Appropriation within dwellings: designing for growth and adaptation

Theme research for the graduation Studio At Home in the City | Amsterdam

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**Chair & Studio**  
Graduation studio Architecture & Dwelling: *At Home in the City / Amsterdam*

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**Date**  
September 2012 - January 2013
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Introduction

Appropriation of living space designed for flexible use

Appropriation in architecture is the practice of adaptation of existing spaces by their users to suit their needs and tastes. The reasons for appropriation are either practical needs of the inhabitants, which change over time, for example when a household expands or contracts, or can be seen as a manifest of the individual’s “discourse on space” (Llopart 2000, pp. 5-8). The first facilitates dwelling in the functional sense, privacy is created, or nearness of functions achieved, while the second one improves living quality and a general feeling of well-being for the inhabitants (we could argue that it helps to create a feeling of the house becoming a “home”).

Appropriation and adaptation within any object shows several advantages. Firstly, the object becomes situated, gains its place within the local and temporal conditions in which it is being used. Secondly, if an object can be easily appropriated in several ways, it becomes dynamic in the sense of being able to accommodate a range of functions over time, being suitable to be used by other groups of people, this flexibility increasing the potential life-span and usability of the object. Lastly, appropriation gives a sense of ownership, the user (in our case, the dweller) gains control of the space once they are allowed to do things their own way. This leads an increased satisfaction, but also care about their dwelling, and subsequently, community (Dix 2007, p.2).

Before the onset of modernism, the everyday dwelling was not considered a part of architecture, which only dealt with the monumental and extraordinary (Habraken 1993, p. 9 ). Similarly, in the pre modern era, it was common practice for people to appropriate and adapt their own dwellings over the course of their life by themselves, without help of an architect (DASH p.7). This changed with the arrival of industrial revolution, when mass housing became prevalent, and served as a means to house the newly arrived workers in the factories. The living conditions were appalling, and the new dwellings were often overcrowded and unhygienic.
Introduction

This changed with the advancement of modernism in architecture, which sought to improve the living conditions in the city (especially for the working class). These architects believed that in order to create a dignified living space for the proletariat, the old representative modes of architecture needed to be abolished, while the problem of a modern dwelling needed to be studied. Thus a period of great enthusiasm followed, in which the lifestyles were analysed, floor plans rationalised on the basis of circulation, ergonomy and economy. This produced many prototypical solutions, such as the famous Frankfurter Küche of 1926 designed by Schütte-Lihotzky in which the home maker’s activities in the kitchen were given the maximum efficiency on the smallest possible area. This is only one of the examples of the functionalist approach to architecture, in which the usage of dwellings, as well as the functional layout of ideal cities was studied and projects made which sought to provide a universal, qualitative solutions to all (Leupen 2005, 87-92).

After World War II, the upcoming welfare state in Europe had adopted modern planning and architecture as a mode for post-war reconstruction. And while this era had indeed provided countless people with qualitative housing, something was amiss. As soon as 1951 the German philosopher Martin Heidegger argued that this Taylorist approach to designing and producing dwellings and buildings had in fact estranged them from their users. In his famous lecture entitled, “Bauen, Wohnen, Denken” Heidegger explores the roots of poetic dwelling in the past ages and concludes that building = dwelling = thinking. Man “dwells poetically”, or at least he used to when he feels a connection to his home, which we could interpret as him having a direct contribution to its built form. Similarly, although a person always lives in a larger community, by being able to define a personal relation to “the center” and express this relationship in his dwelling, he actually contributes the community’s genius loci (Van Dooren 2005, pp 19-20)

The architects of Team 10 were equally concerned with the aesthetics of mass housing and repetition. The Smithsons proposed the theme of repetition for their 1971 meeting in Toulouse, in which they had asked the participants to contemplate the following points.

“How is it that just when we can most easily make things in large numbers, we have lost the secret of repetition as a formal technique? How is it that in general, the industrialisation of house building has
not produced quality in the sense of being well made? Are there any signs of the limits of systems which use repetition even if we could recover formal secrets and win a more adequate building reality?” in (Risselada 2005, p.163)

This problem had been felt all across Europe since the 1960s, with the welfare state being the largest supplier of mass housing. Though the housing shortage was being solved in terms quantity, the new standardised dwellings were deemed “unwelcoming and impersonal” (DASH, The Residential Floorplan, p 7), with many fearing that mass housing would “turn one into a herd-animal, a serf, a dependant” as Berlage had put it in 1918. In the Netherlands, Stichting Architectuur Research (SAR, founded in 1960 and led by the architect N. John Habraken, has pioneered research into building technologies and development strategies in which the future dwellers of the project would have their say in the form and organisation of their future dwelling. In her 1974 essay, “The Violent Consumer, or Waiting for the Goodies”, Alison Smithson concluded that the conventional way of building and codifying parameters for mass (and especially subsidized) housing, in which universal middle class values (and dwellings) were imposed upon people, without them not having any responsibility in and of their built environment (Engel 2005, p.39).

However, there was an alternative to the standard way of top down, state sponsored approach to mass housing. In 1961, a Dutch architect N. John Habraken has written a book “De dragers en de mensen. Het einde van de massawoningbouw” (Supports: The Alternatives To Mass Housing). In it he writes: “A support structure is a construction which allows the provision of dwellings which can be built, altered and taken down, independently of the other” (DASH, The Residential Floorplan, p7). Supports would have a much longer life span and would create conditions for different kind of infills that the inhabitants would put in place to suit their spatial and emotional needs. Typically the infill would consist of the load-bearing construction, stairwells, facades and plumbing. The infill consist of light partition walls, the precise position of “wet cells” (kitchen and bathroom), and the precise composition of the façade elements. The support would not be neutral, and should be able to stand more or less independently of the infill, thus allowing a changing of infills over time (DASH, The Residential Floorplan, p8). The dweller should thus gain a certain amount of control over the way in which his daily practices play out in the dwelling, but it becomes possible
to adapt the dwelling over time. Theoretically, partitions and other infill elements can be moved within the constrains set by the supports and new spatial configurations achieved with relative ease. This approach tries to inject newly built spaces with the capability to transform over time, is similar to that of the canal houses in Amsterdam or the Royal Crescent in Bath. In both cases, the architecture sets a framework (which need not be neutral), in which each individual inhabitant can adapt their dwelling to their individual taste, but can the dwellings can also be split, merged or put to other uses without the ensemble losing its clear identity. Architectural autonomy enabled by everyday practices.

