



PREFAB QUALITY

ARCHITECTURAL QUALITY IN DANISH PREFAB WOODEN DWELLINGS

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Publication date:
2009

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Wraber, I. K. (2009). *PREFAB QUALITY: ARCHITECTURAL QUALITY IN DANISH PREFAB WOODEN DWELLINGS*. Institut for Arkitektur og Medieteknologi.

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PHD DISSERTATION

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PhD dissertation

August 2009

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Financed by: Hjem A/S, Danish Forest and Nature Agency, Aalborg University

ENGLISH SUMMARY

This PhD project is a co-financed project between the Danish Forest and Nature Agency, the single family house producer *Hjem*, and the Department of Architecture & Design at Aalborg University. The aim of the thesis is to investigate the architectural pros and cons as well as the potential of building prefab wooden single family dwellings in Denmark. The main research questions are:

- 1) Architectural quality is commonly used in architectural discourse, but it does not seem to be a well defined concept. Is there a core of elements that form a general definition of architectural quality?
- 2) Prefab dwellings often seem to be looked upon as a lower class of dwellings – should it not be possible to build prefab dwellings of high architectural quality?
- 3) Wood is increasingly often seen in contemporary Danish building and is used as a cheap, strong, light and environmentally friendly material, but what about the aesthetical values seen in relation to the Danish tradition of building in stone and heavy materials? How can we build contemporary wooden dwellings in a Danish context?

In order to investigate these matters the first step is to build a model for analysing and discussing the architectural quality of prefab wooden dwellings. This is done through a state of the art on architectural quality and a structuring of the presented theories into three theoretical clusters that are defined through three keywords each. These clusters and their keywords form a model for analysing architectural quality, which is used for three different purposes in the thesis;

- 1) to analyse non-prefab dwellings that are often mentioned in architectural literature as houses containing architectural quality
- 2) prefab dwellings of different characters (2D and 3D element building systems, and of different degrees of openness towards adjustments in relation to customer and site)
- 3) a more detailed case study of the three house types of the house producer *Hjem*.

The aim of the first of these analyses is to form a set of reference points in relation to architectural quality for the subsequent analyses of prefab wooden dwellings as well as testing and challenging the model for analysis of architectural quality as such. The second analysis should show the pros, cons and potential of building prefab wooden dwellings in Denmark in a wider sense, emphasising different methods of manufacturing and approaches to the degree of flexibility of the building system or house types, whereas

the third analysis should give a more concrete and elaborate understanding of Danish prefab wooden dwellings through looking at the development of *Hjem's* house types and their solutions over the years. This case study is also supplemented by a description of the working process in the early stages of the development of a new house type at *Hjem*, which should give an indication of how it is possible to suitably and productively work with architectural quality in a situation where there are both architects and non-architects participating in the development. The results of this thesis are thus:

- 1) a model for analysing architectural quality focusing on the multiplicity of the concept of architectural quality, rather than the definition and hierarchy of the elements contained in the concept,
- 2) a description of parameters that are of particular importance when building prefab wooden dwellings in a Danish context, and
- 3) a suggestion of which tools and methods to use when working with architectural quality in a development process where there are both architects and non-architects present.

It is concluded that when discussing architectural quality, it is important to cover the areas of *objective/universal experience*, *subjective experience* (personal abilities, needs, dreams, memories and associations), and different *contextual factors*, such as culture, style, economics, society, technology and site (common abilities, needs, dreams, memories and associations), and it is proposed that the more layers and perspectives that are added to the discussion, the fuller the view of the architectural quality will get. In relation to building prefab wooden dwellings in a Danish context, two parameters are found to be of particular importance; *flexibility* and *form, logics and material*, which are clarified and exemplified through the houses that are analysed in this thesis. Finally, it is concluded that in a working process that deals with architectural quality and includes both architects and non-architects, it is important to ensure that all participants feel ownership and responsibility for the project and create a common set of references through study trips, lectures, presentations etc., and to use graphical material that underlines and explains the vocabulary that is commonly used and understood by architects, but not necessarily perceived in the same manner by non-architects. In this way mutual understanding can be reached as misunderstandings that have their roots in different ideas of values and vocabulary can be decreased.

DANSK RESUMÉ

Dette PhD-projekt er samfinansieret af Skov- og Naturstyrelsen, en familiehuseproducenten *Hjem* og Institut for Arkitektur & Design ved Aalborg Universitet. Målet for afhandlingen er at undersøge de arkitektoniske fordele, ulemper og potentialer ved at bygge præfabrikerede enfamiliehuse af træ i Danmark. De primære forskningsspørgsmål er:

- 1) Arkitektonisk kvalitet er almindelig brugt i arkitektonisk diskurs, men det virker ikke til at være en synderligt veldefineret størrelse. Er der nogen nøglebegreber, som sammen kan give en almen definition af begrebet arkitektonisk kvalitet?
- 2) Præfabrikerede boliger ses ofte som andenklassens boliger – burde det ikke være muligt at bygge præfabrikerede boliger af høj arkitektonisk kvalitet?
- 3) Træ ses alt oftere i nutidigt dansk byggeri, og det bruges som et billigt, stærkt, let og miljøvenligt materiale, men hvordan er det med de æstetiske værdier, set i forhold til den danske byggetradition med tunge materialer, som for eksempel mursten? Hvordan kan vi bygge nutidige træboliger i en dansk kontekst?

Det første skridt i forhold til at kunne undersøge disse spørgsmål er, at opbygge en model til analyse og diskussion af arkitektonisk kvalitet i præfabrikerede træboliger. Dette gøres gennem et indledende overblik af primære teorier indenfor emnet arkitektonisk kvalitet, og disse teorier bliver derefter struktureret i tre teorigrupper, hvilke hver i sær beskrives gennem tre hovedpunkter. Disse tre grupper og deres respektive hovedpunkter danner sammen en model for analyse af arkitektonisk kvalitet, som bliver brugt til tre hovedformål i denne afhandling;

- 1) analyse af ikke-præfabrikerede boliger, som ofte bliver nævnt i arkitekturlitteraturen, som huse, der besidder arkitektonisk kvalitet
- 2) præfabrikerede boliger af forskellig slags (2D- og 3D-elementsbyggesystemer med forskellig åbenhed i forhold til tilpasning til kunden og grunden).
- 3) et mere detaljeret case study af huseproducenten *Hjems* tre hustyper.

Målet med den første af disse analyser er, at danne et grundlag med referencepunkter for den videre diskussion og analyse af arkitektonisk kvalitet i præfabrikerede træboliger, samt at teste og udfordre modellen for analyse af arkitektonisk kvalitet, som metode og konstruktion. Den anden analyse skal vise fordele, ulemper og potentialer i dansk præfabrikeret træboligbyggeri i et bredt perspektiv med fokus på forskellige produktionsmetoder og tilgange til fleksibilitet i byggesystemerne eller hustyperne, hvorimod den tredje analyse skal give en mere konkret og detaljeret forståelse for

danske præfabrikerede boliger, ved at der kigges på udviklingen af *Hjem's* hustyper og løsninger igennem årene. Dette case study er også suppleret af en beskrivelse af de tidlige faser af udviklingen af et nyt hus til *Hjems* katalog, hvilket giver en idé om, hvordan det er muligt at arbejde med arkitektonisk kvalitet på en hensigtsmæssig og produktiv måde i en situation, hvor både arkitekter og ikke-arkitekter deltager i produktudviklingen. Resultaterne af denne afhandling er således:

- 1) En model for analyse af arkitektonisk kvalitet med fokus på begrebets mangfoldighed frem for definition og hierarki af de elementer som arkitektonisk kvalitet indeholder
- 2) En beskrivelse af parametre, der er specielt vigtige når der arbejdes med præfabrikerede træhuse i en dansk kontekst
- 3) Forslag til hvilke værktøj og metoder, som kan bruges, når der arbejdes med arkitektonisk kvalitet i en udviklingsproces, hvor både arkitekter og ikke-arkitekter deltager.

Der konkluderes, at når arkitektonisk kvalitet diskuteres, er det vigtigt at indtænke *objektiv / universal oplevelse, subjektiv oplevelse* (personlige evner, behov, drømme, erindringer og associationer) samt forskellige *kontekstuelle faktorer*, såsom kultur, stil, økonomi, samfundsforhold, teknologi og stedet (fælles evner, behov, drømme, erindringer og associationer). Derudover ses det, at jo flere lag og perspektiver, der lægges til diskussionen, desto mere fyldig forståelse af den arkitektonisk kvalitet kan opnås. I forhold til præfabrikeret træboligbyggeri i Danmark bliver to punkter trukket frem, som primære; *fleksibilitet og form, logik og materiale*, hvilke bliver eksemplificerede og præciserede gennem analyserne af konkrete præfabrikerede træhuse i denne afhandling. Til sidst konkluderes der, at i en arbejdsproces, hvor både arkitekter og ikke-arkitekter deltager, er det vigtigt at sikre, at alle deltagere føler ejerskab og ansvar overfor projektet og at der bliver skabt fælles referencepunkter gennem for eksempel studierejser, forelæsninger og præsentationer, samt at der bruges grafisk materiale til at tydeliggøre og forklare det vokabular, som arkitekter bruger og forstår på en specifik måde, men som ikke nødvendigvis opfattes på den samme måde af ikke-arkitekter. På denne måde kan en gensidig forståelse fremmes, og misforståelser, som har deres rødder i forskellige forståelser af arkitektoniske værdier og vokabular, kan mindskes.

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1

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1 INTRODUCTION

“The strength of the prefabricated house lies in its popularity, its cheapness and the industrial base from which it operates. These are precisely the areas in which modern architecture is weakest. Modern architecture is unpopular, expensive and divorced from industrial production. This is why whenever it has tried to extend its field to include the territory of the prefabricated house it has failed and been forced to retreat.”

(Davies 2005)

For the last 150 years, ordinary people – the emerging and subsequently growing middle class – have moved from dense town housing areas and smallholdings in the countryside to own houses in the outskirts of villages, towns and cities, forming neat patchworks of detached single family housing plots. This rapidly increases the demands for detached single family dwellings at a reasonable cost and leads to a need to build quickly and efficiently; which in turn leads to a need for standardisation and industrialisation of the building sector and prefab houses (Lind, Møller 1996, Nygaard 1984). However, as is implied in the above quote from Colin Davies, there seems to be a schism between prefabrication and what we would like to call *architecture*. Prefab houses are often seen as a lower class of building, whereas architecture is *more* than just building. The question is what this *more* is; what is it that makes us judge one building as *mere building* and another one as *architecture*?

Through the first chapter of this thesis the matter of prefab single-family dwellings will be discussed from a historical as well as from a more sociological and philosophical perspective. The main aim is to build a theoretical foundation for investigations and discussions of the architectural quality of prefab wooden dwellings in a Danish context. A vast majority of the single-family dwellings in Denmark are prefabricated, to different degrees, and, as a result of the growing focus on the material, a growing number of the new-built dwellings are made of wood, which is considered to be cheap, strong, environmentally friendly, easy to handle in prefab processes etc. [ill. 1] (Kraul, Madsen 2007). However, there is not a strong contemporary Danish tradition for building with wood, and at the same time many architects have rejected the whole idea of working with prefab building with reference to its rigidity in relation to aesthetics (MacKeith 2005, Arieff 2002, Mikkelsen et al. 2005, Stang 2003, Svendler 2005) – maybe this is why only five percent of the single-family housing stock in Denmark is drawn by architects (Ingels 2003), and both the single-family houses, as such, and the suburban areas where they are placed are often accused of being boring and poor in relation to architectural experience [ill.2] (Knudsen et al. 2000). It is therefore interesting to raise the discussion of what the potential of prefab wooden dwelling is in relation

1. Example of a contemporary Danish prefab wooden dwelling – the Nova house from the company Hjem (Photo: Ida Wraber).

2. A typical Danish detached single-family housing area from the period 1960-1980 (Lind, Møller 1996).

to architectural quality, as well as, of course, investigating some of the pitfalls and disadvantages that architects have been speaking about for many years in relation to the architectural quality of prefab dwellings. Subsequently, in the later chapters of this thesis it will be seen how both the positive and negative matters of prefab are reflected in concrete examples of Danish prefab dwellings. It is important to articulate these matters in order to place the architectural values on the otherwise rational and technical agenda of the building of prefab dwellings, in which almost all Danes spend at least a few years of their lives (Jensen 2008), and make sure that architects in the future can, and feel an inclination to, get in on the most rapidly growing urbanity in Denmark at the moment – the suburban single-family housing areas (Ingels 2003).

1.1 PREFAB BUILDING

1.1.1 Prefab dwellings by architects?

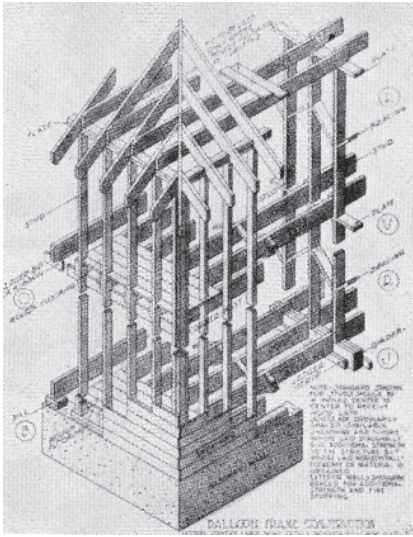
Prefab houses are nothing new and there are several examples of prefab dwellings that are generally considered to be of high architectural quality, and there are also prefab houses that are results of the work of architects who have believed in the possibility to work with prefab and architecture combined. The concept of prefab dwellings has existed for several centuries, and the first known production is a wooden panel house which was shipped from England in 1624 to provide shelter for a fishing fleet (Arieff 2002). After this modest start, the demand for immediate housing solutions grew as a large number of colonies and settlements occurred all over the world, particularly during the nineteenth century. These early examples of prefab houses were constructed by craftsmen rather than designed by architects. Actually, the whole idea was to make it possible for unskilled workers to swiftly put a house together using a minimum of materials – this can for example be seen in the American wooden balloon-frame constructions which were invented in the 1830s [ill.3] (Knudsen et al. 2000). Industrialism, on the other hand, has led to completely new building typologies; vast halls and exhibition areas of steel and glass, such as Crystal Palace, skyscrapers, engineering art, such as the Eiffel Tower etc. [ill.4-6] (Knudsen et al. 2000). In 1908 Henry Ford demonstrated how high-quality objects such as cars could be mass-produced in order to achieve a lower price and better quality for many consumers (Arieff 2002). A hope began to take shape that housing could also be produced with similar techniques, which could improve the accessibility and affordability of good quality dwellings and therefore, around this time, many companies started producing prefabricated houses (Arieff 2002). It was with this inspiration in mind that the modernist architects began to experiment with industrial building (Davies 2005), as for example seen in Le Corbusier's *DOM-INO House* (1914), which is a framework house made of steel and concrete without bearing walls, which became maybe the most architecturally significant standard house of the

3. *Balloon-frame construction* (Wachsmann 1995).

