Homes that work. The role of housing associations as providers of Live/work accommodation*, London: Peabody Trust and The Live Work Network, 2003.

Westferry Studios, 'Westferry Studios', Westferry Studios, <http://www.westferrystudios.com/index.html> [Accessed 6 September 2006].

134 Wohnhaus Heinrich-Leffler Gasse



DATE

1999

COUNTRY

Austria

ARCHITECT

Michael Loudon

TYPE OF PROJECT

Multi-storey apartment block

PROJECT DESCRIPTION

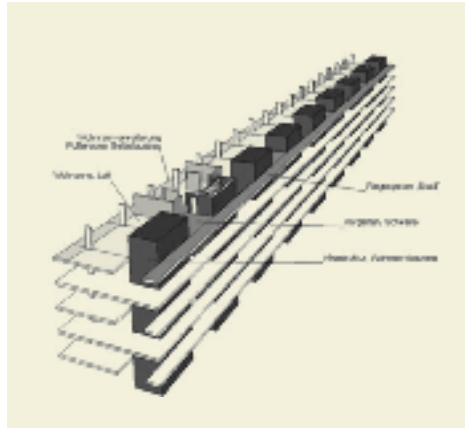
In Michael Loudon's low-cost social housing scheme on Leffler Gasse in Vienna Stadlau (a combination of the potential openness of Wulzendorfstrasse and the variability of Graz-Straßgang) all spaces may be opened up or closed off using sliding panels — the only hinged doors are at the entrance and on the bathroom and WC.

'With all the panels open, the full extent of the space which is available to the occupants is easily seen and may be occupied in many different ways. Closing certain panels may strengthen the preferred pattern of use at certain times and, similarly, the space of the winter garden itself is available for a range of activities from outdoor functions to serving as a spare bedroom.'

REFERENCES

Allison, P., 'Mobile elements in social housing in Austria', *ARCH+*, 134/135, 1996, pp.104-05.

135 Wohnregal Koppstrasse



DATE

1999

COUNTRY

Austria

ARCHITECT

Helmut Wimmer

TYPE OF PROJECT

Multi-storey apartment block [250]

PROJECT DESCRIPTION

The size of an individual apartment can be chosen freely. Bathrooms and other servicing rooms are located in the U-shaped concrete cores on the side of the deck access. Apart from the concrete cores and load bearing columns on the opposite side, the storeys are free of columns or other load bearing elements. This concept allows for the apartments to be cut like slices of a cake.

REFERENCES

Kühn, C., 'Keine Mauern mehr: Helmut Wimmers jüngste Wohnbauprojekte', *Architektur- und Bauform*, 2, 1996, pp.35-54.

Leeb, F., 'Selbstdarstellung im Wohnregal', *Der Standard*, 08 January 2000.

Wimmer, H., '"Wohnregal" Koppstrasse' 1999, <http://www.ats-architekten.at/> [Accessed 23 August 2004].

136 495 West Street

DATE

2000

COUNTRY

USA

ARCHITECT

Tamarkin Architecture, PC

TYPE OF PROJECT

Multi-storey apartment block [9]

PROJECT DESCRIPTION

495 West Street in New York is a new 11-storey factory-like loft development that offers nine raw space units, seven one-storey of almost 290m^2 and two duplex apartments of 436m^2, to be custom finished by the residents.

Each apartment has concrete floors, concrete columns and four sets of risers for gas, electricity and plumbing and lifts open directly into these indeterminate spaces.

The structural grid, with only a few determining elements, allows for a range of uses as well as subsequent division into separate rooms. Neither rooms nor layouts are pre-described and can be chosen by the future occupant. Although built as an apartment block, the building could easily be adapted to other uses such as offices or small workshops / manufacturing.

REFERENCES

Amsden, D., 'Real Estate 2001 Neighbourhood Profiles: Greenwich Village', *New York Magazine*, 2001, <http://www.newyorkmetro.com/nymetro/realestate/features/4884> [Accessed 6 September 2004.

Molloy, A., 'A tower of damnation', *Architectural Design*, 1, 2004, pp.26-33.

137 Affordable Rural Housing Demonstration Project

DATE

2000

REFERENCES

Deveci, G., 'The Affordable Rural Housing Demonstration Project, Kincardine O'Neil, North East Scotland: A scheme of 14 affordable homes to rent' 2000, <http://www2.rgu.ac.uk/subj/search/Research/SustainableHousing/Affordable/Publications/AffordableDemo.html> [Accessed 20 December 2004].

138 Flexsus House 22

DATE

2000

REFERENCES

Kendall, S., and J. Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000.

'Major Works in Japan. Housing: Flexsus House 22', Takenaka Corporation, 2000, <http://www.takenaka.co.jp/takenaka_e/majorworks_e/expert/housing/hous03.htm> [Accessed 19 August 2004].

Ohara, T., K. Suzuki, and Y. Oshi, 'SI housing project – Flexsus House 22 sustainable housing system', in *Continuous Customization in Housing*, ed. by Yashiro, T., Tokyo: CIB, 2000, pp.47-54.

139 WeberHaus Option

DATE

2000

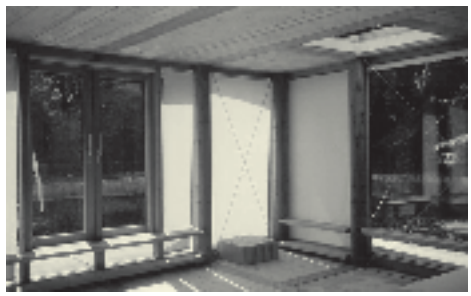
REFERENCES

Aeberhard, B., 'Mit Modulen gegen die Raumnot', *archithese*, 2, 2003, pp.66-69.