In Bath, this meant that the monumental front façade has been set by the developer, while each owner could purchase and fill in the space alongside this façade. This produces a strong coherence on the public side, while the back sides and the interiors have the freedom to be individualized, personalized extended and split according to the latest occupant’s wishes.

Another line pursued was that of functional flexibility. Since polyvalent spaces need to be somewhat larger to accommodate a more varied range of functions and possible divisions, which is not always possible within a (subsidized) dwelling. Here the Rietveld-Schröder house from 1924 can act as an example. The moving partitions can create a large variety of spaces and spatial conditions, depending on how they’re used. When closed, they create an almost a conventional (even if ingeniously tailored to the specific needs of the occupant) floorplan with three bedrooms and a bathroom (night configuration), but when the walls are unfolded during the day, the whole upper floor becomes a common living space for the occupants (Barbieri 1999, p.135) The dwellers have the power to adapt the dwelling to an instantaneous need and are required to reflect on their daily practices to make these transformations. Dwelling again becomes a conscious act, and while spaces aren’t built in the conventional sense, the house is still “reconstructed” daily.

This example, where built in furniture and sliding walls play a major role in letting the dweller adapt the house to his or her instantaneous needs can be seen in the 1935 project by Van den Broek. Here, the dwelling patterns of a typical family were studied to determine the maximum efficiency of the use of space. The goal was to provide the cheapest (and therefore the smallest) dwelling for a family while making...
sure that all of their requirements (for cooking, sleeping, relaxing, etc) were met. The way to achieve this was not by providing enough room to house all these functions separately, but by providing a dwelling, in which the space can be used in more than one way (ie the day-time living-room becomes the night-time master bedroom and so on). (Leupen 2005, pp. 89-91).

While the liberalisation of the housing market in the Netherlands has seemingly increased the diversity of dwellings available on the market, most dwellings are, within themselves, still a more or less finished product which is presented to the consumer, only to be exchanged for a new one when the consumers’ needs and taste change with time. The practice of private commissions still only produces about 11% of built dwellings (2007) and cannot be viewed as a viable alternative for providing the widest range of people with the opportunity to express their spatial and personal needs. Furthermore, mass housing (or at least a housing ensemble) implies the changing of owners, therefore a house that’s designed to appropriated, inhabited in more than just one way.

Thus in our research we have decided to study modern housing ensembles which were explicitly designed to be appropriated and adopted by their inhabitants, not only in the initial design stages, but also later on in time. In our chosen case studies the architects have adopted different strategies to deal with the question of responding to the spatial needs of the inhabitants, but the themes of support and infill and...
flexibility are still a point of reference (even if unconsciously) in all of these projects. During our research, we have concentrated on comparing the specific architectonic conditioners which should trigger and enable appropriation of the dwellings by the people. In addition, we have decided to investigate the actual interventions that the people have made to their dwellings, in order to learn about the actual practice of appropriation and user intervention.

The case studies we have chosen represent a various typologies within Dutch housing design and various conceptual approaches chosen by the architects. We have collected information about the project itself and the intentions of architects and made digital models of the original plan as realised. During our research we have taken a more anthropological approach to gathering data, which is most suited to discern people’s motives, lifestyles and individual approaches for adapting and appropriating certain parts of their dwelling (Llopart 2000, p7). When necessary and possible, we have visited and interviewed the architects about the particularities of the project. Furthermore, we have made visits to our chosen projects, interviewing a sample of people inhabiting these dwellings, and researching the ways in which they use their living space and how and whether they use the possibilities that the architect has tried to embed in their dwelling design. We have recorded their interventions, and what had caused, as well as enquired about any constraints, architectural or otherwise, that might have prevented them from realising their plans.

By doing this, we have reconstructed the phases of the dweller’s interventions, as well as their reasons for doing so. This enables us to study which architectonic features and/or other conditions of the case studies have enabled transformations, and which feature/conditions serve as a constrain to the aforementioned practices. In doing this, we hope not only to document the particular studied cases, but also provide general guidelines that reveal the possibilities and constraints of architecture, as well as highlighting other factors that an architect should keep in mind, that might enable or hinder user adaptation and appropriation within in a particular situation.
Case studies introduction

Row house
- Diagoonwoningen, Delft
- SAR/Molenvliet, Papendrecht

The row house is probably the most common built dwelling in the Netherlands, and is based on the principle of repetition of the same dwelling within one attached building volume. Just because of this repetition of the same dwelling, there is a huge chance that the dwelling loses an individual identity. Both Herman Hertzberger and Frans van der Werf tried to give back the individual identity within the principle of repetition of the basis of the dwelling unit by designing appropriation and initiating growth and adaptation to both give back the individuality as extending the lifespan of a dwelling.

Apartment
- Flexible Housing Dapperbuurt, Amsterdam
- Schiecentrale, Rotterdam

The growing number of inhabitants in cities ask for a higher dwelling density. By not only repeating the dwelling side to side, as done with the row house, but also stacking the housing units, the sense of individuality gets lost even more. Both Margreet Duinker & Machiel van der Torre and Mei architecten created a standard housing unit, where dwellers themself can decide how to use the unit; by sliding walls around a fixed core or a fixed core with an open floorplan around it where the dwellers themselves have to make all the decisions concerning the infill of the floorplan. This leads to a variation of the possibility of complete open areas to a 4-room apartment.
Herman Hertzberger
Gebbenlaan, Delft
1969-1970

Number of units: 8
Ownership: private property
Design concept: incomplete framework
Diagoonwoningen

The development of the process

In the late 1960s, the Dutch government began to grant subsidies for more experimental dwelling forms. Herman Hertzberger initially designed the Diagoon dwellings to be a part of much larger scheme, though in the end, only 8 dwellings were built in the suburbs of Delft.