4. *The Eiffel Tower by Gustave Eiffel, Paris 1889* (Gympel 1996).

5. *Skyscraper: Guaranty Building by D. Adler and L.H. Sullivan, Buffalo, New York 1894-95* (Gympel 1996).

6. *Crystal Palace by Joseph Paxton, London 1851* (Gympel 1996).



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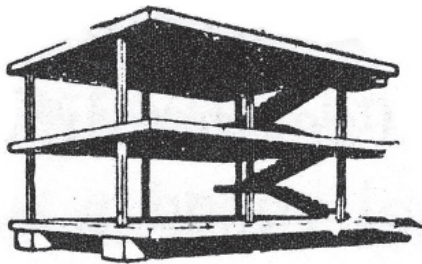


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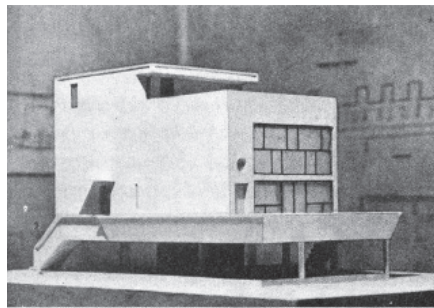
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early modernist era [ill.7] (Arieff 2002, Frampton 1992). Through the 20th century Le Corbusier continued to experiment with dwellings such as machines for living in, as for example seen in *Maison Citrohan* (1921) [ill.8], which is a mass-production house with an offset in a framework of concrete and with factory windows as a stylistic mark of the industrial logics (Frampton 1992, Le Corbusier 1931/1986). In 1928 Le Corbusier was also one of the founders of CIAM¹, an association for architects with special interest in industrial architecture, but another group, interested in the industrial materials and the potential in mass-production, had already been formed almost ten years earlier; the German Bauhaus school (1919-1932) (Frampton 1992). One of the dwelling projects from the Bauhaus architects – Walter Gropius and Adolf Meyer’s *Building*



7



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Blocks – is probably the first project actually built with pre-cast concrete elements in Europe [ill.9]. It was built 1923 in Törten and is a standardised housing system for row houses (Arieff 2002, Knudsen et al. 2000). Another, more futuristic, example of an early proposal for a modular dwelling is Buckminster Fuller’s building kit *Dymaxion house* (1927) [ill.10], which is a house with a circular plan and metal walls, standing on short ‘legs’ like a spaceship. Its design was probably a bit too wild for its time, and it never became a customer success (Arieff 2002). In America several projects popped up during this time, of which Charles and Ray Eames’ *Eames House* (1945-49) [ill.11], is an elegant example. It is built as a part of a series of 36 dwellings called *The Case Study Houses*, which were all drawn by different architects. The idea was to put architecturally interesting dwellings together from prefab catalogue elements that could be bought at the local building merchants’ (Arieff 2002, Knudsen et al. 2000, Buisson, Billard 2004). Frank Lloyd Wright’s *Usonian houses* are based on some of the same ideas [ill.12]; they are not prefabricated systems, as such, but are built on a grid system that is related

7. *DOM-INO House*, Le Corbusier (Le Corbusier 1931/1986).

8. *Maison Citrohan*, Le Corbusier (Le Corbusier 1931/1986).

9. *Buildings Blocks in Törten*, Walter Gropius & Adolf Meyer (Bauhaus Dessau Foundation 2009).

10. *Dymaxion House*, Buckminster Fuller (Arieff 2002).

11. *Case Study House #8, Eames House*, Charles & Ray Eames (Buisson, Billard 2004).

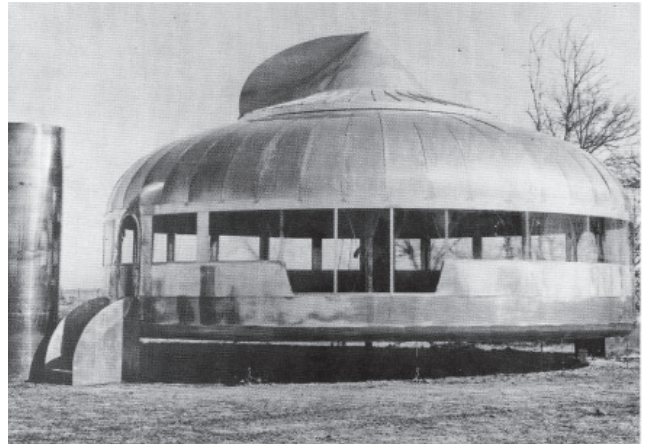
12. *Example of the Usonian Houses: Herbert Jacobs House I*, Frank Lloyd Wright 1936 (Futagawa 2002).

¹ The CIAM declaration from Congrès International d’Architecture Moderne at La Sarraz, Switzerland, 1928 was signed by 24 architects representing France, Switzerland, Germany, Holland, Italy, Spain, Austria, and Belgium; for example Le Corbusier, Sigfried Giedeon, Gerrit Rietveld, and Josef Frank were present (Frampton 1992).

to regular, modular dimensions. Each design of the *Usonian houses* is unique, but the repetition of standard details reduces the cost and work effort. However, also radiators, light fixtures, furniture, paint, and plaster are taken out of the design, along with other 'unnecessary' features such as roof gutters and basements. Even though the inhabitants therefore need to learn to live with thick sweaters during the winter, about 25 *Usonian houses* were designed and built in the 1930s and 1940s (Arieff 2002, Futagawa 2002).



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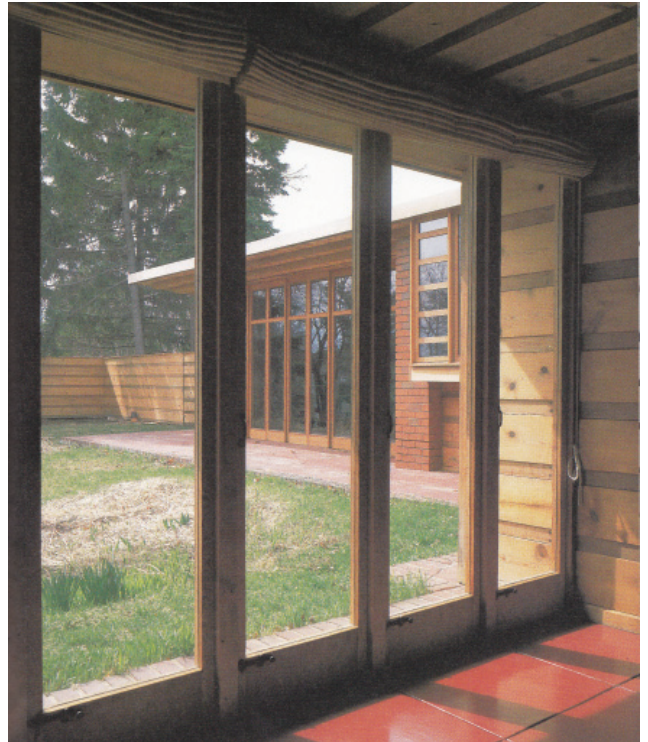


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In Denmark Jørn Utzon's *Espansiva* building system (1970) [ill.13] also builds on a similar idea; it consists of pavilions and a wide range of different panels that can be put together to fulfil the needs and wishes of the house-owner (Utzon 1970), and Arne Jacobsen's (1969-1970) *Kubeflex* [ill.14] – a building system of room size modules – is also meant to be flexible, even though the building elements are quite large (Bundgaard 2002, Åberg, Stenberg 2005). However, none of these house types are sold in larger scale – the Danish examples of Utzon and Jacobsen are actually only built in one instance



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each, which is of course noticeable as the building activity at the time was extremely high. In spite of this, these examples of architect drawn prefab single-family dwellings are still spoken of as architecturally successful dwellings (Arieff 2002, Åberg, Stenberg 2005). As can be seen, many suggestions have emerged during the last century as to what a prefabricated dwelling is – and through which process such a product should be conceived. Even though wave after wave of prefab proposals (in the late 30s, after World War II, and again in the 60s, as indicated through the overview of examples above) have occurred during the 20th century, remarkably little has actually changed during this time (Arieff 2002). There is little question that prefab is popular due to its economic benefits rather than its dashing architectural qualities and too often aesthetics, comfort and quality have been sacrificed for economic reasons (Arieff 2002). Still, the majority of the housing built today is to some degree prefabricated, and the number of built prefab units increases every year. Many prominent architects have been quite sceptical about drawing for unknown users and unknown sites, and those who have been interested and enthusiastic have mostly drawn projects that have stopped at prototype level (Arieff 2002, Åberg, Stenberg 2005), but during the last decade other architects have begun to cooperate with housing producers with the objective of creating architecturally qualitative prefab houses, and at the moment almost all large architectural offices in Denmark and the other Nordic countries have at least one standard house on their repertoires [ill.15-18] (Åberg, Stenberg 2005, Juul 2008). As the prefab dwelling is

13. *Espansiva*, Jørn Utzon (*Espansiva-Byg A/S 1971*).

14. *Kubeflex*, Arne Jacobsen (*Trapholt 2009*).

15. *M2: Hill House*, Bjarke Ingels (*M2 2008*).

16. *M2: Flower House*, 3XN (*M2 2008*).

17. *M2: Sinus House*, Cebra (*M2 2008*).

18. *M2: Split House*, C.F. Møller (*M2 2008*).

once again on many architects' drawing tables and agendas, it is relevant to look at both historic and contemporary prefab dwellings in order to discover the advantages, disadvantages, and potential in this kind of building in relation to architectural quality. Until now only the prefab-enthusiastic architects and the architecturally good, or acknowledged, examples have been mentioned, but the numerous architects that are, and have been, quite sceptical about the matter of prefab architecture have not yet been in the spotlight. In the following section the focus will be on the more critical voices and the schism between prefab building and architecture.

1.1.2 *The schism between prefab building and architectural quality*

When speaking of the criticism of prefab building, it is rather important to have an idea of what premises and societal settings that it has been produced for, as this of course sets the framework for the builders and architects to work in. In building, as in many other industries, the terms efficiency and streamlining occur commonly and in building those matters have been playing a central part for many years now. The main breakthrough for industrialised building came after the World Wars. Europe was left with a massive destruction of the housing stock, and a subsequent need to build rapidly, cheaply and efficiently occurred (Davies 2005, Arieff 2002). In Denmark the lack of



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dwelling was not primarily due to destruction but several years of low building activity during the war. This led to many of the highly standardised concrete building sites, such as Gjellerupparken and Høje Gladsaxeplanen [ill.19], and also to the building of more than half a million detached single-family dwellings in and around Danish towns and villages (Nygaard 1984, Knudsen et al. 2000, Bundgaard 2002). In relation to the amount of built dwellings and the technological standard of these, industrialisation has been a success for post-war society and the building sector, but along the way the architectural qualities have been increasingly forgotten, as Juhani Pallasmaa suggests:

"The 3M module grid used extensively in the industrialized building in the 1960s was a standardization achieved without any appreciation of history or sense of beauty, whose sole consideration was the rationalization of production. But the brutal standardization was also the outcome of a tragic amnesia in the 2500-year-old tradition of harmonic proportions, a tradition whose purpose was to link man to his built world, to creation, and the universe."

(MacKeith 2005)

The primary aim of the building process, at this point, was not to build nice and enjoyable architecture, but to efficiently restore and renew the dwelling stock and this aim, one can say, is closer to the objective of industry than that of architecture. The creation of architecture is built on the idea that every single situation demands special treatment in relation to aspects such as time, place and users [ill.20] (Smith 2003). Prefabrication, on the other hand, is built on the presumption that a large amount of the customers' needs are general and can be identified beforehand; and it is therefore meaningful to optimise some solutions, and give many people a possibility for buying them at a reasonable cost (Lund, Eriksen & Nielsen 2005). Standardisation is consequently considered to be the opposite of the unique architecture and the focus in the ongoing discussion of this dichotomy is mainly on whether or not industrialisation leads to a homogenising of architecture and a playing down of the aesthetic values (Svendler 2005, Anderson, Anderson 2007). The critical stances have been presented and underlined in writings by several architects over the years. The aforementioned Juhani Pallasmaa additionally states that:

"Other characteristics of rationalized building also work towards a weakening of this sense of place on the human scale: over-scaled building complexes, excessive repetition, standardization directed by production techniques, a lack of spatial organization due to need of flexibility, a flattening of shapes and surfaces called for by functional and economic considerations, and an overall erosion of form. Finally, an overall monotony of lighting, a lack of texture, and the eradication of individual detail complete the loss of sense of place"

(MacKeith 2005)

19. Høje Gladsaxeplanen – a Danish concrete prefab project (Lind, Lund 2005).

20. 'What is a house?' by Charles Eames 1944. A house is not only the physical framework of walls, roof, and floor, but also a more abstract framework for events and the needs of the inhabitants (Beim 2004).



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Whereas the architect Christopher Alexander suggests that:

"[...] the details of a building cannot be made alive when they are made from modular parts [...] modular panels tyrannize the geometry of the room."