Bahamon, A., *mini house*, New York: Harper Design International Publishers, 2003.

Bauart, 'Smallhouse – Option, maximal reduziertes Wohnen', Bauart Architekten, 2000, <http://www.bauart.ch/bauartsite/fset01.html> [Accessed 10 August 2004].

140 Modular Construction System



DATE

2000

COUNTRY

Austria

ARCHITECT

Lukas Land Architecture Technology

TYPE OF PROJECT

Single-detached house

PROJECT DESCRIPTION

The Modular Construction System is based on a modular timber component system, which allows planning and modifying buildings of different shapes and sizes. It consists of single components that can be joined and separated. Screw and pin connections ensure the greatest possible flexibility. The modules can be attached and removed without affecting the existing structure.

REFERENCES

Johann Prutscher GmbH & Co KG, 'Ein Baukasten zum Wohnen' <http://www.lukaslang.com/cms/front_content.php> [Accessed 19 September 2005].

141 Berlin Terrace

DATE

2001

COUNTRY

Germany

ARCHITECT

Caruso St. John

TYPE OF PROJECT

Unrealised

PROJECT DESCRIPTION

This project updates the principles of the classic terraced house, with the stair located against the party wall. All three housing types (a four-storey single family house, a two unit five-storey maisonette and a three-storey live / work unit) enable house-by-house solutions through individually variable partition walls, which are non-loadbearing and can thereby be changed or replaced with relative ease.

REFERENCES

Caruso St John, 'Terraced house', *a+t*, 13, 1999, pp.44-47.

Wasserstadt GmbH, 'Vielfalt hinter klassischer Fassade: Die Entwürfe von Caruso St John Architects zeigen den englischen Ursprung der Terraces.' <http://berlin-terrace.de/entw4.htm> [Accessed 11 August 2004].

142 Flexible Housing in Almere

DATE

2001

REFERENCES

Berkel, B. v., 'Flexible Housing in Almere, The Netherlands', *Industria delle costruzioni*, 372, 2003, pp.70-77.

'Wohnhausgruppe in Almere', *Detail*, 3, 2002, pp.200-01.

143 Greenwich Millennium Village (II)

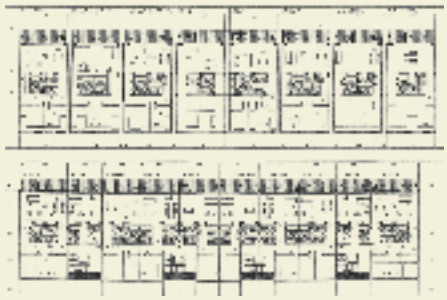
DATE

2001

REFERENCES

Allen, I., 'Village green', *Architects' journal*, 4, 2001, pp.26-35.
Horton, C., and D. Arnold, 'On-site factory speeds up prefabs', *Building Design*, 1580, 2003, p.6.
Pacey, S., 'Reality check', *RIBA Journal*, 7, 2003, pp.30-36.
Pike, R., and C. Powell, 'Housing Flexibility Revisited', *MADE*, 1, 2004, pp.64-71.
Swengley, N., and H. Hartman, 'Building homes for every age', *Financial Times* 2005, pp.1-2.
Till, J., 'The future is flexible', *Evening Standard*, 4 May 2004, p.10.

144 Housing Terrace



DATE

2001

COUNTRY

Slovenia

ARCHITECT

OFIS

TYPE OF PROJECT

Multi-storey apartment block [108]

PROJECT DESCRIPTION

The initial floor plan shows identical units of 7.5m by 13.9m, divided into three zones: Living (4.7m) / kitchen, bathroom (3.4m) / bedrooms (5.8m). The central bathroom and kitchen core allows for two corridors to its left and right. This permeability avoids determinacy and promotes different uses of the space.

REFERENCES

Fawcett, P., 'Ljubljana: flexible housing type by Oman & Videcnik', *Architecture Today*, 114, 2001, p.13.

145 Kettenhaus

DATE

2001

COUNTRY

Germany

ARCHITECT

Becher + Rottkamp

TYPE OF PROJECT

Live / work

PROJECT DESCRIPTION

A basic module of 6.5 by 10m (height 2.75m), can be divided up in various ways and allows a range of alternative layouts: single open space (65m^2), a number of smaller rooms with corridor, workshop, studio, offices, etc.

REFERENCES

Becher, A., 'Kettenhaus in Berlin', *Detail*, 3, 2002, pp.214-29.

146 KraftWerk1

DATE

2001

REFERENCES

KraftWerk1, 'KraftWerk1', Bau- und Wohngenossenschaft KraftWerk1, 2001, <http://www.kraftwerk1.ch> [Accessed 17 August 2005].
'KraftWerk1 housing complex, Zürich', *A+T*, 21, 2003, pp.28-39.
Preisig, H., and K. Pfaffli, 'Nachhaltigkeit im Hochbau', *Architheses*, 4, 2004, pp.34-39.
'Überbauung «KraftWerk1», Zürich', *werk, bauen + wohnen*, 3, 2002, Werk-Material.

147 Multiple Choice: Housing in Isla Margarita

DATE

2001

COUNTRY

The Netherlands

ARCHITECT

de Architecten Cie

TYPE OF PROJECT

Single-detached house [18]

PROJECT DESCRIPTION

The houses are based on a 0.90 by 1.20m grid (maximum clear span 3.60m), filled with standard elements for the floors, external walls and roofs (internal walls were made on site, all other elements were prefabricated). The void space between the profiles creates a slot for the services.