Intention:
"What has been designed should be seen as an incomplete framework. The skeleton is a half-finished product that everyone can complete according to his own needs."

... "One could draw a conclusion from all this that all we have to design is empty shells, as unempathic and neutral as possible, so as to allow inhabitants optimal freedom. However paradoxical it may seem, it is questionable whether such a degree of freedom would not result in a sort of paralysis. We must give incentives, create ‘stimuli’ that are so designed as to evoke images in everyone’s mind – images which, through being projected into a person experiential world, will result in associations that encourage individual use, that is to say, the very use that is most appropriate for his situation at any particular time"
An Incomplete framework instead of a completed building:

The Diagoon dwelling consists of split levels connected by a central staircase and a void which brings light deep into the dwelling. There is a second set of cores that contains a kitchen on the first level and a bathroom on the third level. Although the spaces are not further divided up, the combination of different routes, light conditions and the stark materiality invite the dweller to interpret and adapt the space to their needs.

Similarly, their dwelling’s façade is moulded in such a way that it allows additions without losing the original sense of unity within the project. The additions are enabled by “gaps” which can either be closed off (the original car-port) or filled in (the front porch, the back porch). Furthermore, because the central staircase becomes a continuous circulation element within the dwelling the spaces it connects can be subdivided and/or given different functions as per residents’ current needs.

Five different levels with half storeys height in between are connected to two basic cores. Every level could be partitioned off or not to make different spaces functioning as living, sleeping, study, play, relaxing, dining, etc., which are decided according to the personal tastes of inhabitants.

Initially, there is very little variation in the dwellings, besides the mirroring orientation. The variation arises through the each individual owner’s interventions. To emphasize the incomplete and unfinished state of the dwelling, the interiors (just like the exteriors) are materialised in concrete breeze blocks and the spaces are over-dimensioned to be able to accommodate more diverse functions.
Diagoonwoningen

Fig 08: Variation in floorplans
**External variation**

There are two ways in which the dwellers can determine the form of the dwelling.

Even though the exact dimensions and colour of the window frame are set by the architect, the dwellers were able to choose whether a particular area will be filled in by glass (see through) or a solid panel (not see through). In this way, the elevations could be opened up as much as possible to allow light in and provide views to the outside, or, to provide more privacy by filling in the panels room into this ‘screen’.

Another way in which the dwellers can influence the exterior of their dwelling is expansion. The morphology of the building is such that it allows (and “stimulates” additions) in the carport and various “corners” of the building. Furthermore, the dwellings are not protected by the beauty committee (Welstand), and such additions are not opposed by the authorities. Carel Weeber even added an abstract mural on one of the street-facing walls. Due to the fact all the additions take place within the larger gesture of the architect, the ensemble retains its unity and identity, while fostering growth and external variation.

*Fig 09: External variation: window frames*

*Fig 10: External expansion*
The owner of the house is an architect and has lived in this house since it was first built.

He is currently retired and lives in the dwelling with his wife. His children have long moved out.
Diagoonwoningen

Phases

The first visited dwelling on the Gebbenlaan is inhabited by an older couple, who's two children have already moved out. They changed the dwelling over time: in the beginning, when the children were little, a large area of the house was devoted to their play-space.

When the children grew up, they got more private space and bigger bedrooms - for one child the carport was rebuilt to be a bedroom as an extension of the dwelling.

After the children moved out, every partition of space was removed - the dwellers use the height difference as the “room-deviders”.

Fig 16: Appropriation within the dwelling
The current dweller of this house is also retired has also lived in her dwelling since 1970.

She first moved in with her husband and their small children, but lives alone now, her husband is in a nursing home, the children have become independent.
Diagoonwoningen

Phases

The inhabitant of the second dwelling is one of the original inhabitants. When the owners moved in, they immediately converted the carport to a hobby-space. Both their children got their own (small) bedroom on the third level.

When the children moved out, none of the spaces were added to a bigger space. The only change the dwellers made, was to place a fireplace, since the original designed by Hertzberger never worked.

Now that the husband is in a nursery home, the dwelling is habited by only one older lady. She recently added patio at the front door to the hall.
This house has changed hands most often, according to neighbours and current owners. The first dweller of this house was the architect Carel Weeber, who claimed that the house did not have enough windows. The house occupies a unique position on the passageway between the dwellings in the ensemble.

The current owners are a professional couple. The husband works in Amsterdam; the wife works in Rotterdam and occasionally from home. They are both architecture enthusiasts.
Diagoonwoningen

Phases

The third dwelling of Hertzberger’s Diagoonwoningen, have lived here only since two years. The original owner was Carel Weeber, who added two windows: one in the work-space, the other in the bathroom.

The passage in front of the house has been closed off a few years after the completion of the project, the adjacent room was used as a laundry room.

The current owners are big architecture enthusiasts without children. The wife has two studios in the house: one on the second level, one in the former laundry room, which is accessible from the street as well.

They removed all the partitions, and have no closed off rooms.

Fig 28: Appropriation within the dwelling
Frans van der Werf
Stellingmolen, Papendrecht
1977

Number of units: 123
Ownership: social rent
Design concept: support & infill
Process of developing the project

As a young architect, Frans Van Der Werf got the chance to materialize John Habraken and SAR’s (Foundation of Architecture Research) idea of “support” and “infill” in Molenvliet project after winning a national competition of a dwelling project in 1969.