(Arieff 2002)

According to these two statements there are both problems with a lack of architectural precision and understanding of place and space, and a tyrannising of modules in industrially produced spaces. But does the contemporary process of prefabrication actually set such rigid frames that it is not possible to reach an architecturally satisfying result? Through the recent discussion of the subject, there has also been an opposing current, suggesting that the largest problem, in relation to the aesthetic matters in prefab building, is actually the fact that architects tend to withdraw from the scene as a result of bias and the rigidity of system thinking, which is seen as a threat to their artistic freedom (Arieff 2002, Mikkelsen et al. 2005, Stang 2003), or as Colin Davies explains it:

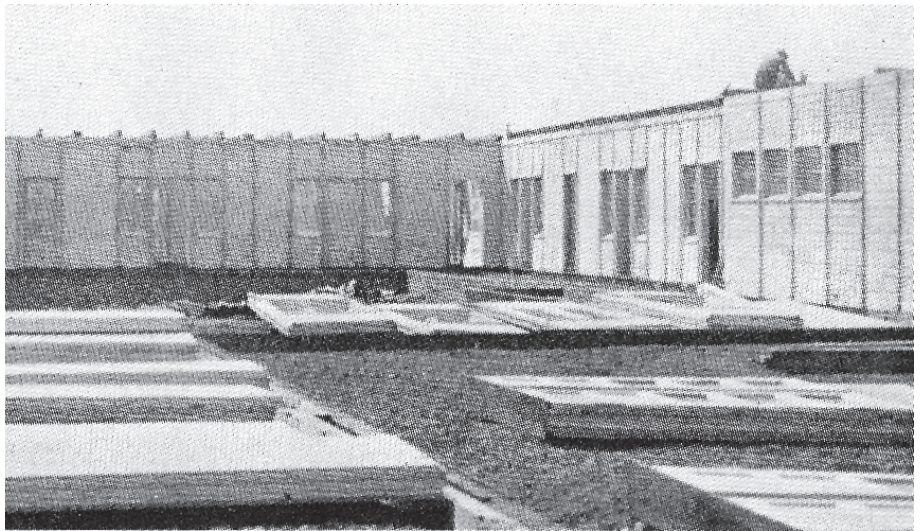
"While architecture has been struggling to find the true artistic expression of industrial production, construction has been quietly industrializing itself behind architecture's back."

(Davies 2005)

This can for example, as previously mentioned, be seen in the case of the single-family houses in Denmark, where only five out of a hundred are drawn by architects, even though the single-family housing areas make up the most quickly growing urbanity in Denmark and that about half of all dwellings in Denmark are single-family houses (Jensen 2008). This building typology makes up a traditionally standardised housing market for primarily young families wanting to get out of the town apartments, but without having much money to do so (Jensen 2008), and therefore it is a necessity to accept the prefab processes if architects want to gain ground in this large and constantly growing, part of the Danish dwelling market (Ingels 2003). But, as is indicated in section 1.1.1, there are many different prefab building systems and methods of prefab production and the question is if all prefab methods set up similar rules for the aesthetical work of the architect. In order to reflect further upon the matter of the possible aesthetic rigidity in the prefab process, it is therefore necessary to look at what kinds of prefab processes actually exist and the different frameworks that they set up for the architect to work within.

1.1.3 Types of prefab production

Prefabrication can be understood as many different types of production, and today almost all building is, to some degree, prefabricated (Anderson, Anderson 2007, Thorsen 2005). When looking at a building site, many building parts arrive as prefabricated elements – windows, concrete slabs etc. However, for several decades after the World Wars, the standard house building companies were craftsman based; some of them produced modules (mostly 2D) in factories, which is mainly a streamlining of the product [ill.21], whereas others streamlined by building the same house over and over again, thus mainly improving the process of traditional house building [ill.22].



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21. Example of 2D panel building from the early 20th century (Wachsmann 1995).

22. The Danish *Murermesterhus* (Master constructor house) is an example of a dwelling type that is improved through repetition (Photo: Ida Wraber).

These two different ways of streamlining, standing alone or in combination with each other, are still described as the main ways of working with efficiency improvement in building (Christensen 2005, Nielsen, Selmer 2001). In relation to the streamlining of products there are many different systems for making the product easier to manage and build. Some prefab houses are made from prefabricated 2D elements, such as *Hjem* [ill.23], others from 3D elements, such as the *ONV house* [ill.24], but there are also different ways of mass customising architecture, for example *Willa Nordic* [ill.25-26] that has an element- and detail-library; but the shape and expression of the house can be chosen freely by the customer - it only takes some technical adjustment according to the existing solutions in the 'library' in the last part of the drawing process [ill.27]. The larger the unit from the factory, the fewer the possibilities of surprises at the building site with respect to for example rain, snow, wind, and missing building parts and materials, which might lead to open constructions for shorter or longer periods of time – but on the other hand; the larger the element from the factory, the more

23. Prefab house constructed by 2D elements: *Uno* from *Hjem* (*Hjem* 2009).

24. Prefab house constructed by 3D elements: *The ONV house* (*M2* 2008).

25. Customized prefab house: *Willa Nordic* romantic style (*Willa Nordic* 2009).

26. Customized prefab house: *Willa Nordic* modern style (*Willa Nordic* 2009).

27. Table showing the characteristics of three different types of prefab house building systems: *ONV House*, *Hjem*, and *Willa Nordic*. The larger the unit from the factory, the fewer the possibilities of surprises at the building site and thus a more efficient building process. Larger units however also give less flexible building systems and more difficulties in relation to transportation from factory to building site.



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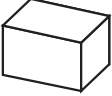
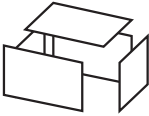
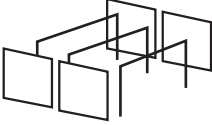
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<p>PREFAB HOUSE TYPE</p>	 <p>ONV house</p>	 <p>Hjem</p>	 <p>Willa Nordic</p>
<p>CONSTRUCTION</p>	 <p>3D elements</p>	 <p>2D elements</p>	 <p>Element- or detail library</p>
<p>TRANSPORTATION</p>	<p>Large 3D volumes are transported on trucks with semi-trailers. The size of the volume is limited by the maximum size of the truck.</p>	<p>Large 2D elements are transported on trucks. The size of the elements are limited in height and length by the maximum size of the truck.</p>	<p>The elements are not very large and are transported to the building site by a truck unassembled.</p>
<p>ASSEMBLY</p>	<p>Casting of foundation, the assembly of 3D volumes, a few adjustments on site, and connection to plumbing and electricity.</p>	<p>Casting of foundation, assembly of outer/inner walls, and roof. Adjustments and finish of interior and exterior on site.</p>	<p>The whole assembly and all plumbing and electricity work take place on the building site.</p>
<p>DURATION</p>	<p>The assembly only takes one day. The whole process, from the cutting of the first sod to the completion of the house, takes 2-3 weeks.</p>	<p>The assembly takes a couple of days. The whole building process on the site takes 8-12 weeks.</p>	<p>The assembly of the smaller elements is not very different from traditional building and the duration of the building process can shift widely.</p>
<p>FLEXIBILITY</p>	<p>The flexibility is low. The possibilities of adjustments are tied to the colour of the exterior cladding and the materials in kitchen/bathroom.</p>	<p>The flexibility is not very large in the main form, but different materials for the exterior, kitchen, and bathroom can be chosen by the customer.</p>	<p>The system is very flexible as the elements are small and can be put together in many different ways.</p>

difficult the transportation of the element from the factory to the building site [ill.28] (Mikkelsen et al. 2005). The maximum limit for the dimensions of an element is legally set by the size of a semi-trailer (width 4,5 m, height 4 m, length 13 m) (Juil 2008) z– with a larger transport there will be a need for an escort of warning cars, both in front of and behind the truck. This represents an ongoing balancing act in prefab building; the choice between the larger predictability in completing as much as possible in the



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protected environment of a factory, and the easier transportation of smaller elements from the factory to the building site. The first two mentioned building systems – 2D and 3D element building – can also be more or less open to changes by the customer [ill.29]. The *ONV house* is for example a relatively fixed unit whereas Arne Jacobsen’s *Kubeflex* is meant to be a flexible 3D element building system, in the same way as *Hjem* is a relatively fixed system, whereas Jørn Utzon’s *Espansiva* is more open. Mass-customisation, as for example seen in the production of *Willa Nordic*, makes it possible to mass-produce with a large range of variation in relation to the customer and the site through thinking in modules without letting those define the project with respect to the design (Mossin 2003). In regard to aesthetic freedom such mass-customised buildings therefore work more or less like traditional processes of unique houses. There is also still a wide range of standard house dwellings, which are mainly streamlined in relation to the process – by means of a repetition of the process and optimised cooperation agreements, such as the contemporary architect drawn *M2 houses* [ill.30], but also the more traditional building companies such as the brick houses of *Eurodan* [ill.31]. These dwellings are generally rather closed building systems, even though they are not assembled from factory made units in large scale but are primarily built on site. The dwellings that, following the traditional practice, are built on site are often

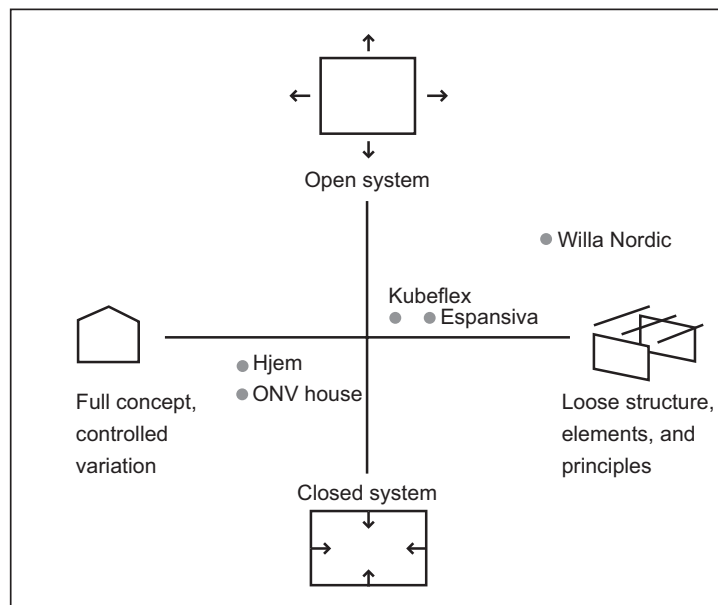
28. A 3D element from an *ONV house* on its way to the building site. The larger the prefab elements, the more inefficient and difficult transportation to the building site (M2 2008).

29. Prefab house can be constructed from 2D or 3D elements, or combinations of these two, but they can also be more opened or closed towards changes in the design in relation to the specific site and user (basic graphics from (Mikkelsen et al. 2005)).

30. Contemporary prefab detached single family house from M2: *X-house*, *3XN* (M2 2008).

31. Traditional prefab detached single family house from *Eurodan* (Eurodan 2009)

constructed in heavy materials, such as bricks. However, when producing elements in a factory, it is in many ways more efficient to build lighter constructions, as they will have to be lifted, handled and transported as larger units before ending up at their place in the final building. There have also emerged more concrete and sharpened demands in relation to environmental issues, which has caused the business to think new in terms of for example energy savings and life cycle perspectives. Wood has therefore entered the building sector again, and especially the standard house producers have begun to take advantage of this light and strong material.



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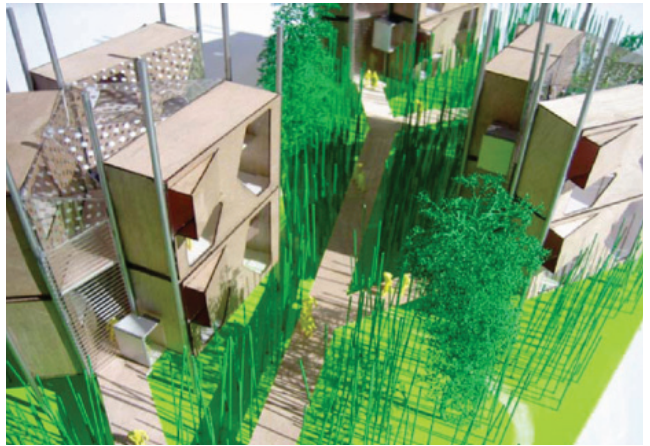


1.1.4 Wood in prefab dwellings

Several prefab housing companies (*Hjem, HP3, Scandibyg*) have brought wood up as a material that does not demand much energy to handle and transport and, on top of that, is immediately comprehended as natural and environmentally friendly [ill.32] (Lind 1998, Kindt 2004b). Actually, every fourth newly built detached single family dwelling is a wooden house (Kraul, Madsen 2007) and in recent years a few more experimental projects of wood such as the *Boase* by *Force 4* have also emerged [ill.33]. However, Denmark, as opposed to the other Nordic countries, does not have a strong contemporary tradition for building in wood [ill.34]. For the last century, wood has mainly been used as a building material for less durable houses, such as summer houses, allotment huts, temporary post-war house replacements and refugee camps [ill.35-36] (Lind 1998, Storvang 2000). Therefore, the idea of a wooden house is connected to temporary building and is often accused of being fragile to the forces of rain and



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wind (Vadstrup 2000). The idea of a permanent house, on the other hand, is deeply connected to the heaviness and robustness of brick or stone walls (Lind 1998). So, how can permanent dwellings of wood be architecturally designed? How does the expression of the houses change when the building material changes? Is the Danish wooden house a *wooden house*, or is it, in its expression, a heavy construction house made of wood? According to the 19th century theorist Gottfried Semper's *Stoffwechseltheorie*,² the ideas of the deeply rooted building traditions stay within building when new materials and technologies emerge. His often used example is of the Greek temple which is built of stone, but the column-beam construction is not optimal for stone – it is reminiscent of a time when temples were built from wood [ill. 37]. Similarly, the colourful wall paintings of the temple mime the textile covering of the ancient, primitive tent-like constructions (Semper 2004). Semper does not consider these remnants something negative, but it is something that one needs to be aware of when working with new materials or technologies. On this background, this thesis focuses on what a contemporary Danish wooden dwelling is. In order to encircle the Danish prefab wooden dwellings, the concept of house and home; architecture and building; and prefab generalisation as opposed to architectural specification will be discussed and investigated. The central theme can be condensed into the question of *how we can build prefab wooden dwellings in Denmark of such quality that they rightfully can be labelled architecture*. Before digging into the more philosophical matters of what it means to dwell and how architectural quality can be defined, the development of the Danish single-family dwelling will be outlined in order to form a historical foundation for the further discussion; what mechanisms in the historical development of prefab building have led up to the present situation in Denmark and what key-issues have been raised along the way?