With the help of an interactive CD-ROM, future residents could determine the number of rooms, options for a front or back garden or the position for the car as well as the number and position of windows. Some houses have been designed to allow future extensions).

REFERENCES

Elias, H., 'A question of design: A structured set of options allowed each occupant of housing in Almere, the Netherlands, flexibility of layout within a given envelope', *MetalWorks*, Spring, 2005, pp.11-15.

148 Silvertown

DATE

2001

REFERENCES

'Ash Sakula Architects, London', *A+T*, 24, 2004, pp.6-21.
'First look: colour takes over Silvertown', *Building Design*, 1648, 2004, p.4.
'High hopes for low costs', *Building Design*, 1514, 2001, pp.10-12.
'Silvertown housing in London', *Detail*, 11, 2005, pp.1286-88.
Young, E., 'Wrapped attention', *RIBA Journal*, 11, 2004, pp.52-56.

149 Smarthouse

DATE

2001

COUNTRY

The Netherlands

ARCHITECT

BAM Vastgoed & Robert Winkel

TYPE OF PROJECT

Single-detached house

PROJECT DESCRIPTION

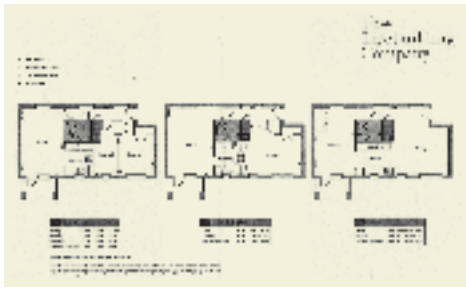
This steel building system, based on a standardised frame, works around a minimum of parts, which are bolted together to make variation quick and easy.

REFERENCES

Crone, J., 'Catalogusbouw', *Bouw*, 3, 2002, pp.30-32.
Cuito, A., *New Generation Houses*, Barcelona: Loft, 2006.
European Real Estate, 'HBG and Robert Winkel Architecten introduce Smarthouse', European Real Publishers, 2001,

<http://www.europe-re.com/system/main.php?pageid=1001&articleid=4067>[Accessed 23 November 2005].
Peterse, K., 'Cataloguswoning koppelt standaardisatie aan individualiteit', *Bouwen met Staal*, 158, 2001, pp.26-31.

150 St. James Urban Village



DATE
2001
COUNTRY
Britain
ARCHITECT
PRP Architects
TYPE OF PROJECT
3-storey apartment block [413]
PROJECT DESCRIPTION
St James Urban village is one of the very few UK developer-led schemes to take the issue of housing flexibility seriously. It consists of 413 units accommodated in a number of two- to three-storey buildings. The housing scheme is located on a brownfield site close to the town centre of Northampton. Some of these units were built in a way that enabled purchasers to choose from three different options for their apartment's layout. A sample unit, an elongated plan with triple aspect, was only divided by a central bathroom and kitchen core. The space around this core can either be left undivided to form an open plan loft-like arrangement with a central kitchen. A different option shows the kitchen closed off on one side, so that a separate bedroom is created and a third option shows the subdivision of that bedroom into two. Whilst the vast majority of the apartments were sold in the two-bedroom option, figures showed that the development as a whole sold quicker than expected, the purchasers valuing the choice and flexibility that they were offered. In order to achieve the proposed flexibility, the developer had to change their construction process; rather than fitting out a repetitive layout from scratch, some decisions (final partitions, final wiring etc) had to be left until the unit had been sold and the purchaser decided on their option. This interfered with the normal construction sequencing and led to a marginal increase in costs.
REFERENCES
The Lifebuilding Company, 'The Lifebuilding Company. First in neighbourhoods', The Lifebuilding Company, <http://www.thelifebuildingcompany.com/html/main.html>[Accessed 12 March 2005].

151 Wenswonen

DATE
2002
COUNTRY
The Netherlands
ARCHITECT
Willems van den Brink
TYPE OF PROJECT
Multi-storey apartment block [38]
PROJECT DESCRIPTION
The project uses a systematic design and construction process with a combination of factory and on-site construction. Initiated by the private developer Wenswonen, future home owners can select not only the size of their dwelling (additional factory produced room units can be attached to the concrete base building) but also the façade and interior layouts. A custom-designed software allows each household to make design decisions about interior layout and the design of the façade (elements can be selected from a kit of parts prepared by the architect) step-by-step, with price information at each stage. Initially, only the positions of the service duct and stairs are determined.
REFERENCES
'Case Studies of Residential Open Building. Wenswonen', <http://www.bsu.edu/web/capweb/bfi/documents/wenswonen3.pdf>[Accessed 3 January 2006].
'Wenswonen', <http://www.wenswonen.nl>[Accessed 3 January 2006].

152 Abode

DATE
2003
COUNTRY
Britain
ARCHITECT
Proctor and Matthews Architects
TYPE OF PROJECT
Multi-storey apartment block [82]
PROJECT DESCRIPTION
The development comprises of 82 apartments and houses, ranging from one to five bedrooms. Of particular interest are the family houses which have two entrances; one at ground level to spaces for home working and one to the main house at first floor level. This gives the possibility of dividing off the ground floor at a later date.

REFERENCES
Booth, R., 'Harlow's revolution starts here', *Building Design*, 1563, 2003, pp.10-13.
Moen, J., R. Evans, S. Proctor, and A. Ogorzalek, 'Jon Moen, Director, New Hall Projects, Roger Evans, Roger Evans Associates, Stephen Proctor, Proctor Matthews and Andrew Ogorzalek, PCKO: New Hall, Harlow', in *Building for Life: National Conference London*, ed. by Commission for Architecture and the Built Environment, London: Commission for Architecture and the Built Environment, 2002.