Four levels of decision-making are designed to be involved in by related actors: overall plan of the district, the tissue plan, the Supports design and the Infill design. According to the research method developed by SAR, Van Der Werf proposed a model of support structure which encourages variety of infill dwellings to accommodate 350 people for the specific projecting site.

The allocation of dwelling spaces is adjusted according to the actual needs of future inhabitants after a series of meeting for general information. Each of the households got two sessions of 45 minutes meeting with the architect to decide the infill for their own dwelling. The final infill assembly kit required was sent to the site when the empty shell support was ready to receive its infill. When the tenants changed, the layout of the dwelling could be easily be changed due to the clear Support-Infill division and the modular construction (van der Werf 1980, pp. 160-69).

Fig 31: Infill meeting with F. van der Werf
The design of supports - spatial organization and internal variation

The systematic design of the support was developed according to the SAR’s evaluation system where a series of concept such as zone, margin, sector, sector group are introduced (van der Werf 1980, pp. 160-69).

The architect uses an α zone and a α margin to describe the internal area that is next to an external wall and the area between two α zones respectively in his floor plan. He uses the sector to describe the part of a zone with its adjoining margin between the structural members, and sector group the combination of the sectors forming one dwelling unit. After considering the depth of zones, margins and the width of sectors, a series of analysis within this system was conducted to formulate the conventions about the position of the functions the combination of functions in sectors and sector groups (Wiewel 1976, pp.47-78).

These conventions which could be arranged in some charts help develop each basic variation which means a dwelling program with certain function located at certain position in a specific sector group. These basic variations were again tested by designing and drawing one or more of their completed layouts as sub-variations. The basic structure of in situ concrete piers, 20 cm x 140 cm placed parallel to each other on a 480 cm (15’9”) square grid was designed and evaluated as one of the seven components of the “support” that allows the variation of infill.

The others include floor decks, with openings for staircases and vides; Pitched roofs, two bays wide, parallel with the piers, sloped at 45° to provide a habitable attic with a loft under the ridge as an extra space for the use of the upper level dwellings; wooden frames which act as armatures for specific facade elements in the longitudinal facades, and prefabricated concrete parapets and wooden frames in some of the transverse facades; roof terraces located on the flat roof space of the ground floor dwellings as outdoor extensions of the upper level dwellings; open galleries for upper level access; vertical service shafts 60 cm square containing all wiring and piping for gas, water, electricity, television, telephone, chimney, ventilation and sewerage.

While the infill assembly kit consists of gas heater, kitchen group including fixtures and cabinets, bathroom group(s) including fixtures and cabinets, wiring components facade elements (windows, doors, frames), interior partitions (van der Werf 1980, pp. 160-69).
Fig 33: 5 main basis variations of a typical dwelling on first level

Fig 34: Ground floor plan of the visited block showing one sub-variation for each dwelling
Molenvliet

External Variation
A flexible system of window frames was developed for the variation of facade according to different spaces and functions behind it and different personal taste. Within this system, the tenants could choose different “infill” components including standardized windows, doors, glass and panels with thermal insulation and their combinations. There was also choice from 8 colours (Kapteijns 1978, pp.81).

Fig 35: variation of window frames

Fig 36: a few possible infill components on the triangle part of the facade
The first visit at the Molenvliet project was to a dwelling which is being inhabited by the original dwellers. Even though all dwellings are rental, and this couple created their own floorplan in the beginning, this couple has made several changes over time in the maisonette on the top floor.

Taking in account that they would have children someday, they chose to have 3 bedrooms from the start and a large living space. Because the houses are rental, the sanitary facilities and kitchen are very in sum and standard, also when replacement is needed. Therefore the couple decided to spend “own” money for a more luxurious kitchen and bathroom.
At the beginning, the couple had a large living room and a cooking area separated by a closed toilet on the first level. On the upper level, they had one master bedroom and two single bedrooms for kids, a standard bathroom and a storage room. The attic functioned as a guest room. After they moved in for a while, partition between children’s bedrooms was moved so that the sizes of the two rooms were more equal.

Later they renovated their bathroom on the upper floor. The shape of the shaft was changed from a square to a rectangle because of the interchanged position of the toilet and the shower. The partition under the pitched roof was moved outwards to accommodate a bathtub and a new window was made on that roof over it. A part of the hallway was also closed off to accommodate a washing-machine.

When their children moved out, one bedroom was transformed to a storage space. The other kid’s bedroom has been transformed to a baby’s room since they had a grandchild who comes to stay once a week. The attic has become a storage space. The kitchen was also modernized.

**Fig 42: Appropriation within the dwelling**
Dwelling [B] - Stellingmolen 284A

The second visited dwelling is a smaller apartment on the ground floor. The previous renter just left a few weeks ago; the new renters, a young couple, about to move in, are currently renovating the apartment with the help of the corporation and furnishing it.

The apartment only has one bedroom, and a fixed bathroom core in the middle, which makes the interior quite fixed.

Now that the apartment is new for the new dwellers, they noticed some “flaws” in the dwelling: misplaced electrical connections, missing lighting spots and multiple useless hallways, due to the size and fixed core.
Phases

The tenants have been changed for a few times, but the layout of this apartment has kept the same as the beginning. A small and a large spaces with windows was used respectively as a bedroom and a living room with a cooking area. The big dark space at the corner was divided to storage rooms and a bathroom that could be both accessed from the bedroom and the living room.
Dwelling [C] - Stellingmolen 232

In the third dwelling; a maisonette on the top floor, is currently inhabited by a single middle aged man. He lived in one of the smaller apartments elsewhere in the Molenvliet project, but wanted a bigger home since his son sleeps every other weekend at his place.

The dwelling consist of a large kitchen and living space with a balcony on the first level, and two bedrooms and bathroom on the upper floor.
Phases

The dwelling space contained 3 bedrooms at the very beginning. When the current tenant moved in, the two smaller bedrooms on the upper floor had been merged into one larger bedroom. The rest of the layout has never changed.