32. Contemporary Danish prefab wooden dwellings, the ONV house (M2 2008).

33. Experimental prefab wooden project: Boase, Force4 (Force4 Architects 2009).

34. Traditional Swedish prefab wooden house by Willa Nordic (Willa Nordic 2009).

35. Wooden post-war project at Ellebjergvej in Copenhagen, 1947 (Photo: Ida Wraber).

36. Danish wooden allotment hut (Photo: Ida Wraber).

37. The Lion Gate at Mycenae, Acropolis. Stone construction with clear references to the traditional wooden post-and-lintel construction (Gympel 1996).

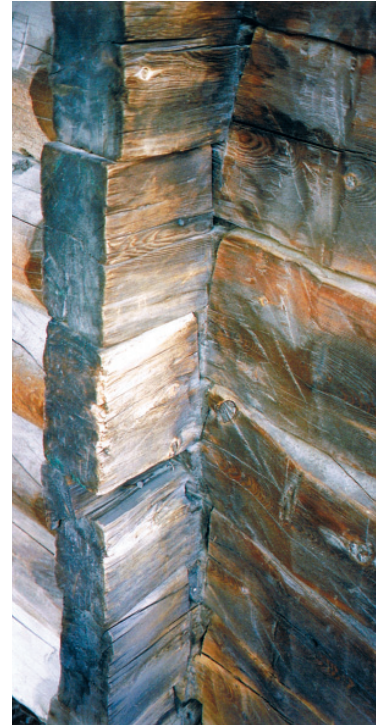
²Theory of material transformation

1.2 DWELLINGS IN A DANISH CONTEXT

1.2.1 *The first man-built dwellings*

At times, the cave is mentioned as the most primitive dwelling typology. However, since the first human beings were wandering hunter-gatherers, it is more probable that the first dwellings were simple and light tent-like constructions. Examples of these can still be seen in nomadic cultures [ill. 39] (Bøggild-Andersen, Wolf 1950). In 4-5000 BCE many people started becoming less mobile; they began to cultivate pieces of land and keep domestic animals. This opened up new opportunities to make the dwellings more sturdy and embellished. In Denmark this meant that the heavier materials - soil, peat and stone – were more commonly used as walls, instead of for example light skin envelopes. Another way of constructing walls is by weaving twigs between wooden poles, and then daub the construction with mud (Bøggild-Andersen, Wolf 1950). To begin with, the houses kept the form that is most natural for tent-like constructions, with circular or rounded floor plans, and there are traces of these houses all the way up until the Iron Age. However, already in the younger Stone Age, the square floor plans appeared for the first time. The emergence of this house form is sometimes supposed to be connected to the timber material, but as wood is also often used in constructions with poles rising vertically from the ground, it is most likely to be tied to the gabled roof construction, which works best with a square floor plan (Bøggild-Andersen, Wolf 1950). These early dwellings were primarily a place for cooking when the weather is poor, keeping warm by the hearth, and keeping stock of food and tools – the only light inlet being the door opening and the fire hole in the roof (Bøggild-Andersen, Wolf 1950).

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38. *Joint detail of a massive wooden wall of horizontally oriented beams (Photo: Ida Wraber).*

39. *Example of Nomadic dwelling: Sami tent (Cornell 1968).*

40. *Example of a farm house with multiple wings around a court yard in southern Sweden from the early 19th century. Watercolour by Frans Lindberg, 1938 (Cornell 1968).*

41. *Example of timber framing (Cornell 1968).*

42. *Example of groove and tongue construction (Cornell 1968).*

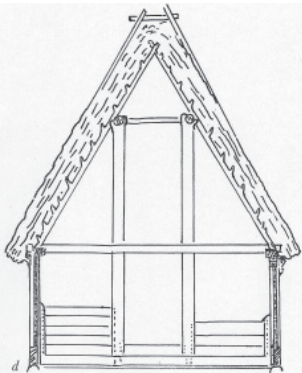


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1.2.2 Timber framing and brick building

During the Middle Ages the traditional shape of the Danish farm house as a collection of different wings around a yard was developed [ill.40]. The Norwegian and Swedish long rafters from fir can form long massive wooden walls [ill.38], but the shorter rafters that can be shaped out of the Danish oaks and beeches are better for lighter framework constructions – and therefore timber framing became the most important building technique in Denmark [ill.41] (Vadstrup 2000, Bøggild-Andersen, Wolf 1950). Sometimes these constructions are daubed with mud and sometimes they are clad with horizontal boards of wood in a groove and tongue construction holding the ends of the boards in place [ill.42]. In the centuries following after the year 1000, the European traditions of building came to Denmark with the Christian church. The church built impressive facilities in a new material to the Danes – bricks (Bøggild-Andersen, Wolf 1950). At first, the Gothic style was adopted in the Danish timber framing constructions, but as time passed the rich began to build in brick, which was a high-status material (Bøggild-Andersen, Wolf 1950). Not until the end of the 17th century did the brick become a building material for the common people, but many places in the countryside, the timber framing still stood strong in the 19th century (Bøggild-Andersen, Wolf 1950).

1.2.3 *Single family houses*

The villa – or rather the single family house – began to gain ground in relation to different kinds of collective forms of living during the second half of the 19th century; not only as a living form for the rich. This was a result of the opening of the previously quite strict borders of the towns and cities. Due to cessation of the privileges of the royal boroughs and the fact that the city walls were not able to protect the cities against attacks from modern war machinery, the city walls lost their importance as protection and delimitation (Lind, Møller 1996). From 1860 to 1919 about 120,000 detached single family houses were built in Denmark and the landscape around the larger towns and cities is dotted with these small houses [ill.43] (Lind, Møller 1996, Bøggild-Andersen, Wolf 1950). To Copenhagen this spreading of the inhabitants was a necessity, as the population had grown to a degree where the city was no longer healthy to live in, as evidenced by for example the cholera epidemic in 1851 (Lind, Møller 1996). Furthermore, the feudal system was changed, which led to the disintegration of the traditional village – the villagers now got the possibility to buy their own piece of land and move out into open countryside plots. As a result of this, many people, who had been employed at farms, were excluded from the village working community. Some of these unemployed and homeless people flocked to the larger cities, where it was possible to get work in the new industries, and about 300,000 Danes emigrated; mainly to America. However, a third group found a new and better life along the new railroads, which were built from 1860 to 1920 (many of these are now closed down again) (Lind, Møller 1996). At the stops along the railroads, new villages emerged, and towns developed where the stops were placed near existing villages. In sixty years, almost 600 new towns developed. These towns housed a new class of citizens – the free working and middleclass. In and near the villages and towns the land was cheap and builders could therefore easily buy a piece of land on which they would usually first build a house for themselves and then start building houses to sell to neighbouring grounds. Sometimes they moved into the newly built house and sold the older one before moving on to the next building project. About 100,000 detached single family houses were erected in these new train station towns [ill.44] (Lind, Møller 1996).

1.2.4 *The garden housing movement*

In the final years of the 19th century, a countermovement to industrialism emerged. The British planning theorist Ebenezer Howard presented a radical and long-range concept for city planning in his book *Garden Cities of Tomorrow* from 1898. As opposed to the known industrial cities, the garden city should be a self-supplying unit surrounded by communally owned open land, and the houses should be low with individual

43. *Eberts Villaby (Ebert's villa village) on Amager in Copenhagen ca. 1896-1900* (Lind, Møller 1996).

44. *Patterns for house layouts from the late 19th century* (Lind, Møller 1996).



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45. Welwyn Garden City, Ebenezer Howard and Louis de Soissons, founded in the 1920s (Cornell 1968).

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46. The three magnets: town, country, and town-country presented in Ebenezer Howard's book *Garden Cities of Tomorrow*, 1898 (Watkin 2000).

47. Bakkehusene at Bellahøj, Copenhagen, Ivar Bentsen and Thorkild Henningsen 1921-23 (Photo: Ida Wraber).

48. Studiebyen in Hellerup, Copenhagen, Edvard Thomsen, Anton Rosen, Ivar Bentsen, Thorkild Henningsen, and Kay Fisker 1920-24 (Photo: Ida Wraber).

49. Grøndalsvænge in Copenhagen, Poul Holsoe and Jesper Tvede 1914-20 (Photo: Ida Wraber).

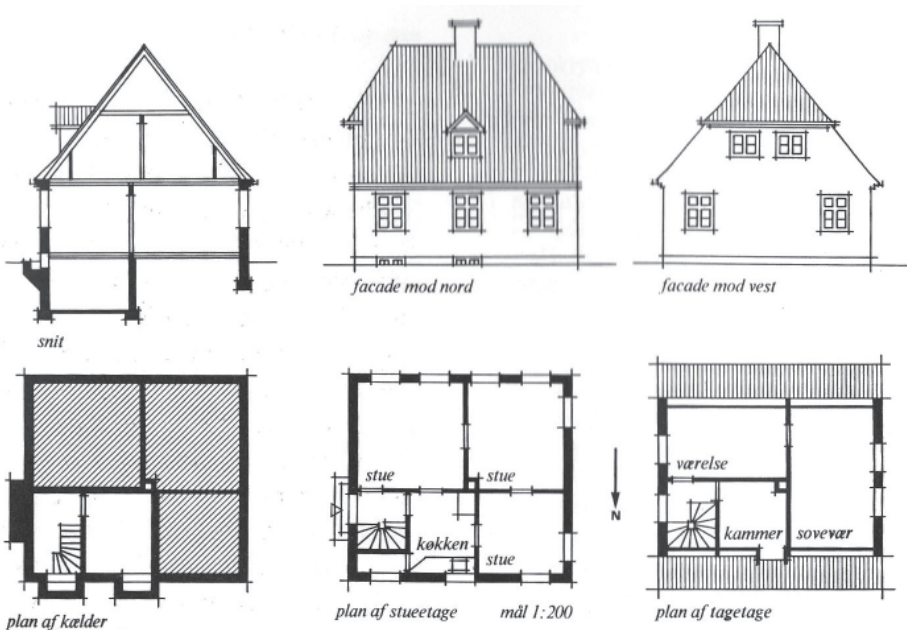


1.2.5 Standard houses

The first consciously elaborated standard house in Denmark was *murermesterhuset* (the master constructor house) from around 1920. It is a 1½ story brick house that can have smaller variations, such as a balcony or bay window in the façade facing the street, but its plan and façade follow a clearly recognisable pattern. The square floor plan is split into four equally large rooms with a chimney in the middle – simple and sensible [ill.50]. The house is formed in relation to the economics, technology and way of life of the time, but during the years it has proved to be very robust, and it is still today, almost ninety years later, among the most popular house typologies on the market (Lind, Møller 1996). In the following time period, from 1920-1960, even more houses were built – 822,000 new dwellings, which is almost three times as many per year than the preceding sixty years. Through this massive building the housing stock in Denmark grew from about 540,000 to 1.4 million, which is a growth of 150%. As the population only grew with 50% during the same period, this gave a significant rise in the general dwelling standard (Lind, Møller 1996). Every third of these new dwellings was a detached single family house and by the end of the fifties there were 440,000 detached single family houses in Denmark, which means that every third household had their own house.

During the World Wars, the building sector stagnated because of lack of building materials which led to a deficiency of dwellings in the years after the Second World War. Therefore the Danish Government gave people the opportunity to obtain cheap

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50. Example of *Murermesterhus* drawings – there are several variations, but the common characteristics are the simple cross layout, with four equally large spaces, the doubly pitched and partly hipped roof, and the robust workmanship (Lind, Møller 1996).

51. *Svenskehusene* (the Swedish houses) in Rønne, Bornholm (Lind, Møller 1996).

52. *Villa* by Povl Baumann (Photo: Ida Wraber).

53. Example of house in *Studiebyen* (the study village) in Hellerup, Copenhagen (Photo: Ida Wraber).

54. Example of house in *Studiebyen* (the study village) in Hellerup, Copenhagen (Photo: Ida Wraber).

loans for building, and, in order to rebuild the Danish society as quickly and efficiently as possible, the solution was to a large extent prefabricated or modular houses (Bøggild-Andersen, Wolf 1950). In some parts of the country, the Swedish government helped by building prefab houses from wood; for example in Rønne on Bornholm and in Århus [ill.51]. In the 20s and 30s the architects built in a neo-classicist style, which can for example be seen in the houses of Povl Baumann [ill.52] or in the houses in *Studiebyen* (the study village) in Hellerup [ill.53-54] (Lind, Møller 1996). However, in the 1930s a new movement arrived in the Nordic countries – modernism. The dwellings, and dwelling areas, should now, as mentioned earlier in the text, be seen as machines for living, according to Le Corbusier and his fellow-modernists. There was a new focus on the societal importance of building good dwellings, in large scale and small scale alike, and with this followed radical new thoughts on how, and from which materials, dwellings should be shaped (Nygaard 1984, Bøggild-Andersen, Wolf 1950). Modernism



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was introduced in the Nordic countries at the housing exhibition in Stockholm in 1930 and was soon adopted by the Nordic architects under the name functionalism (Lind, Møller 1996). In Denmark Arne Jacobsen and Mogens Lassen are some of the most influential functionalist architects [ill.55]. For the more common public, the bungalow was the modern house [ill.56]. The bungalow is a one storey house with a low pyramid shaped roof covered with felt roofing, which was a new material at the time. Therefore there is no room for utilising the space under the roof construction. Instead, the house typology has a cellar with a sensible room height. The floor plan is quadratic with four equally large rooms as in the *murermesterhuset* of earlier times. In the bungalow one can often see the corner window, which is a true functionalistic detail. In this manner the bungalow is a prudent Danish mix of common sense and new style (Lind, Møller 1996). During the Second World War, building naturally stagnated and not until the last year of the 40s, building reached the same level that had been achieved in 1939. There are many linked houses from the early post-war times such as *Atelierhusene* at Utterslev Mose in Copenhagen [ill.57] (Viggo Møller-Jensen, 1942-43), *Søndergårdsparken* in Bagsværd [ill.58] (Hoff & Windinge, 1948-50) or Arne Jacobsens row houses in Vangede [ill.59] (1939-42). Jørn Utzon further developed this housing typology, and around 1960 he built *Kingohusene* [ill.60] (1958-60) and *Terrassehusene* [ill.61] (1962-63) in northern Zealand. These are linked houses with private atriums or courtyard areas that are inspired by Mediterranean houses but have advantages in relation to the Danish climate as well (Lind, Møller 1996, Nygaard 1984, Hiort 1952).