153 Edificio Balmes

DATE
2003
COUNTRY
Spain
ARCHITECT
Carlos Ferrater
TYPE OF PROJECT
Mixed use with multi-storey apartment block
PROJECT DESCRIPTION
The residential units are built on the same structural grid as the offices below, implying that offices could become apartments and vice versa.

REFERENCES

'Apartment and Office Building / Carlos Ferrater Studio', *A&U*, 2003, pp.130-33.
Ferrater, C., 'Office & apartment building, Calle Balmes 145, Barcelona', *Via Arquitectura*, 3, 2003, pp.100-03.
Ferrater, C., 'Residential and office building in Barcelona, Spain', *Industria delle costruzioni*, 372, 2003, pp.78-81.

154 Eichrain

DATE

2003

COUNTRY

Switzerland

ARCHITECT

Theo Hotz AG Architekten + Planer

TYPE OF PROJECT

Mixed use with multi-storey apartment block [304]

PROJECT DESCRIPTION

Apartments are conceived to allow for change with regard to the arrangement of rooms.

REFERENCES

'Städtebau am Zürcher Stadtrand. Zu den Siedlungen Eichrain (Theo Hotz) und Stöckenacker (von Ballmoos Krucker Architekten) in Zürich Nord', *werk, bauen + wohnen*, 7/8, 2003, pp.64-65.
Theo Hotz AG Architekten + Planer, 'Eichrain' 2004, <http://www.theohotz.ch/swf03/index.html> [Accessed 1 November 2005].

155 Siedlung Hegianwandweg

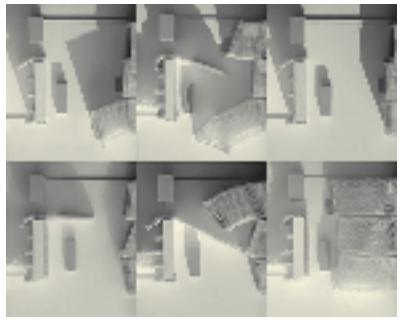
DATE

2003

REFERENCES

Aeberhard, B., 'Hegianwandweg, Zürich', *Archithese*, 1, 2004, pp.60-63.
EM2N, 'Hegianwandweg Housing', EM2N, 2003, <http://www.em2n.ch/em2n.php?p=2&id_projects=7> [Accessed 10 August 2004].
'Hegianwand Housing Development', *A+T*, 22, 2003, pp.98-111.
Zurbuchen, B., 'Stadtratten und Landratten... in der Stadt', *werk, bauen + wohnen*, 1/2, 2004, pp.60-63.

156 Soft House



DATE

2003

COUNTRY

Canada

ARCHITECT

Forsythe + MacAllen Design

TYPE OF PROJECT

Apartment

PROJECT DESCRIPTION

Soft House is a textile system for prefabricated interior walls, which are made from a soft, translucent fabric, which can be used to change relationships between private and common spaces.

REFERENCES

Pedersen, M., 'Accordion Architecture. A Canadian firm's material experiments produce flexible living spaces', metropolismag.com, 2004, <http://www.metropolismag.com/cda/story.php?artid=793> [accessed 02 August 2005].

157 Domino.21

DATE

2004

REFERENCES

'Domino 21 arquitectura vivienda industrializada alphaproject etsam madrid construtec ifema idm reyes d.21 domino.21', <http://www.angelfire.com/ill/domino.21/index.html> [Accessed 23 March 2005].
'La experiencia [domino.21] involucró a la madera', *Boletín de Información Técnica*, 2005, pp.14-20.
Reyes, J. M., 'Domino.21, an immediate solution for housing', Kemen Haworth, 2005, <http://www.haworth.es/ingles/kh_articulos.asp?id=12#todoDIV> [Accessed 04 May 2005].

158 Cala Domus

DATE

2005

REFERENCES

Smit, J., 'Home chic home', *Building*, 8234, 2002, pp.48-49.
Swengley, N., and H. Hartman, 'Building homes for every age', *Financial Times* 2005, pp.1-2.
Till, J., 'The future is flexible', *Evening Standard*, 4 May 2004, p.10.

159 Wohnen [+]

DATE

2005

COUNTRY

Germany

ARCHITECT

blauraum architekten

TYPE OF PROJECT

Multi-storey apartment block

PROJECT DESCRIPTION

All but the structure of a 1974 office building was taken away, which was then reconfigured as an apartment building including newly designed façades, infrastructure and infill.

REFERENCES

'Apartments, Hamburg. The second project by blauraum is the conversion of an office building into a residential complex.' *A10*, 4, 2005, pp.40-42.
'Bogenallee 10-12', *Bauwelt*, 15, 2005, pp.20-23.
'Umnutzung eines Bürohauses in Hamburg', *Detail*, 3, 2006, pp.166-67.

160 Donnybrook

DATE

2006

COUNTRY

Britain

ARCHITECT

Peter Barber Architects

TYPE OF PROJECT

Terraced houses [42]

PROJECT DESCRIPTION

Large courtyard spaces on the first floor are unprogrammed and act as an invitation to residents to appropriate them.

REFERENCES

Spring, M., 'Costa del Cockney', *Building*, 8419, 2006, pp.26-27.

Taylor, D. 'Radical housing sought in East End contest', *Architects' Journal*, 16, 2001, p.6.

Woodman, E., 'Streets ahead', *Building design*, 1710, 2006, pp.12-15.

Young, E., 'Neighbourhood Watch', *RIBA Journal*, 4, 2006, pp.32-40.