On the lower level, a living room and a kitchen connected to a terrace are set on the two sides of the servant core which was fixed as part of supports. There’re two bedrooms of equal sizes and a bathroom on the upper level.
Dapperbuurt

Duinker & van der Torre
Wagenaarstraat, Amsterdam
1986-1988

Number of units: 17
Ownership: social rent
Design concept: sliding walls/fixed core
The process of developing the project

The Dapperbuurt area is a nineteenth century neighbourhood, which is characterized by a clear urban fabric with an orthogonal street pattern. In this area are many city renewal projects; the dwellings of Duinker van der Torre are one of these projects. It exists out of three locations, spread over the Dapperbuurt area. Two of them in de Wagenaarstraat, the third in the 2e van Swindenstraat across a new city square. The architects aspired to realise dwelling ensembles which can be seen as “self-standing” elements in the continuous urban pattern.

The basic idea for these dwellings lays in the Schroderhaus by Rietveld, named in the introduction. The architects Margreet Duinker and Machiel van der Torre strived for the low-barrier but highest possible flexibility within an apartment and thought of the sliding walls as done in the Schroderhaus the perfect method. Even though they wished for a bigger width of the dwelling, which would place the core in the centre of the dwelling, they used the sliding walls as a very easily adaptable division and unity-creating method to initiate possible desired adaptation and allowing a wish for showing an identity within a dwelling with hardly any character on its own. Another wink to the Schroderhaus are the cornerwindows, which, just like Rietveld’s design, can open completely without a frame style in the corner.
Dapperbuurt

Identical squares?

The development of floorplans which are as open and flexible as possible was an important theme from the beginning of the design process. This resulted in two main dwellingtypes: the “sliding door dwelling” in the Wagenaarstraat and the dwellings with the free “core” or “beam” in the 2e van Swindenstraat.

For this research we will focus on the dwellings on the Wagenaarstraat.

Starting point of the design was to give the biggest possible part of the space to the living area. Initially the wish of the architects was to create a ‘perfect square’. This means they wanted to position the core, housing four sliding walls, so the dwellings can change from one big open space apartments to a three-bedroom one, in the middle of the floorplan. With this the users have a big amount of freedom to organize and inhabit their homes. Also, the design gives an expansive feeling in a relatively compact apartment (ca. 85 m²).

However, the maximum given dimensions for the units, given by the Amsterdam municipality, did not allow this. The smallest possible dimensions for the core are realized, but still had to be places off-centered, because otherwise none of the remaining ground space would be sufficient to realize a living area. By placing the core off-centre, one dimension arises that allows such a function. At the same time, this “off-centering” of the core already decides how to use a space in the dwelling. Combined with the position of the entrance in the corner near the biggest possible separate room, it is already “determined” how the spaces will function: the living area in the biggest possible room with the kitchen nearby which is fixed. This means the remaining ground space, which can be divided in two separate spaces, will house the sleeping function.

Considering the designed hallway in the core, the architects already realized this. They saw that the “bedrooms” would have an extra entrance, to ensure privacy.

Unlike the desired free, perfect square with a high level of flexibility in the spatial organisation, the dimensions of the apartment limit down this idea.
The apartments on both the Wagenaarstraat are almost perfect squares. All of them have an identical base. At the Wagenaarstraat: the same dimensions; a “wet” core (containing the kitchen, bathroom and toilet) which is positioned slightly off centre; a small entrance hall in the corner; three sliding doors which disappear in the core when opened; and one “fixed” set of doors.

Although every apartment is built the same, because of the sliding doors every apartment is being used differently, according to the households’ wishes: one open space, one separate bedroom or a three-room apartment.

Fig 62: Spatial infill
One of the dwellings on the ground floor, was the one first visited. It is currently rented by a single older man, an artist. With a permanent knee injury he is grateful to have been assigned this ground floor apartment.

When it comes to the flexibility of the spaces and walls; he never uses them. The sliding door between a bedroom and the kitchen is fixed to increase more storage space. One of the bedrooms is opened to the livingroom to increase this space. Since he lives alone he only needs one bedroom, but lots of space to store his self-made art.
Dapperbuurt

Phases

The dwelling space exists of a very flexible floorplan but at the same time a very fixed one, since the sliding walls make the dwelling vary from a studio apartment to a 3-bedroom one, but the possibilities within this flexibility is very limited.

Due to this limited flexibility, the dweller uses the apartment every day in the same way: a closed off bedroom, by fixing two sliding doors to closed walls. Besides providing privacy in the bedroom, this closed wall creates extra storage space for the kitchen - the built kitchen as the architect designed appears to small and lacking storage space.

The sliding wall between the kitchen and living area remains open every day - the dweller wants the spaces to be opened towards each other, to make the kitchen part of the living space. The dweller owns lots of (self-painted) art, and uses the second bedroom as an extend of his living space to store and show his pieces.

While the sliding walls are changed very easily, the dweller never changes them.
Dapperbuurt

Dwelling [B] - Wagenaarstraat 32H

On the third floor lays the apartment which is visited second. This dwelling is “clamped” between two other sliding-door apartments and has no direct facade towards the street - the gallery is the inbetween space.

In this dwelling lives a Brazilian family with two small children.

Fig 73: Visited dwellings

Fig 69-72: Visitation pictures Wagenaarstraat 32H
Dapperbuurt

Phases

Due to too little storage space, the previous tenant already fixed the sliding door between the kitchen and bedroom. Against this fixed wall shelves are placed.

Because of this household every room is fixed in program: one livingroom, the kitchen and two bedrooms - the level of flexibility is only being used when the mother cleans the house: with only one electrical connection she can reach the entire floor with the vacuum cleaner.