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55. Example of a Danish functionalist house – Arne Jacobsen's own villa in Ordrup, Copenhagen 1929 (Photo: Ida Wraber).

56. Example of a bungalow in Copenhagen with the flat pyramid roof and corner window (Photo: Ida Wraber).

57. *Atelierhusene* by Utterslev Mose in Copenhagen, Viggo Møller-Jensen 1942-43 (Photo: Ida Wraber).

58. *Søndergaardsparken* in Bagsværd, Hoff & Windinge 1948-50 (Lind, Møller 1996).

59. Row houses in Vangede, Arne Jacobsen 1939-42 (Photo: Ida Wraber).

60. *Kingohusene* in Helsingør, Jørn Utzon 1958-60 (Photo: Ida Wraber).

61. *Terrassehusene* in Fredensborg, Jørn Utzon 1962-63 (Photo: Ida Wraber).



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For some years in the beginning of the 1950s and the years immediately before that, architects drew between one third and half of the single family houses in Denmark, but during the sixties, the architects' share decreased to only a few percent. This was primarily a result of the large increase in the total number of new single family houses (Nygaard 1984). From 1960 to 1980 the Danish BNP almost doubled which meant a considerable heightening of the population's living standard. During this period another 450,000 detached single family houses were built – which is almost 75 houses per day for 19 years. The wages increased and more people were thus able to buy their own house (Lind, Møller 1996). The same happened to the prices of the detached single family houses, which meant that the value of a house would increase considerably in just a few years (Nygaard 1984). Therefore a house owner, quite shortly after buying a house, could get a loan for a car or a summer house with the newly bought house as safety. Actually, from 1960 to 1979 the price for a detached single family house almost increased tenfold (Lind, Møller 1996). It was therefore quite profitable to buy a house and this caused a large migration; all in all, 1.5 million people (out of a total of 4.7 million Danes) moved to the new single family housing areas (Lind, Møller 1996, Kraul, Madsen 2007). Many of the houses built were produced similarly to *murermesterhuset*; a standard house that a local builder is used to building with smaller variations (Nygaard 1984). The typical house from this period is made from red or yellow bricks, has a large living room and kitchen in one side of the house and bedrooms with entrances from a long, dark, pistol-shaped corridor in the other side [ill.62-64].

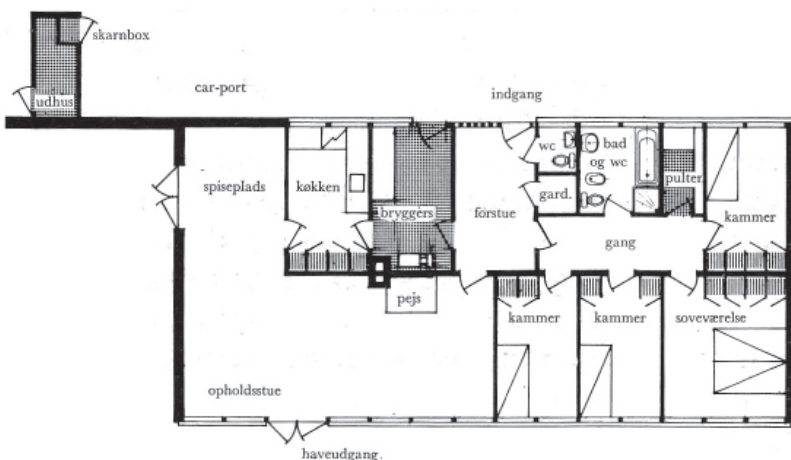
62. Example of a typical layout for a Danish single family house in the 1960s-80s with the characteristic pistol-shaped dark corridor linking the entrance, common rooms, and private rooms (Paludan house from 1968) (Lind, Møller 1996).

63. The simple logics of the façades of the common Danish single family house in the 1960s-80s (Paludan house from 1968) (Lind, Møller 1996).

64. A section of a typical single family house from 1960s-80s – simple and rational (Paludan house from 1968) (Lind, Møller 1996).

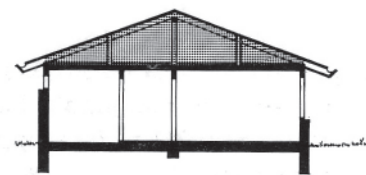
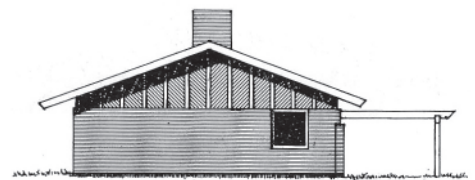
65. Conbox – a multi-storey prefab system, Jacob Blegvad in cooperation with Aalborg Shipyard in the 1960s (Nygaard 1984).

66. *Høm Huse* is an example of a company that delivers simple and complete concepts for self-building sets as well as ready-to-move-in houses (Lind, Møller 1996).



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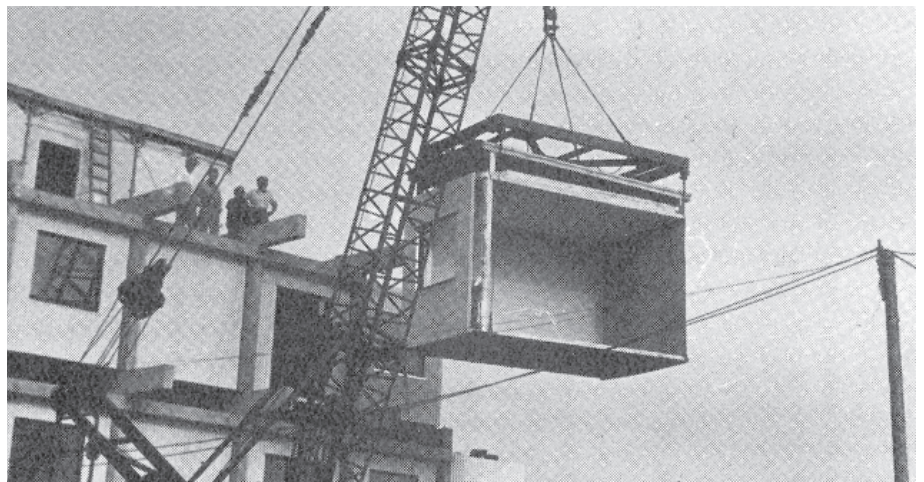
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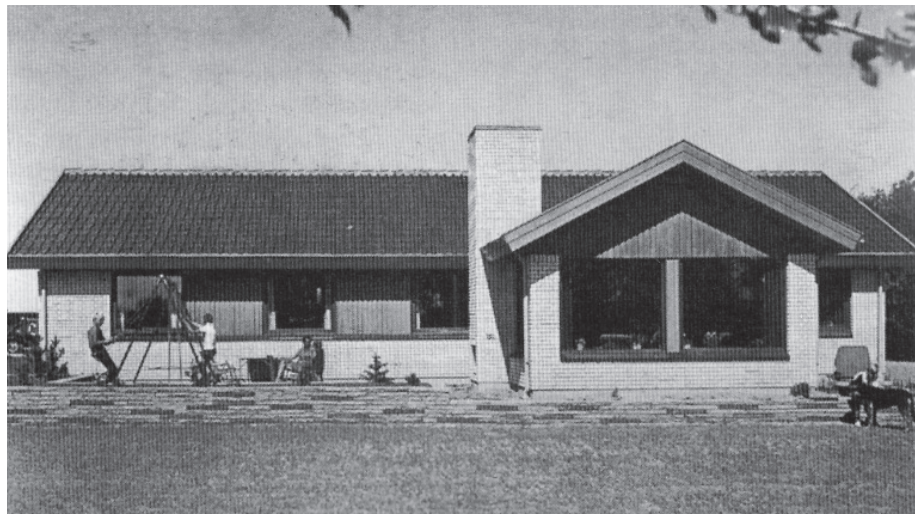
1.2.6 The architects' standard houses

The growing demand for new housing could not be satisfied by the existing building sector. Therefore different parties initiated prefabrication of different kinds. Other industries started to be used as partners in the industrialisation process; for example Aalborg Shipyard has developed a multi-storey building system, *Conbox*, in cooperation with the architect Jacob Blegvad [ill.65] (Nygaard 1984). *Hom huse* was one of the large producers of single family houses at the time – they could deliver the house as a self-builder system, or as an almost ready-to-move-into house [ill.66] (Lind, Møller 1996). Many of the technologies were initially used for the development of multifamily houses, but as time passed they also reached the single family housing sector, and all of sudden there was a large amount of standard house companies (Lind, Møller 1996).



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Already in 1958 architects spotted that single family house design was about to be drawn away from them and the *Architects' Society* (Akademisk arkitektforening), and they therefore formed *Arkitekternes Typehuskontor* (The Architects' Standard House Office). Their standard house was simple, rational and elaborately detailed [ill.67]. However, the organisation of the building process was much more intricate than in other standard



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house companies and therefore the *Architects' Standard House Office* was closed down after only ten years of service (Lind, Møller 1996, Nygaard 1984). Some architects also have their own standard houses on the market. One of these is sold in much larger number than any of the others – the *A-house* (A-huset), drawn by A. Brøchner-Nielsen in the 50s [ill.68]. The house started out as an ordinary house in 1½ storeys, but over time it changed into a house with very low façades that caused the roof construction to almost

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67. Simple and elaborately detailed – the standard house by *Arkitekternes Typehuskontor* (the Architects' Standard House Office) (Lind, Møller 1996).

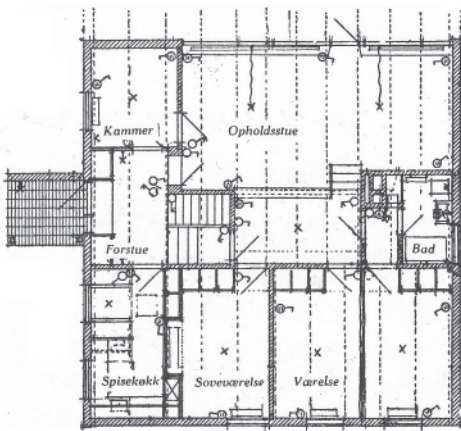
68. *A-huset* (the A house) by Brøchner-Nielsen in the 1950s (Lind, Møller 1996).

69. Plan of a single family house of the architects Iversen & Plum 1950 (Lind, Møller 1996).

70. A single family house by Iversen & Plum, 1950, with an industrial expression (Lind, Møller 1996).

71. The *Espansiva* system offers a rich variation of different standard pavilions and panels that can be put together in numerous different layouts and expressions (*Espansiva-Byg A/S* 1971).

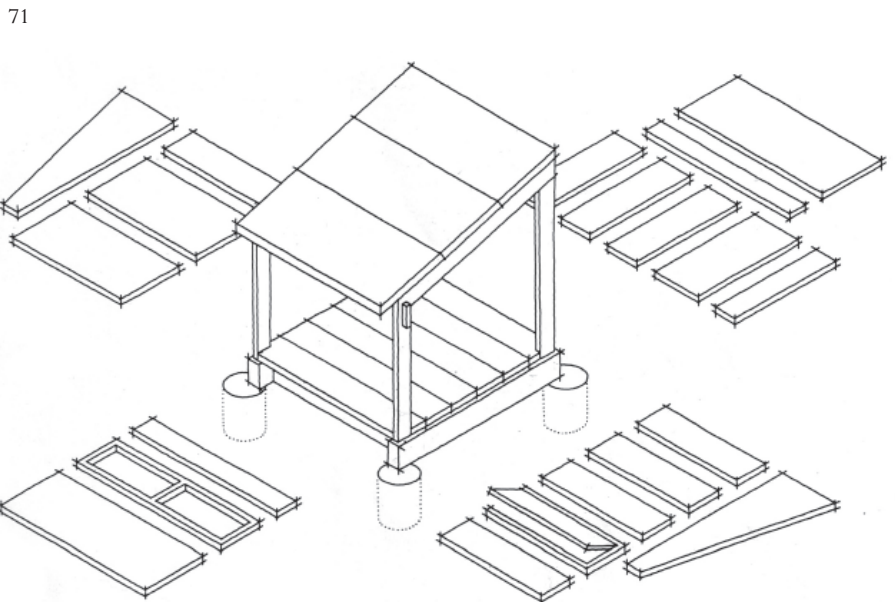
reach down to the ground - i.e. it forms an A-shape (Lind, Møller 1996). *Paludans huse* [ill.62-64, p.38] and Iversen & Plum's houses [ill.69-70] are other examples of standard houses drawn by architects in this period (Nygaard 1984). Jørn Utzon also entered the industrialised housing market in 1970 with *Expansiva*, as previously mentioned. His suggestion, however, was not a complete house, but rather a building system. Standard pavilions and panels could be combined into a vast number of different houses [ill.71]. The pavilions had pitched roofs, which can give a varied roof landscape in the exterior and in the interior, the wooden constructional framework contributed with rhythm and visual warmth; this gave the house both a rustic and refined expression (Lind, Møller 1996). The project did not come any further than to the prototype stage, probably because the customers' wish for the security and predictability that the prefab catalogue



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houses could give rather than the organic and additive building system that Utzon proposed (Nygaard 1984). Arne Jacobsen also showed interest in the industrialised building process and, shortly before his death, presented two different building systems for single family housing, *Kubeflex* and *Kvadraflex*, at a building exhibition in Ishøj near Copenhagen. These were also made with a wooden framework, but were more rigid in the systems as they were composed by predefined room-sized units. Just like *Espansiva*, neither of these houses was built in a larger number (Lind, Møller 1996). Security and predictability attract house buyers and therefore another kind of house producers was more successful; craftsman owned companies that could build houses cheaply and efficiently. Examples of such companies are *Jens. P. Koch* that primarily sold houses based on a very low price and a simple transaction and financial plan [ill.72], and *Roslev Huse* that sold *Succes-huset* which, due to its flexibility in relation to becoming detached or linked houses, could be sold in a large number – at its peak 400 a year (Lind, Møller 1996).