161 Oakridge Village

DATE

2006

REFERENCES

Design For Homes, 'Oakridge Village, Basingstoke. Housing Corporation Winner 2005', <http://www.designforhomes.org/hda/2005/complete/oakrvill.html> [Accessed 22 November 2005].

Smith, A., 'A test of their metal', *Building. Specifier supplement*, April, 2003, pp.4-8.

Spring, M., 'Show homes', *Building*, 8391, 2005, pp.50-53.

162 Consort Road

DATE

2007

COUNTRY

Britain

ARCHITECT

Walter Menteth Architects

TYPE OF PROJECT

Multi-storey apartment block and town houses [49]

PROJECT DESCRIPTION

This scheme features a number of design features to increase its flexibility. The scheme has a wide span concrete structure so that in future, if required, all the internal partitions can be rearranged. Wherever possible services are located to the plan perimeter to facilitate such adaptations. In the apartments, a relatively small plan is made perceptually bigger through a series of design moves that allow the spaces to be used in a variety of ways. The wall between bedroom and living room has a sliding section to allow them to be joined. Apartments are all provided with 6m^2. winter gardens.

REFERENCES

'Consort Road', < http://www.xco2.com/case_studies/cns.htm>

163 Rochdale

DATE

2007

COUNTRY

Britain

ARCHITECT

Proctor and Matthews Architects

TYPE OF PROJECT

Apartments and terraced houses

PROJECT DESCRIPTION

One of the key design concerns was to provide flexibility in the way that the houses could be joined or divided over time. This was of particular importance to accommodate extended families. House type B (2 bedroom) can be combined with house type A (5 bedroom) to create a 7-bedroom house if required, or stand alone as a 2-bedroom house with entrance courtyard or, if combined with house type A, can act as a teenager or grandparent annex.

More details of all these projects are on the website www.flexiblehousing.org

Detailed references to projects are given in Chapter 8, and secondary references in the footnotes at the end of each chapter. The following is a short selection of some of the most useful writing on flexible housing and the issues around it.

Brand, Stewart, *How Buildings Learn: what happens after they're built*, New York: Viking, 1994,
A seminal book, which argues that buildings have a life beyond the immediate and must be designed to accept change.

Eldonk, Jos van, and Helga Fassbinder, *Flexible Fixation: the paradox of Dutch housing architecture*, Assen: Van Gorcum, Eindhoven University of Technology, 1990.
A comprehensive summary of Dutch flexible housing with a wide range of examples from throughout the twentieth century.

Friedman, Avi, *The Adaptable House: Designing Homes for Change*, New York: McGraw-Hill, 2002.
A book by the leading North American expert in the field of adaptable housing. Whilst it concentrates on terraced and detached houses (as opposed to multi-storey apartment blocks), it sets a series of useful principles. See also the same author's *Grow Home*.

Gann, David, et al., *Flexibility and Choice in Housing*, Bristol: Policy Press, 1999.
David Gann is one of the foremost researchers in the field of applying technological solutions to housing in order to achieve flexibility and more efficient forms of construction.

Habraken, N.J, *Supports: an alternative to mass housing*, London: Architectural Press, 1972.
One of the most influential books on the subject of housing in which the user can take control of their own dwelling. Habraken lucidly sets the scene for the principle of support and infill that is taken up by the Open Building movement.

Hamdi, Nabeel, *Housing Without Houses: participation, flexibility, enablement*, New York: Van Nostrand Reinhold, 1990.
A book that brings together issues of participation and flexibility, written by one of the architects of the pioneering Adelaide Road housing.

Henz, Alexander and Hannes Henz, *Anpassbare Wohnungen*, Zürich: ETH Wohnforum, 1997.
This is a study dealing with the fundamental ideas behind adaptable dwellings: why they exist and means for their strategic implementation. There is a wide range of historic and contemporary examples.

Kendall, Stephen, and Jonathan Teicher, *Residential Open Building*, London and New York: E & FN Spon, 2000.
The best book on the 'Open Building' movement, which advocates a support and infill approach to housing. Numerous examples and technical advice.

Kronenburg, Robert, *Living in Motion: Design and Architecture for Flexible Dwelling*, Vitra Design Museum, 2002.
Catalogue of an exhibition of houses and design objects, based around a literal reading of flexibility with the common theme of parts that move.

Leupen, Bernard, *Frame and Generic Space: a study into the changeable dwelling proceeding from the permanent*, Rotterdam: 010 Publishers, 2006.
A systematic and intelligent approach to the frame / infill approach, with numerous examples of flexible housing and a good bibliography.

Oliver, Paul, *Dwellings: The Vernacular House Worldwide*, London: Phaidon, 2003.
Whilst not specifically about flexibility, the vernacular house (on which this is the definitive work) embeds many of the principles discussed in this book.

Open House International (www.openhouse-int.com)
The founding principles of Open House have informed much work in flexible housing and the journal has published numerous articles on the subject.

Periàñez, Manuel, *L'habitat évolutif: du mythe aux réalités*, Paris: PCA, 1993.
A comprehensive overview of adaptable housing arising out of a French Government project. Also available on line (in French).

Priemus, Hugo, 'Flexible housing: fundamentals and background', *Open House International*, 18, 1993, pp.19-26.
This is a brief summary of the issues set out in Priemus' book in Dutch: *Wonen, kreativiteit en aanpassing*, Den Haag: Mouton, 1969.

Rabeneck, Andrew, David Sheppard, and Peter Town, 'Housing flexibility?' *Architectural Design*, 43, 1973, pp.698-727.
Still the most comprehensive article on housing flexibility and a critique of some of the assumptions behind it.

Service Wohnung: Grundriß nach Gebrauch, *Arch+*, 100/101, 1989
A series of articles on specific historic examples, as well as principles of flexible housing such as the idea of equally-sized rooms, changeability of minimal spaces and the division of large areas.