Fig 74: Appropriation within the dwelling
Schiecentrale

**Mei Architecten**
Lloydstraat, Rotterdam
1904-1906/2004

Number of units: 176
Ownership: private property
Design concept: Neutral dwelling with a fixed core
Schiecentrale

Process of development

Schiecentrale is a hybrid development in the former harbour of Rotterdam. It combines offices, retail space, parking and a hotel, partly in an old industrial building (an old power station, partly in a new-built spaces). The in the phase 4b, 173 dwellings were added, along with parking garages, office space and retail space and a gym. The parking garage is 4 stories tall and supports two slabs with a communal courtyard in between. The lower stories of the slabs are exclusively devoted to office. The upper stories are designated to living/working. The slabs are accessed by means of a gallery.

The load-bearing structure is a concrete skeleton with irregularly spaced bays. This structure is pierced by service cores, onto which the kitchen/bathroom cells are attached to. This core is asymmetrically placed within the dwelling. The architect has insured maximum daylight inside the dwellings by creating floor-to-ceiling windows. This could be achieved by having minimal internal finishes inside the dwellings, since the occupants would need to pay for those themselves.
**Internal organization**

The dwellings are accessed by an external gallery. The service core is positioned asymmetrically and in some cases already suggest further spatial organisation, with the bathroom and the kitchen being designed by the architect. The dweller can theoretically expand these, and or change their as long as they stay within the reach of the plumbing. The space is left further undivided and the detailing stark and industrial.

The irregularly spaced load-bearing skeleton, combined with party walls that do not always coincide with the building structure gives great possibilities for internal variation. The skeleton structure allow larger units to be split into more, while smaller units can be added together (this has not yet happened as the project is still relatively new). The dwellings are designated as live/work spaces, so a dweller can establish a small home office in them.

Because the elevator cores do not occupy the whole width of the slab, some apartments have an L-shape, while other are completely rectangular. Furthermore, the rotation of the core in the apartments can create further diversity. Similarly, not all stories have the same combination of sizes of apartments, the higher up one goes, the larger (and more expensive) the apartments get.

However, all units are faced with same basic starting conditions, a completely transparent gallery side, an asymmetrically placed core and floor to ceiling windows on the other side. The dwellers need to resolve the privacy on the gallery side themselves. The other side does not pose a problem, as the dwellings are placed high above the street level/courtyard to ensure privacy from onlookers.
A childless couple in their later years, they used to live in a Jacobsveen loft across the street, where they liked the industrial spaces and contact with their neighbors, but found it slightly dark.

They kept the open character of the space, arranging their living space around the central core, only using a closet to separate their bedroom from their bedroom.
Phases

The dwellers moved in and separated a space for their bedroom with a cupboard. All the living functions are organised around the central core, with the living room facing the view of the harbour, their dining area and working space on the gallery side.
Schiecentrale

Fig 89: Visited dwellings

Dwelling [B] - Lloydstraat 338  10th floor

A single occupant, a young man who is self-employed in the media industry (animation) in Rotterdam. Sometimes works from home. He liked the idea of being able to adapt the dwelling to his needs. His architect friend designed the space in a couple of consultations, the main concept was to create a more differentiated space where different activities would each receive their own spatial expressions (this happened through the use of lowered ceilings to create a more sheltered atmosphere).
Schiecentrale

Phases

The inhabitant wished to create a more varied atmosphere within the dwelling. By interrupting the open space around the core, and creating a suspended ceiling in the less public areas of his dwelling (kitchen and bedroom), he has managed to create a dwelling with a continuously changing atmosphere, as well as gaining extra storage space.

The dwelling bears a resemblance to a cave or perhaps a shell, tailored specifically to its owner.
One of the larger apartments, the owners are a retired couple, their children already independent.

They used to live in a large dike-house in West Brabant before moving to Rotterdam. They like the complex because of its industrial vibe and a lot of young people living and working there. They have opted to enlarge storage space next to the core and add a small guestroom with no direct light/air for when their grandchildren come to stay over, so that they could still enjoy the wide views from their living room.
Phases

The inhabitants needed more storage space, as well as a bedroom for their grandchildren (they come to stay with them in the weekends). The bedroom for the children is only used for sleeping and storing their toys and has no windows to the outside, but small windows to the living room. The inhabitant’s own bedroom faces the gallery. The large living space takes the whole width of the apartment and faces the view of Rotterdam harbour.
Comparative summary

The comparative summarize of the projects is to be found in the matrices attached to this research in Appendix 01.

In every case study the architects already thought about a certain level of freedom to appropriate the space to allow for growth and/or adaptation. By comparing the initial ideas or theories with the actual changes that are or can be made in practice, we get a clear idea on how ideas turn into reality.

From the beginning there has been a separation between internal and external variation. Although changes to the interior can have major effects on the external space, this comparison is about how changes can be made to the interior and exterior separately.

**INTERNAL VARIATION**

In this chart, the spatial practice in each visited dwellings over time is placed next to the intentional spatial organization that allow the variation of dwelling space. The gestures of appropriation of the spaces are categorized into 5 main types according to the actual changes taking place in studied cases.

They are:
- merge two rooms (spaces) into one
- functional transformation within the same space
- slightly modify the size of rooms (non-bathroom)
- enlarge the bathroom; enlarge the kitchen
- rooms are partitioned off from a larger space.