1.2.7 The stagnation of single family house building

During the 70s the detached house got competition from the modern thoughts of collectiveness, and cohabitations were preferred to the isolated detached house by many people (Lind, Møller 1996). Therefore in 1979, on the *Architects' Association of Denmark's* 100-anniversary, the *Practising Architects' Council* (PAR, *Praktiserende Arkitekters Råd*) initiated an experimental housing project in Humlebæk, north of Copenhagen. The aim of the project was to combine the advantages of the detached single family house and the cohabitation ideology that was modern at the time. The name is inspired by the experimental housing area in Hellerup from 1920-24; it is also called *Studiebyen* (the Study Village). *Studiebyen* in Humlebæk includes 21 houses on a plot that with a normal density of detached single family housing areas would only have room for eight houses [ill.73]. The size of the houses varies from 56 m² to 156 m² and different house and roof typologies are represented to indicate the multiplicity of possibilities contained in the detached single family house typology. The project shows that it is possible to build densely without blurring the individual expression of each house, but it is not possible to walk all the way around all of the houses, and this representation of freedom and ownership seems to be very important in Denmark; even though the detached single family house is pointed out as being un-ecological housing typology, the ideal of being able to walk around one's own house lies quite deeply in the soul of the Danes (Lind, Møller 1996). The single family housing market is to a large extent taken over by the standard house producers and there are only few architects that at times draw single family houses, such as Nielsen, Nielsen & Nielsen and Tage Lyneborg [ill.74] (Lind, Møller 1996). Furthermore, after 1980 95% of the buyers purchased used houses (Lind, Møller 1996). The rates on loans began to increase and the prices thus decreased

72. *Jens P. Koch house from the 1960s – very characteristic design of the time and the low price is the most important sales parameter* (Lind, Møller 1996).

73. *Studiebyen (the Study Village) in Humlebæk – a mixing of communal living and single family housing 1979* (Lind, Møller 1996).

74. *Example of single family house from the 1980s – by Tage Lyneborg in Copenhagen* (Lind, Møller 1996).

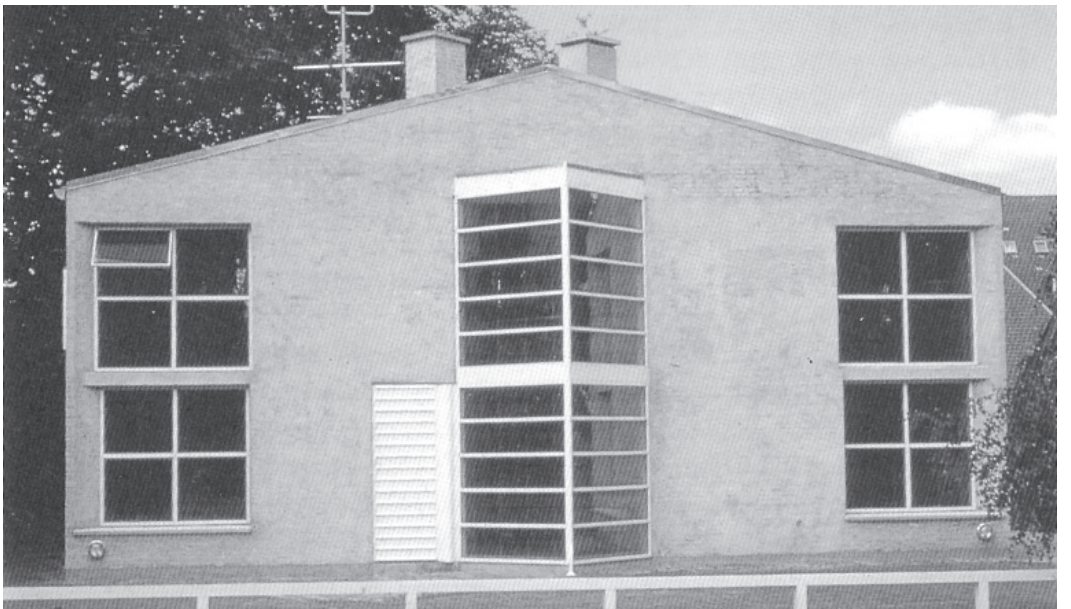


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and many house owners therefore had a growing debt and shrinking capital (Lind, Møller 1996). This resulted in a peak of 150,000 houses being put up for sale, whereas only 40,000 houses were actually bought. Not until the mid-1990s the market again reached a level which made it profitable to buy houses (Lind, Møller 1996). Through the 1990s the market continued in the same tracks. The producers tried to give the user a feeling of getting an individual or customised house, even though the mark of serial production was clearly there – and there had to be a serial production in order to keep the prices down. The materials were mainly brick; sometimes covered by a layer of plaster (Lind, Møller 1996).

1.2.8 Recent years

Until recently the Danish building sector has been prosperous; this is also seen in the detached single housing building – at the moment there are one million detached single family houses in Denmark with three million people living in them, and it is still the preferred form of dwelling in Denmark (Kraul, Madsen 2007). Several new actors have emerged; *M2* with exclusive versions of the standard house drawn by renowned Danish architects (*CEBRA*, *Schmidt Hammer Lassen*, *3xN*, *Dorte Mandrup*, *C.F. Møller* and *B.I.G.*), *HP3/Scandibyg* (with *ONV* architects) with a standard wooden house built from prefab room-sized volume building blocks, and *Hjem* (with *AART* architects) with wooden construction 2D elements that are produced in a factory and quickly assembled on the building site. These three companies have in different ways put focus on other qualities than just a cheap and efficient building process – they have shown that a detached single family house can be contemporary in expression and the latter two of the mentioned companies also do this at a reasonable price. Design has become more important and our home is a place for us to stage ourselves, where the inhabitants should reflect on their happiness, interests and values (Kraul, Madsen 2007, Mechlenborg 2005). Also, the more traditional single family house producers therefore cooperate with known architects – for example *Frydkjær* that have a new *Friis & Moltke* house on their repertoire [ill.75]. People do not want to live in a catalogue or standard house – they want a personal dwelling (Jensen 2008). However, when people get the possibility to be part of the design process, the house often ends up looking like most other houses (Kraul, Madsen 2007). This is probably because people find inspiration in what they see in magazines and at friends' houses, and therefore everyone wants a larger and more luxurious bathroom at a specific time, or an open connection between kitchen and living room at another – people want to buy the contemporary idea of a good life [ill.76] – but the difference lies in for example the choice of tiles for the bathroom or domestic appliances and table material for the kitchen. Thus, individualism is expressed in the interior details – and even if the houses at first might look the same, the inhabitants themselves do not at all think that they are (Kraul, Madsen 2007). At the moment, the

75. Example of cooperation between a traditional single family house producer and an architectural office – *Unikaplan* by *Frydkjær* and *Friis & Moltke* (*Friis & Moltke* 2009).

76. The contemporary idea of a good life and a good home includes a large kitchen-dining area where the adults and children can work, cook, and play – i.e. giving the opportunity of being together even though not everybody in the family wants to participate in the same activity. In the *IKEA*-advertisement father and son prepare some food and the daughter is reading peacefully on the other side of the kitchen table (*IKEA* 2009).



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FAKTUM køkken med SOLÅR døre/skuffefronter af bøg* 18.483

FAKTUM køkken med SOLÅR døre/skuffefronter af bøg 18.483. SOLÅR døre/skuffefronter af massiv bøg, bøgtræsfiner med klar lak. Integrerede greb af massiv bøg. PERSONLIG bordplade af hvít keramisk med kant af aluminiumsmønster. Whirlpool kårde hvidevarer 29.195,- 27.595,- NUTID HO EV frithængende emhætte 5.295,- 4.899,- Kombineret frithængende emhætte og lampe. Velegnet til brug over en køkkene eller et fritstående komfur. Ø 55, H 54-130 cm. Grant misteltenmønster 801.238.65 DACE reol 1.599,-/stk. Rustfrit stål: B75×D35, H 180 cm. 401.262.05

*Hvad indeholder prisen? Se side 136.

environmental issues are important and both the producers and the Danish population as such are about to get used to the fact that environmentally friendly houses can be something else than hippie-houses made of seashells and bales of straw [ill.77], as is for example also demonstrated in the building exhibition *Fremtidens Parcelhus* (the detached single family house of the future) in Herfølge in Zealand, or *Komforthusene* (the Comfort Houses) near Vejle [ill.78] (Kraul, Madsen 2007). These, however, are only the tendencies of today, and they can and will change, as we have seen that they have done many times through history. But is there something in the way we look upon our dwellings and architecture as such that does not change? The following section returns to the more sociological, philosophical, timeless and time-bound, aspects of what a dwelling is, and what it actually means to dwell.



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1.3 WHAT IS A GOOD DWELLING?

“For some people the word home means the place that is closest to the heart, the haven where you seek shelter during the struggles and disappointments in life, certain to find comfort and rest. For other people the home is only a necessary stop on the daily dessert walk through amusement and business, the place in which you eat, sleep and dress, however indifferently to where it is and how often it changes place.”⁵

(Gad 1918/2008)

A home is a complex matter. It is a container – a house – made of wood, stone, glass and metal, a specific space and place, a certain number of rooms; it is the patterns of a specific everyday life, a set of family rules, patterns of movement; a stabilising core for a group of people; a family (Pallasmaa 1994, Winther 2006). To convert a house into a home is therefore not necessarily a simple matter – and it is not possible to produce and sell *homes* (Pallasmaa 1994). It is possible to feel at home, wherever one lives, but on the other hand you can have several places where you feel at home, which is not necessarily your house (Mechlenborg 2005, Winther 2006). A place for dwelling can therefore be understood differently depending on the viewpoint it is being observed from.

Through the eyes of a culture historian the notion of what a good dwelling is changes – more or less dramatically – over time but is fairly general in a specific area, or among a group of people at a specific time (Bøggild-Andersen, Wolf 1950, Schoenauer 2000, Rybczynski 1987, Hellspong, Löfgren 1994). Every building has a use, and the more simple and necessity oriented the building is, the further into the background the beauty and the decorative step; one could for example think of the difference between a shed [ill.79], which is often purely functional and not very decorated, and churches, which are less function oriented and very elaborate [ill.80]. Dwellings have traditionally been mostly related to the practical activities and purposes, such as protection from wind and rain, a setting for celebrations, rest and sleep, births, cooking, washing and so on (Bøggild-Andersen, Wolf 1950). Hereafter comes getting hold of building materials and the sufficient techniques for handling those, and then the desire to create something which is pleasurable to look at and live in (Bøggild-Andersen, Wolf 1950). The connections and contradictions between these elements – function, technique, economy and desire for beauty – characterise the development of dwellings over the years (Bøggild-Andersen, Wolf 1950).

77. *Example of environmentally friendly house built of mud and straw in the conceptual self-builder area Friland in Jutland (DR 2009).*

78. *Contemporary environmentally friendly house built in the experimental project Komforthusene (the Comfort Houses) in Skibet near Vejle in Jutland by Bjerg Arkitektur 2007-08 (Komforthusene 2009).*

79. *Detail of a shed. A shed is often a simple construction with focus on functionality rather than aesthetics (Photo: Ida Wraber).*

80. *Detail of a church. A church is often a complex construction that should impress visitors and focus is to a high degree on aesthetics rather than functionality (Photo: Ida Wraber).*

⁵ Quote is translated from Danish by the writer. Original quote: ”For den Ene betyder Ordet Hjem det Sted, som ligger Hjertet nærmest, den Havn, hvorhen man tyer under Livet Kampe og Skuffelser, sikker på at finde Trost og Hvile. For den Anden vil Hjemmet kun sige: En nødvendig Station paa den daglige Ørkenvandring gennem Forlystelserne og Forretningerne, det Sted, hvor man spiser og sover, klæder sig om, saa nogenlunde ligegyldig for, hvor det findes og hvor ofte det skifter Sted.”

At the moment the focus is on the desire for beauty; our homes are staged like never before – in magazines homes are described in nostalgic styles as a place of safety and stability [ill.81]. The single family house is the ultimate dwelling form of the Danish housing market – the final goal of our housing dreams; a place where families can live peacefully, without crime or heavy traffic, and where the inhabitants are entitled do whatever they please; change the windows, plant some trees, build an extra room, or maybe tear down a few walls (Jensen 2008). This is also increasingly important at a time where our house is seen as a mirror of our personality. Through having a large kitchen-dining area, we signal that we are a family that does things together and enjoys each other's company. We display our ecological and fair trade food habits in the same room as our flat screen TV is situated, in front of which the whole family sits and enjoys the evening's entertainment and each other's company. We show our surplus time and

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energy through having a large ‘wellness’ bathroom. The home has become a centre for, and display of, our consumption (of food, entertainment, wellness etc.) and a mirror of who we are; just like the clothing was the main mirror of one’s personality in the 80s [ill.82-83]. Through our display of consumption we do not necessarily reveal who we really are, but rather who we wish to be - a glazed roofing on your house does not necessarily mean that you *are* a director or the like, but that you *would like to identify* with that group of people (Jensen 2008). Therefore we spend an increasing amount of money on our dwellings. But on the other hand, we spend decreasing amount of time in them (Winther 2006). Many people in Denmark feel that they have difficulties making ends meet in their everyday life – we simply work too much to have the family life that we dream of – and this seems to result in a focus on the dwelling, through which we show that it *is* indeed important to us (Jensen 2008, Winther 2006). It is between these poles that the contemporary social concept of the home is stretched out – between the high speed society, which constantly calls for personal development and reinvention, and the stable repetitions and habits of the inert daily life - the faster the development and the higher the demands of mobility and flexibility in society, the greater the need for having a place to recover and having a moment of peace with the closest friends and relatives (Mechlenborg 2005, Winther 2006). Therefore, the contemporary dwelling should not only be functional, durable and a mirror of personality; it should also represent softer and more abstract values such as safety, calm, and rituals. Those aspects are discussed more in depth by for example the theories of phenomenology.