Turner, John F. C, and Robert Fichter, *Freedom to Build; dweller control of the housing process*, New York: Macmillan, 1972.
A pioneering book in setting a radical agenda for users to take control of their own environment.

'Wohnen. wer mit wem, wo, wie, warum'. *Arch+*,176/177, 2006
This issue investigates different methods of organising space in a flexible way and illustrates these through contemporary examples.

We have made every effort to trace and contact the copyright holders of the figures. These are listed below, and we would like to thank the numerous people who have provided permission to use. Please contact us if there are omissions or corrections, and we will include these in subsequent editions of this publication.

Key: T: Top. B: Bottom. M: Middle. L: Left. R: Right.

A.D.P. Architektur Design Planung Walter Ramseier 105, 148, 149, 185L; Akademie der Künste, Berlin 15; *Allison, P., 'Mobile elements in social housing in Austria', ARCH+, 134/135, 1996* 224BM; Alvar Aalto Museum drawings archive 207R; *Apartment and Office Building / Carlos Ferrater Studio', A&U, 2003* 228TL; Architektenlinie 4 222R; Architekturzentrum Wien 90, 93, 140R; Ash Sakula Architects 150R, 158B; Atelier P+F 89; b&k+ brandlhuber & kniess 117L; BAM Vastgoed & Robert Winkel 226BR; *Barr, A. W. C., Public Authority Housing, London: Batsford, 1958* 209 M; *Bauer, C., Modern Housing, Boston: Houghton Mifflin,1934* 14, 132L; Bauhaus-Archiv Berlin / Foto: Dr. Lossen & Co 24; Bauhaus-Archiv, Berlin 63; Becher + Rottkamp 150L, 226 M; Bennett, Peter and Proctor and Matthews Architects 122T; *Berger, P., 'Für die Zukunft planen'. Wohnen, 1-2, 2003* 203L; Beton Verlag — Rudolf Menk 82L; Binder, Bernhard Front Cover, 79; blauraum architekten 165T, 165M, 228R; Blundell-Jones, Peter 28, 39R, 108L; Bott, H., and V. v. Haas, Verdichteter Wohnungsbau, Stuttgart, Berlin, Köln: Kohlhammer, 1996 19; *Brahmshof Zürich', werk, bauen + wohnen, 12 (1993), Werk-Material 1-6* 45; *Brand, S., How Buildings Learn, New York: Viking, 1994* 170; broekbakema 16B, 42, 65, 75, 76; Brolyng Steen, Thomas 88TR; Broome, Jon 101R; *Cantacuzino, S., Wells Coates, London: Gordon Fraser, 1978* 206R; Centraal Museum Utrecht 57L, 62R; Centre Pompidou 83, 145T; *Christiansen, J. H., 'Fleksible boliger', Arkitekten (Copenhagen), 18, 1988* 98; CMCH 220BL; Countryside Properties and Proctor and Matthews Architects 122B; CZWG 224TM; DACS 18; DAM 206L; de Jager & Lette Architecten 222L; *Deilmann, H., J. C. Kirschenmann, and H. Pfeiffer, Wohnungsbau. The Dwelling. L'habitat. 3rd edn, Stuttgart: Karl Krämer Verlag, 1973* 210TL, 210 BL; Deveci, Gokay 118; *Doutriaux, E., 'L'experience De La Grand-Mare Rouen 1968-1970', Moniteur Architecture AMC, 114, 2001* 164, 213BL; DSDHA 143; Eduard Hueber / archphoto.com 134L; Elias, Helen 226TR; *Ellis, C., 'Do-it-yourself vernacular', Architects' Journal, 51, 1980* 194L; EM2N 125T, 145B, 146; *Entre Loger et Habiter', Architecture d'aujourd'hui, 225, 1983* 217M; *Fawcett, P., 'Ljubljana: flexible housing type by Oman & Videcnik', Architecture Today, 114, 2001* 226L; Fessy, Georges 97, 136; *Fink + Jocher, Housing Estate in Hannover', A&U, 373, 2001* 223R; *Flexibele Woningbouw Te Rotterdam', Bouw, 7, 1985* 95; Fondation Le Corbusier / DACS (FLC/ADAGP, Paris and DACS, London 2006) 61; Forsythe + MacAllen Design 228M; Friedman, Avi 112; fritz haller bauen und forschen gmbh 80; *Geist, J. F., Das Berliner Mietshaus 1862-1945. München: Prestel, 1984* 203M; Gellings, Paul 207L; Gentzsch, Erhard Archiv 175, 213R+B; GESIBA 141; Grandorge, David 225R; Guard Tillman Pollock Ltd 113; *Gullichsen, K., 'Massenproduktion, eine Illusion: Ein Sommerhaus für den Selbstbau', werk, bauen + wohnen, 4, 1998* 212L; Hamdi, Nabeel 48, 49, 92; Hannes Henz 125B; *Henz, A. and H. Henz, Anpassbare Wohnungen, Zürich: ETH Wohnforum, 1997.* 219R, 220M; Hild, Andreas 102; HTA Architects Ltd 23BL, 128; Hvidt & Mølegaard A/S 218M; Jacques, M., and A. Nève, eds., Steven Holl, Basel: arc en rêve centre d'architecture / Birkhäuser, 1993 220TL; *Jax, G., 'Wohnen im Wohnregal: Flexibles Wohnsystem, Koblenz', Deutsche Bauzeitschrift, 5, 1999* 223M; *Jencks, C., Le Corbusier and the Continual Revolution in Architecture. New York: Monacelli, 2000.* 204L, 205L; Johann Prutscher GmbH & Co KG 225M; *Kirsch, K., Die Weißenhofsiedlung: Werkbund-Ausstellung »Die Wohnung« — Stuttgart 1927. Stuttgart: Deutsche Verlags-Anstalt GmbH, 1987.