Moreover, the orange texts means those interpretation expected by architect and the blue means the unexpected ones. A column titled why closing the chart to further explain the relationship between the previous two columns: spatial organization and in practice, while the non-architectural conditions as described before are also taken into account. These lead to a ranking chart showing the comparative rate of variation as the following:
### Comparative summary

<table>
<thead>
<tr>
<th></th>
<th>Diagoonwoningen</th>
<th>Molenvliet</th>
<th>Dapperbuurt</th>
<th>Schiecentrale</th>
</tr>
</thead>
<tbody>
<tr>
<td>rooms are partitioned off from a larger space</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>merge two rooms/spaces into one</td>
<td>+++</td>
<td>+</td>
<td>++</td>
<td>?</td>
</tr>
<tr>
<td>functional transformation within the same space</td>
<td>++++</td>
<td>+</td>
<td>+</td>
<td>?</td>
</tr>
<tr>
<td>modify the size of rooms (non-bathroom)</td>
<td>O</td>
<td>+</td>
<td>O</td>
<td>?</td>
</tr>
<tr>
<td>enlarge the bathroom</td>
<td>O</td>
<td>+</td>
<td>O</td>
<td>?</td>
</tr>
<tr>
<td>enlarge the kitchen</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>+</td>
</tr>
<tr>
<td>conclusion: rate of internal variation</td>
<td>HIGH</td>
<td>MEDIUM</td>
<td>LOW</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

What needs to be explained here is that Schiecentrale is a relatively new project; we can’t see any later changes of the configuration of the apartments by these first dwellers yet. But even at the beginning, these apartments already show abundant variation on their spatial setting compared to other cases. Thus we could consider it has a high rate of internal variation.

We observe high rates of internal variation within Diagoon dwellings and the Schiecentrale. In both
Comparative summary

cases, the inhabitants have taken the basic spatial structure and transformed it over time to suit their needs. In Diagoon dwellings, this is even more evident, they are already 42 years old and many changes have been reversed, depending on the needs and desires of the dwellers. Although the Schiecentrale has only had one variation, it already shows it can accommodate a very diverse set of lifestyles and spatial desires.
Molenvliet disappoints, the internal changes have been rather limited (though there have been changes) compared to the theoretical freedoms for adaptations. Still, this means that the initial diversity of the project remains in place, but rather more static that the architect originally envisaged.
In both Dapperbuurt Dwellings, we found that the inhabitants do not use the flexibility afforded by the floorplan daily. Both have fixed one of the walls adjoining the kitchen. One of the households has completely fixed all the walls, while the other only uses it to facilitate cleaning and ventilation of their dwelling, which, in a way, actually does facilitate daily patterns of the inhabitants.
Comparative summary

EXTERNAL VARIATION

In the following chart, we show the external variation in our case studies. Only two projects exhibit external variation, Diagoon dwellings and Molenvliet. The variation occurs in two categories:

- Customisation of Façade elements
- Expansion of the dwellings

In each case we show the possibilities that were offered. In the case of the façade, only certain parts were filled in according to the resident’s wishes (materiality and colour of the solid walls was not an option, for example). In case of the expansion of the dwellings, only Diagoonwoningen show any activity.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Customisation of Façade Elements</td>
<td>++</td>
<td>++</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Expansion of the dwellings</td>
<td>++++</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Conclusion: rate of internal variation</td>
<td>HIGH</td>
<td>MEDIUM</td>
<td>LOW</td>
<td>LOW</td>
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</table>

In the first case, the dwelling’s morphology allows the occupants to fill in any gaps, which most of them took. All of the original carports have been closed off. Some are now used as a hobby room, or were intended to be an extra bedroom. Although none of the dwellings have been “filled in” to their maximum potential, a variety of additions can be observed, a testament to the success of this scheme.

As for the façade infill, all the studied households have opted for a façade with maximum transparency of their living rooms. Only the narrowest panes of glass have been replaced by panels, for the difficulty of cleaning these windows. Furthermore, this side of the dwelling faces the garden, so privacy is ensured. However, the top level of the dwelling (which also faces the garden, but in all cases also houses the
Comparative summary

bedroom(s)), shows a more closed, and a slightly more varied picture. The feeling of privacy is more important in a bedroom, as well as the fact that the occupants prefer these spaces to receive less light (especially on early summer mornings).

In the Molenvliet case, the dwellers could choose their own façade elements and composition from a kit of parts and a set of colours. Even though this might seem quite limiting, a great deal of variation had initially been achieved. However, similarly to the internal variation of the same project, the amount of changes since the beginning have not been very rapid, due to the relatively high cost of changing a façade.

However, in 1994, the housing corporation decided to modernise the dwellings, which resulted in a decrease in variety. Fewer colours have been offered, and some solutions have become completely standardized, such as the facades of the attic spaces which now all look the same. Some changes have been made to the original elevation compositions (especially in the name of better insulation), but generally the other façade elements have kept their formal diversity, only losing their varied colour. Though this has been a change, it was a change that was not influenced by the occupants, and a change in which their choices have been curtailed, and the overall level of diversity and expression had been lowered, rather than expanded.
Conclusion

The essence of this research was to obtain more information on how architecture can allow growth and adaptation within a dwelling or a dwelling ensemble. This is essential not only to personal well-being of the inhabitants, but since these structure have the potential to accommodate different functions and lifestyles, building for appropriation and adaptability could extend the lifespan of a building from 30 to 100 years. However, the theory of the architects who designed based on this idea, is often (slightly) different than the outcome of the projects, we wish to look which factors (some outside the architect’s influence) can either contribute to, or discourage from appropriation and adaptation.

Although the cases offer very specific architectural solutions that were mentioned in each case (such as the architectural “stimulants” consisting of oversized beams and roughly materialized polyvalent spaces in the Diagoon dwellings designed by Herman Hertzberger), we wish to point out the general patters that encourage appropriation and adaptation. After all, it is not our aim to make a list of known architectural features, but uncover the reasons for their success or failure in triggering the imagination and action of their inhabitants.

Throughout the conclusion, we will refer to the following terms as applicable to the dwellings and link them to the number of adaptation and changes the inhabitants have made to their dwellings.