81. *Picture from a Danish home magazine 2009: Houses are decorated in nostalgic styles with focus on calm and safety for the family (Samso 2009).*

82. *Punk rockers: In the 1980s people showed their personality and interests through the clothes – today it is rather through appearance of the dwelling (Lundgren 2004).*

83. *Break-dancers: another style of appearance from the 1980s showing personality and interests of the bearer (Lundgren 2004).*

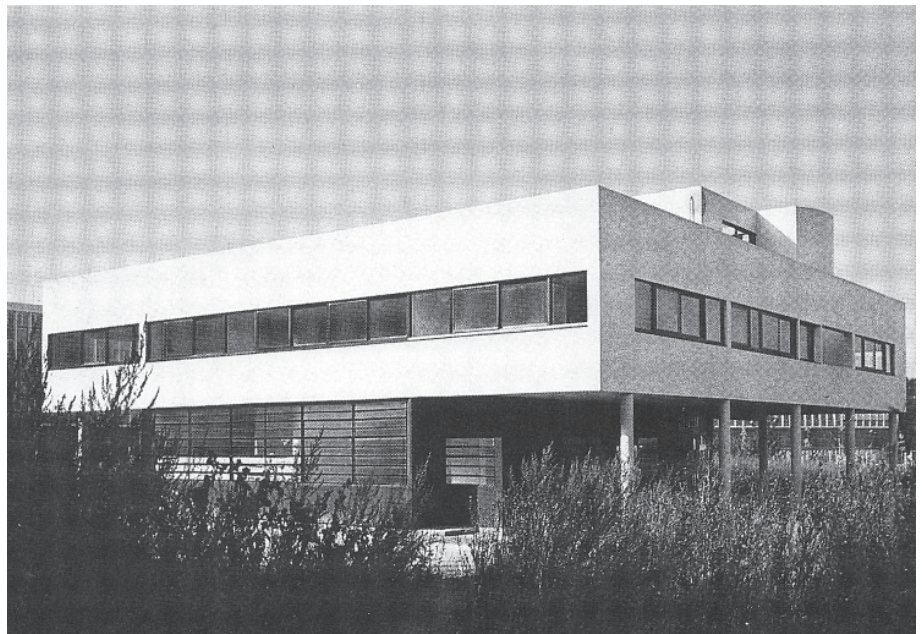
From a phenomenological view our sense, or image, of home is often described as depending on our first childhood house. We remember this down to the smallest details and with all our senses (Pallasmaa 1994, Bachelard 1994, Benjamin 1992, Bang

2001). The house determines the border between inside and outside, and within this physical framework of the house we collect our experiences of the home (Winther 2006, Bachelard 1994). The home is our own protected corner of the world, a shield from other people's eyes and ears – it is the place of the body and the mind, where we eat, wash, dream; live (Winther 2006, Bachelard 1994, Certeau 1988). According to one of the early phenomenologists, Martin Heidegger (Heidegger 2000), dwelling is fundamental to our being in the world – we are *dwellers*. In his essay *Building Dwelling Thinking* he focuses on the meaning of the three words of the title from an etymological standpoint; “*To build is already to dwell*” he writes referring to the fact that building (*bauen*) does not only mean build, but also to dwell, to remain or stay in place and preserve, or take care of what exists in that particular place (cattle, landscape, community etc). Therefore, the matter of dwelling is a corner stone in our being. However, it is not unimportant *how* we dwell – the more we reflect upon our dwelling in the world, the better we build to preserve and take care of a specific place and its inhabitants (Heidegger 2000, Seamon 1998). The phenomenological perspectives, as can be seen, therefore primarily relate to the idea of home as an abstract matter of feelings, communication, and representation; the actual physical form, is not in focus. However, a house can of course also be described more concretely in relation to form, functions, economics, temperatures, light, colours etc. In the following section the more concrete matters will be drawn into the discussion, and different perspectives on how to design and evaluate architectural quality will be outlined.

1.4 PERSPECTIVES ON QUALITIES IN ARCHITECTURE

During the last century the discussions of how to view and evaluate architecture have been more alive than ever before with many different styles and theories in play at once; such as art nouveau, modernism, functionalism, post-modernism, phenomenology, and architectural psychology. Not only have new theoretical frameworks been developed, but also building techniques and methods have evolved rapidly as seen in the earlier sections of this chapter. Some theories have been more or less tied to the development of building technologies – for example the Modernists’ interest in the industrialisation of building, both in relation to new materials and modes of production, that lead to a new stylistic manifest [ill.84]. The theme of generality or specificity of the relation of architecture to its surroundings and its inhabitants has been a central issue in the 20th century. The main reason for this is probably the industrialisation of building and the possibility to build on a large scale, quickly and efficiently, for many people. The builders, or the architects, thus draw and build for a customer unknown to them and to some extent also for a context not known to them in advance – the prefabricated detached houses are good examples of such buildings. Therefore, industrialisation brings up the question of to what extent building should be specifically shaped for the context and a specific customer. Through the last decade there has been a certain focus on the quality and the values of our physical surroundings spanning from city planning to household products, and the architects are challenged by other trade groups to explain their values and aims. Through this focus, the discussion and the used terminology have been sharpened and nuanced, and it has brought the discussion of architectural

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84. *Villa Savoye by Le Corbusier 1929-31 – an experiment with stylistic possibilities of the new industrial materials and modes of production (Lund 2001).*

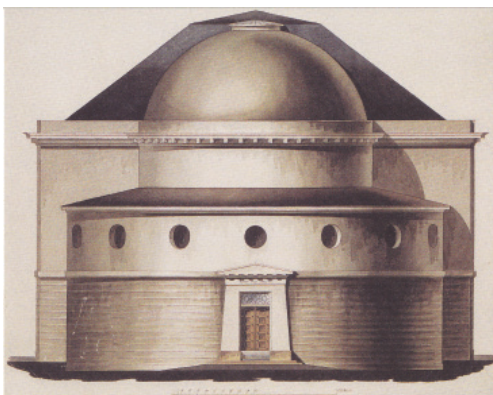
quality out to a wider group of actors than the rather narrow traditional group of architects (Jensen, Beim 2006). This puts pressure on architects to actually verbalise their factual and intuitive knowledge, which had previously not been that important, as the discussion has mainly existed within a closed group of like-minded people; brought up in a well-established master-apprentice tradition. Different countries have initiated different initiatives to create a framework for the discussion of architectural quality. In Denmark an architectural canon has been created on an initiative from the Danish Ministry of Culture (launched 2006). This canon defines the twelve most important pieces of architecture either built in the country, or drawn by Danish architects [ill.85-88], and through these examples a common understanding of what architectural quality is should be formed (Juel-Christiansen et al. 2008). In Great Britain another approach has been taken with the introduction of DQI (Design Quality Indicator), which is an architectural design tool that has been developed through the last years (launched 2002), and it is now widely used to structure design processes in order to make sure that the right values are emphasised in the product (Construction Industry Council 2008). Despite, or maybe due to, these different approaches to discussing and defining architectural quality, the question still remains – is it possible and desirable to capture the values of well functioning and poetic architecture; and subsequently how could this be done?

85. *From the Danish Architectural Canon: Vor Frue Kirke. Church in Copenhagen, C.F. Hansen 1811-29 (Viking, Hovring 2006).*

86. *From the Danish Architectural Canon: Østbroen. Bridge between Zealand and Funen, DISSING+WEITLING 1991-98 (Viking, Hovring 2006).*

87. *From the Danish Architectural Canon: Dyrehaven. Landscape garden in Copenhagen, Rudolph Rothe 1846 (Viking, Hovring 2006).*

88. *From the Danish Architectural Canon: Sidney Opera House. Jorn Utzon 1957 (Viking, Hovring 2006).*



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1.4.1 The complexity of architecture

Architecture is a field that lies on the border between the scientific and technical skills of the constructor, engineer, and mathematician, and the more intuitive field of the artist; the sculptor and the painter. This meeting between science and art – between the earthbound and the poetic – is what gives architecture a complexity that is unique amongst the fine arts (Wallenstein 2004). There are some parts of architecture that clearly and unambiguously can be measured and evaluated – such as the minimum need for space in relation to functionality, the lowest temperature in a room on a cold winter’s day, or the deformation of a column. But there are other parts – the more poetic and artistic matters – that have traditionally been passed on from master to apprentice, from generation to generation. Even though the styles have changed from time to time, there seem to be some general concepts that are common for most eras. At least we still consider many historical buildings such as Parthenon, Pantheon, the Gothic cathedrals, Palladio’s villas, or Mies van der Rohe’s and Le Corbusier’s architecture as being of high architectural quality [ill.89-92]; there is a general feeling amongst architects that these are great works of architecture. But on what foundation are these evaluations made? On what background is this common feeling created, and with what words and concepts could these seemingly intuitive or tacit matters be described?

89. Durable architectural quality? Parthenon at Acropolis completed 438 BC (Watkin 2000).

90. Durable architectural quality? Pantheon in Rome, 118-28 AD (Watkin 2000).

91. Durable architectural quality? Villa Rotonda near Vicenza, Andrea Palladio 1566-70 (Photo: Ida Wraber).

92. Durable architectural quality? Barcelona Pavilion, Ludwig Mies van der Rohe 1929 (Gympel 1996).



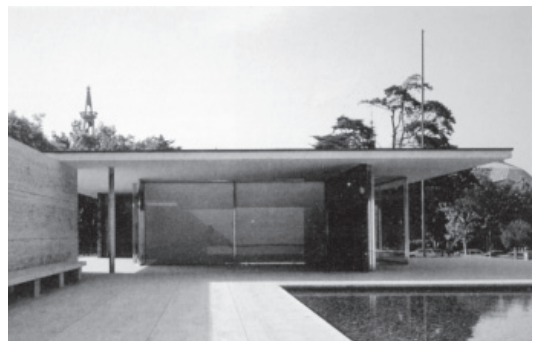
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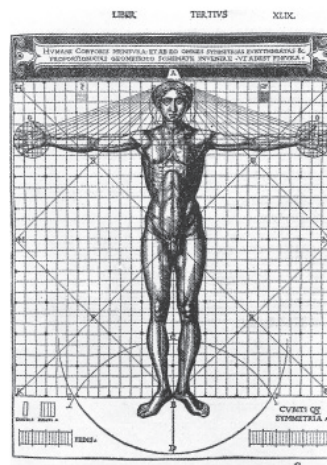
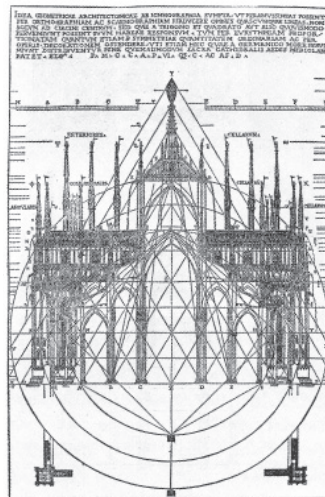
1.4.2 The concept of quality

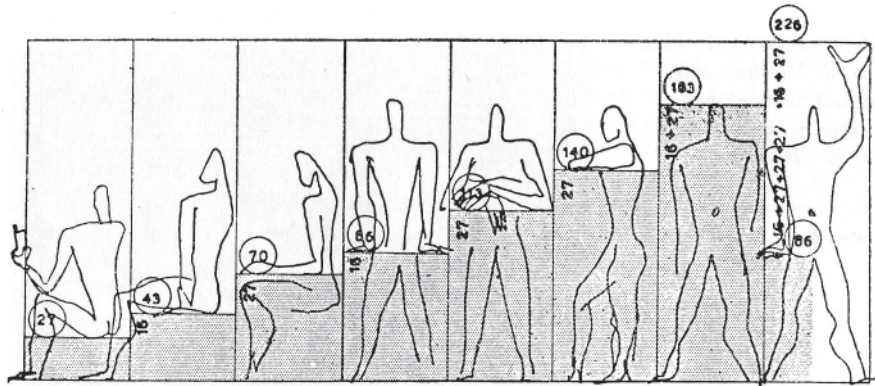
Quality is, as indicated above, a wide concept; it can relate to the properties or characteristics, the standard or the type of an object. These kinds of interpretations of quality are objective, but the concept can also relate to the matter of how something is subjectively perceived – the personal judgement of what is good and bad (Jensen, Beim 2006). Therefore the concept of architectural quality contains so much more than the question of how a building performs technically and functionally; whether it still stands after a storm, if it can keep the rain out, or if the single apartments have suitably sized and equipped kitchens. However, this is nothing new – already in the times of the Roman Empire Vitruvius defined architectural quality as a matter consisting of three intrinsically connected aspects – *utilitas*, *firmitas* and *venustas* (Kruft 1994), which was translated by the Renaissance theorist Henry Wotton into commodity, firmness and delight. The technical, and to some extent the functional, aspects can be held up against different standards and recommendations, but the aesthetic aspects are more difficult to measure and therefore the matter of architectural quality can be divided into objective and subjective matters – the measurable and the immeasurable. The Renaissance theorists were generally speaking quite impressed by Vitruvius and his division of the immeasurable, *venustas*, into six separate categories – *ordination*, *disposition*, *eurythmi*, *symmetria*, *decor* and *distributio*; for example Alberti and Vasari built their theories on such principles (Scruton 1979). The Renaissance was thus a revival and development of the principles of the Greek mathematics and the architects and theorists were preoccupied with the idea of man as the image of God and the bearer of the universal harmonies, and the Vitruvian man inscribed in a circle and a square [ill.93] was seen as the ultimate picture of the mathematical relation between microcosm and macrocosm (Wittkower 1973). Principles and rules

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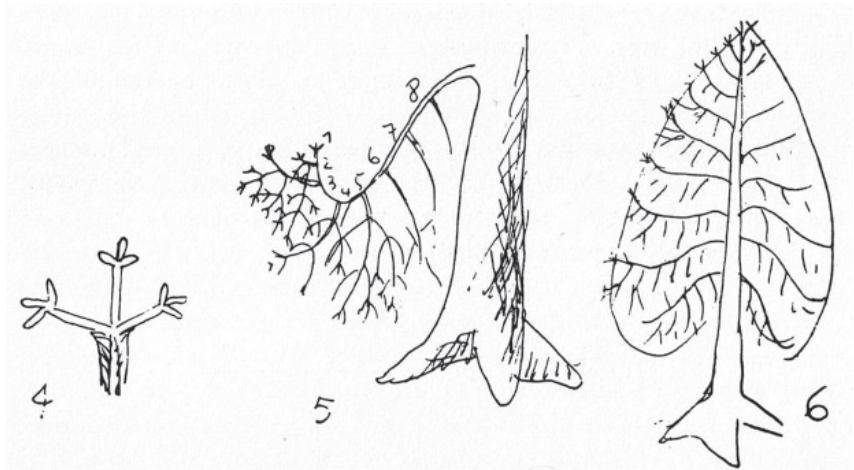
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93. Leonardo da Vinci's classical drawing of the man inscribed in a square and a circle showing the fine proportions of the human body (Rasmussen 1966).