* 205M; Knauf Perlite 204R; Kossak, Florian 6, 57R, 85R, 86L; Kramm & Strigl 109L; *Kühn, C., 'Keine Mauern Mehr: Helmut Wimmers Jüngste Wohnbauprojekte', Architektur- und Bauform, 2, 1996* 39L, 154T; Kurtz, Jörg 82R, 138; *Lebesque, S. and H. Fentener van Vlissingen, Yona Friedman. Structures serving the unpredictable, Rotterdam: NAi Publishers, 1999* 208TR; Leistner, Dieter / Architekton 109R; Les Anticonformes', Construction moderne, 3 (1975) 86M, 86R; Leupen, Bernard, Heijne, René and Jasper van Zwol (eds.), Time-Based Architecture (Rotterdam: 010 Publishers, 2005) 108R; *Linz Werkgruppe, 'Flexibles Wohnen', werk-archithese, 11/12, 1977* 214R; *Luscher, R., 'The 'La Faye' industrial housing estate in Givisiez', werk, bauen + wohnen, 4, 1988* 218R; Martinez, Ignacio 116; Maurios, Georges 27, 87; *Mayer, H. K. F., Der Baumeister Otto Bartning Und Die Wiederentdeckung Des Raumes. Heidelberg: L. Schneider, 1951* 23TL, 64; Mecanoo 217L; Meding, Michael 84; Metron Architektur AG 74, 104; Metrostav Archives 66; Meyer, Peter 21L, 21M; Meyer, Stefan 114TR, 114BR; *Ministry of Housing and Local Government, The Adaptable House. London: Eng. G.B. Central Office of Information, 1962* 73; *Ministry of Housing, 'Space in the Home', Design Bulletin, 6, 1968.* 36; Museum of Modern Art, New York 21R; *Neufert, E., Bauentwurslehre: Handbuch für den Baufachmann, Bauherrn, Lehrenden und Lernenden, Berlin: Bauwelt Verlag, 1936* 132R; Nick Gutteridge 124; Nielsen, Henrik — Pressehuset 88BL; Noden, Emily 101L; Nova Scotia Archives 204M; ONL 224BL; Osaka Gas 106, 171; Otake, Seiichiro (Home Make, Tokyo) 55, 221M; *Palladio, A., Quattro Libri, Milan:Hoepli, 1945* 151; PCKO Architects 127; Peter Phippen, PRP Architects 140L; Phil Sayer 173; Piercy Connor Architects & Designers 38; Pike, Rebecca 215M; *Pisos Piloto — Model Apartments: Experimental Domestic Cells. Barcelona: Editorial Gustavo Gili, 1997* 71, 157L; Popp, Wolfram 114L; *Prefabricated house in the USA', Architects' Journal, 5 January, 1950* 208BR; *Price, C., Cedric Price, London: Architectural Association, 1984* 211L; Proctor and Matthews Architects 154B, 227R, 229BM; *Projekt: Vario-Haus-System', AW Architektur + Wettbewerbe, 183, 2000* 224TL; *Rabeneck, A., D. Sheppard, and P. Town, 'Housing flexibility?' Architectural Design, 11, 1973* 212M, 212R, 213TL, 214M; Reger Studios / Bilder, Konzepte und Visionen 220R; Reisch, Michael 117R; *Renzo Piano Building Workshop 1964-1988. Tokyo: a + u Publishing co., Ltd., 1989* 174, 216L; Reyes, José Miguel 126; Richters, Christian 121B; *Roadside Cottages, Walton-on-Thames', The Builder, 232, 1901* 56; Rolies, Pieter 223L; Sarah Wigglesworth 72, 168L; *Schaffer, S., 'Firminy retrouvé son Unité d'habitation',D'architectures, 64, 1996* 210M; Schett, W., 'Swiss City-Blindness', Daidalos, 60, 1996 221L; Schneider, Friederike (ed.), Grundrißatlas Wohnungsbau — Floor Plan Atlas: Housing (Basel: Birkhäuser, 1994) 99; Schneider, Tatjana 3, 35; *Schwalb, G., Differenzierte Wohnanlagen. Differentiated Housing Estates. Ensembles d'habitations différenciées, Stuttgart: Karl Krämer Verlag, 1975* 214L; Schweighofer, Anton 94, 96; *Service Wohnung', Arch+, 100/101, 1989* 17, 142, 153L, 188 BR, 203L, 218L; shaqspeare 60; Skarne 219M; Smith, Jefferson 155, 158T; *Smithson, A and P. Smithson., The Charged Void: Architecture, New York: Monacelli Press, 2001* 209L; Stamm Teske, Walter 100, 215BR; Steidle + Partner 85 L, 135; Stücheli Architekten 123; *Sumi, C., Immeuble Clarté Genf 1932 Von Le Corbusier & Pierre Jeanneret. Zürich: Institut für Geschichte und Theorie der Architektur, Eidgenössische Technische Hochschule, 1989* 206M; Takenaka Corporation 119; Tamarkin Company 134R, 225L+B; Taro, Igarashi 208M; *The Architectural Forum, 'The New House 194X', The Architectural Forum, 77, 1942.* 23BR, 25, 43, 67, 68, 156, 207R, 208TL, 208BL; The Lifebuilding Company 227L; Theo Hotz AG 228BL; *Three constructed buildings', werk, bauen + wohnen, 12, 1987* 216M, 217R; Till, Jeremy 13, 81, 166L, 185BR, 229L; *Trapman, J., 'Kristalbouw', Bouw, 1957.* 69; UN Studio 121T; Van den Brink, Willems 139, 227M; Van der Werf, Frans 91, 115, 167, 215TR, 216R; *Van Loghem, Ir. J.B., B.I. — Bouwen, Bauen, Bâtir, Building Holland; Nieuwe Zakelijkheid, Neues Bauen, Vers Une Architecture Réelle, Built to Live In. Amsterdam: kosmos, 1932* 62L, 133; Van Onna, Norbert 103; *Vers Une Industrialisation De L'habitat', L'Architecture d'aujourd'hui, 136, 1968* 23TR, 211M, 211R; Vickery, R: courtesy Architectural Association Slide Library 153M, 153R; Von Sternberg, Morley 137; Walter Menteth Architects 195R, 229MT; WeberHaus 120; Weinstein AU 107; William Sutton Housing Association 78; William-Olsson, Anders 70; Wiltshire, Dan Back Cover, 22, 144, 152, 157R, 165B, 166R, 168R, 169, 176, 183, 184, 185TR, 186L, 187, 188T, 188BL, 189, 190, 191, 193, 194R, 195L, 196, 197, 198, 199; Wimmer, Helmut 40, 111, 186R, 222M, 224R; *Wohnraum in der Stadt. Stadt-Architekturen und Wohnungsbau: Programme, Pläne, Entwürfe', werk, bauen + wohnen, 3, 1984* 207BM; *Zeller, C., '"Die Zeit der Baukünstler ist vorbei" Zum architektonischen Werk von Hans Fischli', werk, bauen + wohnen, 6, 1989* 207TM.