*Long term versus everyday use*
Are the adaptations within the dwelling made to accommodate daily patterns (everyday use) or do the changes once made long term and relatively more static (time frame of years)

*Effort to make a change*
Refers to the relative ease with which the inhabitant can change the spatial layout of the dwelling. Sometimes, sliding a wall is all it takes to create split a larger room (low effort), while it takes considerably more effort and planning to change and internal partitions and even more still to extend the house (both high effort).
Conclusion

**Possibilities for change**
Do the dwellings, and the systems of change within the dwellings allow for a wide variety of possible adaptations (high), or only seemingly so, when the actual number of choices is limited by the inherent qualities of the dwelling (layout, systems of adaptation) (low).

**Ownership**
Refers to whether the dwellings are privately owned or rented. In the first case, the decision to change the dwelling lies with the owners, in the second case, the decision whether change is permitted lies with the owner of the building (a housing corporation) and not its actual inhabitants.

**Arrangement**
Refers to whether the dwellings are stacked (on top of one another) or stand side by side. (row housing).

By assigning each of the case studies a rating with this system, we can combine these with the amount of internal and external variation seen within each case. Afterward, we can further analyse these results and conclude which factors are beneficial to adaptation and appropriation, which factors discourage dweller’s appropriation, and which factors are of little importance when it comes, both for internal variation, and for external variation.

Fig 99: elements to initiate the possibility to change for growth and adaptation
Placing the elements into a chart to show and test the possible combinations, we again find a separation between internal and external variation.

If we look at the internal variation diagram, we see that the way of arranging the dwellings have no influence; all combinations with both side-to-side and stacking are neutral. Also, the ownership has no influence on the appropriation for every day use. This is because within the category of social rent it is just as easy and possible to, for instance, slide a wall as it is in a privately owned dwelling.

Besides that, what strikes is that both the combination ‘long term – low effort’ and ‘low effort – low possibilities’ are in practice different than how the architects intended. This doesn’t mean the combination is bad, but that this is a combination that does not appear in the architect’s vision. Fixing a wall and using it for storage for instance, is still a conscious act of appropriation even though it goes against the architects intention of flexibility and changeability. Furthermore, the dwelling in the Dapperbuurt offers rather low possibilities of change, since these are all spatially fixed. However, they are still being used by the dwellers, but in a different way than how the architect intended – ventilating or cleaning the dwelling at once, while after that the walls will be re-placed as they were before so that the space will be used in the same way.

The scheme shows that within the private property, we see that every combination is possible. However, some combinations are unlikely to happen within a dwelling - which is designed for appropriation to initiate growth and/or adaptation.

For instance, within this ownership, the elements of low effort and low possibilities are unlikely to happen, since dwellings designed for this appropriation, and for private property ownership, will be more “extravagant” than low possibilities or effort. As Herman Hertzberger wants to “force” people in the Diagoonwoningen...
to think about what to do with their dwelling, by showing the possibilities (such as the over-dimensioned beams); the effort the dweller has to take by actually execute one of the possible changes is (too) big and for the long term.

Looking at the long term vs. short term (every day use), we see that at both the low possibilities is a red element. Having low possibilities especially for a long term in a dwelling that should be designed for a dwelling to initiate growth and adaptation will most likely will not achieve that goal, since the options for initiating this lack with little possibilities.

For the short term, having low possibilities in combinations with a low effort, would seem to be a good combination. However, the Flexible Housing in the Dapperbuurt in Amsterdam shows that also this combination does not work as it would in theory. The low possibilities limits the desire to change a lay-out of the floorplan, even though the effort is low. Having low possibilities will, as in the Dapperbuurt, not have enough “impact” to initiate for growth and adaptation, which means that tenants will have the elements fixed or “accepted” as they are and anticipate on that.

Looking at the external variation scheme, what strikes is that both ‘every day use’ and ‘low effort’ are no options to consider, in every combination with the other elements. This is because changing the external part of a dwelling is always for the long term and never a low effort – changing a window/facade element or expanding the dwelling side- or upwards, will also always be for a long term – it is simply not possible that this can be done per day, considering the households wishes.

In theory, it would be possible to have a combination of stacking dwellings within the social rent ownership – the building is a property of one institution: a land lord, the housing corporation etc. This has no impact on the possibilities of expanding a dwelling: even an entire floor can be placed on top of an existing

Fig 101: elements to initiate the possibility to change for growth and adaptation for external variation
building. However, since the owner is different from the dweller, this kind of expansion is not dweller-initiated, and therefore does not react on the households (as appropriation does) wishes but on the wishes of the owner.

Side-to-side arrangements allow external variation more: a dweller can expand its dwelling up- or front-/backwards, since there are no other dwellings to be consulted before being able to make this adaption to the dwelling.

Within the privately owned dwellings, we see that this ownership triggers people more to make changes to their homes to allow for growth and/or adaptation. When renting the apartment, the effort to “ask” the owner for a change is:
A] too big for the (possible) change, and
B] unlike to happen.

For instance, the Molenvliet project was developed for further changes (changing the façade elements), however the housing corporation changed soon after finishing the project and hardly allows changes to be made to the dwellings, internal as well. Being the owner of your dwelling, you don’t have this problem – the dweller can decide what and whether to change his dwelling.

Overall we have noticed several common point when it comes to appropriation within a dwelling which is designed for allowing growth and adaptation. Generally large privately owned non-stacked housed allow for the greatest degree of appropriation both internal and external. Even though appropriation in theory can happen within socially rented apartments, practice shows that the ownership model and bureaucratic struggle to get approval and financing for further adaptation is difficult and therefore these processes occur less often.

Furthermore, we have found that people are more likely to adapt their dwelling for over a long(er) term. Instantaneous adaptation of dwellings with sliding walls requires a specific kind of dweller, such as Mrs. Schröder. This does not mean that the system does not work well, but that the system is not used to its full potential.

We found that internally, the dwelling arrangement has no effect on internal variation; people are able to appropriate or to adapt their internal living space if given the chance, regardless the external situation.


## Illustration credits

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*Note: All uncredited illustrations were produced by our research group*