This book arose out of a research project funded by the Arts and Humanities Research Council (AHRC). In the UK, research into the design of housing is not often funded and so we are exceptionally grateful to the AHRC for supporting the project. The anonymous reviewers for AHRC made important suggestions, in particular prompting us to shape the research so that it was of direct use to practitioners. The project team at the University of Sheffield was completed by Professor Sarah Wigglesworth who throughout has made important contributions, particularly in the area of design analysis.

Our work progressed most when we moved from the literature review to interviews with leading UK practitioners and providers. The contributions of the following people were central in developing our understanding of the issues of flexible housing. Many of them also contributed to a conference on the subject held in November 2005. Simon Allford of AHHM, Peter Barber of Peter Barber Architects, Sue Belk of Warden Housing, Rory Bergin of HTA, David Birkbeck of Design for Homes, Jon Broome of Jon Broome Architects, Neave Browne, Peter Chlapowski of PCKO, Clive Clowes of the Housing Corporation, Stephen Hill of English Partnerships, Andrew Matthews and Stephen Proctor of Proctor Matthews, Bob Meanwell of David Wilson Homes, Walter Menteth of Walter Menteth Architects, Jon Moen of New Hall Projects, Peter Phippen of PRP, Dickon Robinson of The Peabody Trust, Robert Sakula and Cany Ash of Ash Sakula Architects, Andrew Scoones of the Building Centre Trust, and John Weir of HauteFuture. Peter Chlapowski and Rory Bergin also made useful comments on the draft of this book.

In Sheffield we have been supported by our colleagues and students throughout the project. The students of our Masters studio were both patient and inventive in exploring the concept of SoftSpace with us, and have thus contributed to a key idea within the book. In terms of the production of the book we would like to thank Rasmus von Rolf for the preparation of the plan drawings, Dan Burn for his assiduous picture research and Dan Wiltshire for his wonderful ability to turn ideas into the diagrams that illustrate the book.

We also would like to acknowledge the support of the all the architects and libraries who have been generous in the provision of photographs and drawings, and in particular: Bernhard Binder, Peter Blundell Jones, Kurt Breiter of fritz haller bauen und forschen gmbh, Eva de Bruijn of Architectuurstudio Herman Hertzberger, Dusan Cechvala of Metrostav, Robert Coles of PRP, Gokay Deveci, Clemens Krämer of WeberHaus, Franz Fehringer of Atelier P+F, Avi Friedman, Erhard Gentzsch, Wendy Gornicki of William Sutton Housing Association, David Grandorge, Susanne Grenaae of kab-bolig, Ann Hagnauer of Metron Architektur AG. Nabeel Hamdi, Charlotte Huisman of Ateliers Jean Nouvel, Bernd Kniess, Christian Kühn, Toyoshi Matsumoto of Osaka Gas, Georges Maurios , Werner Meier of A.D.P. Architektur Design Planung, Walter Menteth of Walter Menteth Architects, Norbert van Onna, Sandra Oppermann of EM2N, Rebecca Pike, José Miguel Reyes of ETSAM, Sylvia Schimmer of broekbakema, Hiroyuki Shimpo of Takenaka Corporation, Marija Tokic of Architektenlinie 4, Kelly Walker of Weinstein AU, Frans van der Werf, Anders William-Olsson, Annie Willis of Tamarkin Co., Helmut Wimmer, Manuela Zenkl of GESIBA

The Architectural Press have been very supportive of the project from the start, in particular the initial commissioning editor Alex Hollingsworth and our editor Jodi Cusack. Key to the success of the book has been its design, and here we are incredibly grateful to Ben Weaver for his intelligent, inventive and precise input.

Finally, the biggest debt is to our respective partners Florian Kossak and Sarah Wigglesworth, who like the partners of any author have had to suffer the process more than enjoy it. We cannot thank them enough for their support and understanding, as well as their intellectual contributions.

Bold references are to the main entry
Italic references are to images
The numbers refer to pages not to the project number.