94. Illustration by the engineer Cesare Cesariano that shows the proportional logics inherent in architecture, human beings, and cosmos (1521). The same system that is used to analyse the human body is also used to analyse the cathedral of Milan (Gympel 1996).

95. Le Corbusier's suggestion to a proportioning system related to the human body – *le Modulor* from 1948 (Rasmussen 1966).

96. One of Le Corbusier's drawings showing the repetition system of nature – how the detail and unity are connected through a logics that permeates every tiny part (Le Corbusier 1971).

of order and harmony were sought in architecture with reference to, and inspiration from, musical harmony – the main aim was to describe architectural success by means of objective mathematical terms [ill.94]. This tradition was primarily brought back to life the 20th century by some of the Modernist architects, such as Le Corbusier, who in his book *Towards a new architecture* claims:

“As to beauty, this is always present when you have **proportion**”
(Le Corbusier 1931/1986)

This is reflected in several parts of his work – for example in the *Modulor*; a proportioning system that has its offset in the human body [ill.95] and in his repeated interest in the mathematical growth of plants and trees [ill.96] (Scruton 1979, Le Corbusier 1945, Le Corbusier 1971). To Le Corbusier, a system of proportioning is a way to avoid working in a chaotic world of shapes. In the paper *Architecture and the spirit of mathematics* Le Corbusier describes how he discovered this:

"I built my first house at the age of 17; it was decorated from top to bottom. I was 24 when I did my second; it was white and bare: I had travelled. It is 1911, and the plans for this second house are on the drawing board. The arbitrariness of the holes in the façade (the windows) becomes startlingly obvious. I blacken them with charcoal. At once the black dots speak a language, but this language is incoherent. The absence of rules and laws is obvious. I am overwhelmed: I realize that I am working in total chaos. Here is when I discover the necessity for the intervention of mathematics, the need for a monitor. From now on this obsession will occupy a corner of my mind."

(Le Corbusier 1971)

A more recent example of a theory following this line of formalist discussions is represented by Robert Venturi's book *Complexity and contradiction is architecture* (Venturi 1966/1977). Venturi, however, turns against the modernist simplicity, and argues that architectural qualities arise from complexity and contradiction. He for example mentions the Greek temples as examples of buildings that are seemingly simple, however, in reality it is the precision in the complex distortions of the geometry and the tensions that are expressed through these contradictory elements that make it look simple – *and poetic* [ill.97] (Venturi 1966/1977). The theories mentioned above all have their focus on proportion and mathematical order or harmony, even though they do not always agree on how to describe these orders more specifically; for example Le Corbusier argues for simplicity whereas Venturi argues for complexity. However, they all deal with the definition of *universal rules* of architectural beauty – striving to find the objective methods of composing architecture of high quality. Therefore, they also inherently have their main focus on the visual matters of architecture; and in practice, it is difficult to imagine architectural experience as a purely visual matter. When speaking of room experience as a whole, one can hardly neglect the matters of warmth and

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97. The Greek temples, even though they seem simple in their design, are filled with complex and contradictory matters that make them seem interesting and create dynamics in the simple concepts (Gympel 1996).

coldness, smells and sounds, which cannot as easily be described through mathematical systems as the visual composition. These matters are on the other hand the focal point of the more subject focused theories, of which the previously mentioned theory of phenomenology has been one of the most influential to architecture.

1.4.3 The phenomenological experience of architecture

The Finnish phenomenologist and architect Juhani Pallasmaa argues that our culture has been vision-centred for a long time, and that all the other senses have been forgotten or considered less important during this period. However, Pallasmaa suggests that the skin is actually the most original sense-organ and that all the other senses can be seen as extensions or variations of it. Even the transparent cornea of the eye is covered by a layer of modified skin (Pallasmaa 1996). Our experiences of architecture are complex and put together by using the senses of seeing, hearing, smelling and feeling. We unconsciously integrate our perceived sensations into the experience of our environment (Lawson 2001). Then the question of course is, whether the complete experience is more, or something else, than the pure sum of the single sensations. If an experience were the result of a sum, our experiences would be quite general and alike if two persons are standing in the same room, at the same time, looking in the same direction etc. However, if there is something more involved, the same perception will manifest itself differently from person to person as a subjective experience. Hermeneutics and phenomenologists claim that the experience will vary from person to person as a result of different historical, cultural and individual horizons. From this perspective, architecture is therefore seen as a dynamic concept that is dependent on movement and relationships, both physical and psychological, but at the same time neither a purely external object or a purely inner experience (Heidegger 1997, Merleau-Ponty 1945/2002). The experience of a building will be different depending on the time of the day and the year, the memories and expectations of the subject, and the space of a building is also changed by the tension that emerges when someone enters it (Merleau-Ponty 1945/2002, Bachelard 1997, Dahlin 2000). Thus architecture can be considered to depend on human interaction in order to be meaningful (Christoffersen 2006). If no one experiences or uses the architecture, it is not possible to discuss its architectural qualities. Therefore, the architectural quality of a building is not *only* a result, or the sum, of the temperatures, proportions, textures, scents etc. of a room but is also influenced by the specific person's earlier experiences and perceptions (Dahlin 2000). The experience of space can thus vary, but the idea of what space is can also be perceived differently. It can be a more or less concrete – or explicitly spatial – concept and can be described as a representational strategy that is inherently interlaced with time and with the social setting (Crag, Thrift 2000). Therefore space should not be perceived as a static matter but as a dynamic concept, developing and changing over

time and depending on the actions, movements and conceptions applied to it – as well as space influence the experience of time, and the actions and movements within it (Crang, Thrift 2000). In other words; space is not an object – a neutral medium – but rather is an active co-player in our experiencing of the world (Crang, Thrift 2000).

According to Martin Heidegger architectural space is an intensification of our being in the world. For example a bridge does not only tie the two banks together, but it also underlines the separation of the same two banks – at the same time as the two banks underline the stretching of the bridge [ill.98]. The construction stands as a stable contrast to the constantly moving and changing stream of water and in this way both the stream and the bridge are also intensified by each other (Heidegger 1997) The Norwegian theorist Christian Norberg-Schulz, follows in the Heideggerian track when suggesting that the quality is the *nature* or *essence* of an object (Norberg-Schulz 1963) and the creative process is the challenge of unveiling this essence – just as described in the example of Heidegger’s bridge. This process of revealing something that already *is* can only be done through mastery of a specific language – in this case the architectural

98. *A bridge and the two banks underline each other – the stretching of the bridge is underlined by the trench between the banks, and vice versa. Pont du Gard, southern France, end of 1st century BC (Photo: Ida Wraber).*

99. *Example of a famous and recognisable neighbourhood: the Fuggerei in Augsburg (Alexander et al. 1977).*

100. *Two examples of intimacy gradient; the top drawing showing an office and the bottom drawing showing a dwelling (Alexander et al. 1977).*

101. *Example of an alcove creating a framework for eating (Alexander et al. 1977).*

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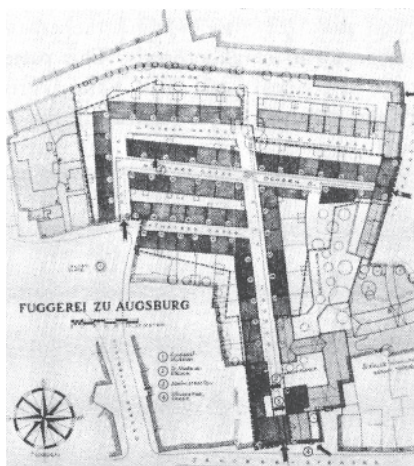


language (Heidegger 1997, Norberg-Schulz 1963). In order to reveal something in a distinct and understandable manner, it is necessary to create conformity between the components and the whole (Norberg-Schulz 1963). Norberg-Schulz calls this the poetical framework of understanding. Within this framework nothing appears as an isolated object or event, but everything is defined through its relationships to the surrounding world (Norberg-Schulz 1963). These aspects of the qualities of architecture are very intangible and they are not always easily related to concrete pieces of architecture or working processes. David Seamon (Seamon 1998), however, suggests that the theories of Martin Heidegger and related phenomenological views are more concretely investigated and discussed in writings by Christopher Alexander (Alexander et al. 1977) and Thomas Thiis-Evensen (Thiis-Evensen 1987), who both go a step further, trying to uncover structures that are ‘softer’ than the classical and modernist perspectives, but more concrete than the phenomenological theories.

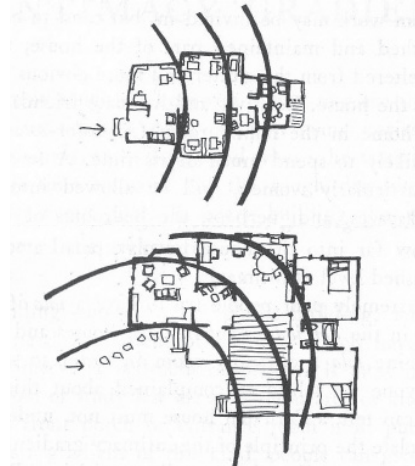
1.4.4 Structures and patterns in architecture

The American architect Christopher Alexander approaches the description of architecture through a listing of 253 ‘patterns’. The patterns are described as architectural typologies spanning from large scale city planning down to details of dwellings and have names such as *identifiable neighbourhood* (14) [ill.99], *intimacy gradient* (127) [ill.100], and *alcoves* (179) [ill.101] (Alexander et al. 1977). Every pattern is a part of a larger structure and can be linked to at least one of the other patterns – both in the larger and the smaller scale. By combining the patterns in the suggested combinations a whole and coherent design will be achieved at all levels, Alexander and his co-writers argue. The pattern language, which is made up of the described patterns, is furthermore said to be only one out of many possible languages – every society that is alive, it is explained, has its own specific pattern language. Every individual person even has an own language,

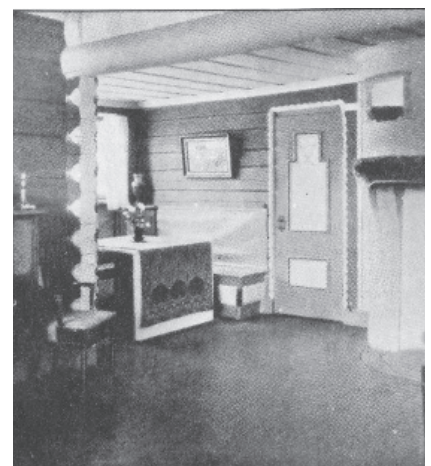
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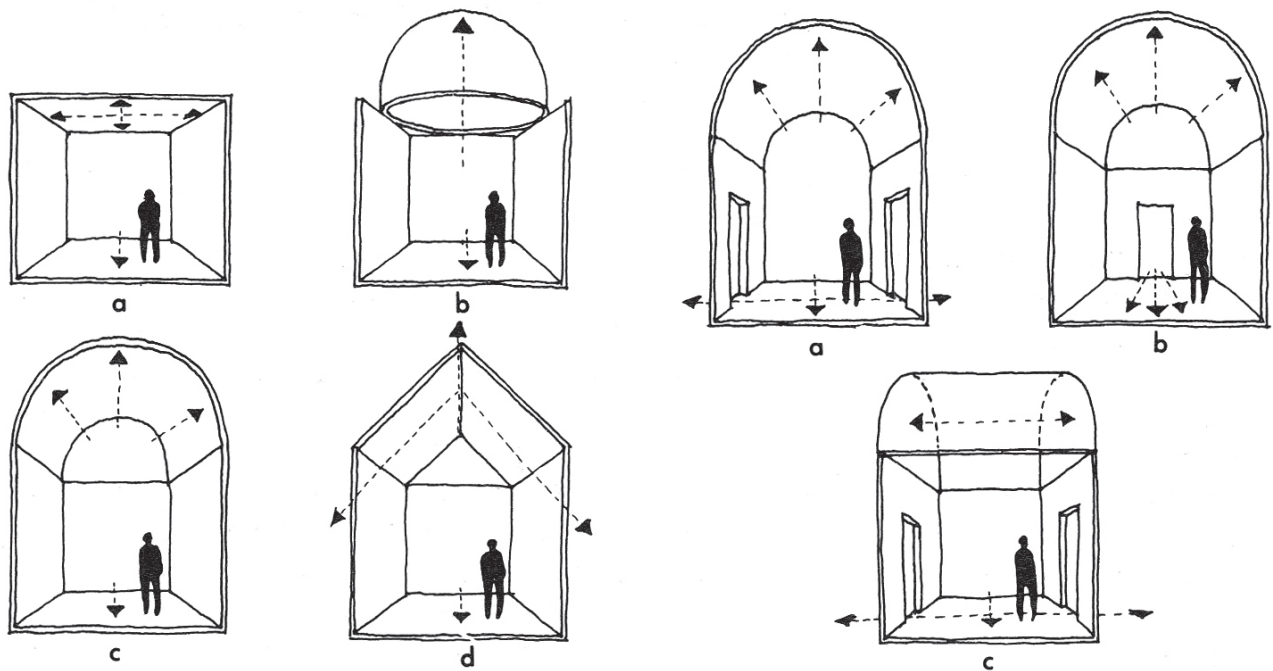
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but these will be similar in groups of people with similar backgrounds and from similar cultures (Alexander et al. 1977). Thiis-Evensen is also structural in his analysis of the elements of architecture, but instead of patterns, his 'pieces' are called archetypes, and they are all related to the main groups of *floor, wall, and roof*. The aim of the investigation is to define a grammar of architectural form that continues the tradition originating with Christian Norberg-Schulz (*Intentions in architecture* (Norberg-Schulz 1963)) and Robert Venturi (*Complexity and contradiction in architecture* (Venturi 1966/1977)) (Thiis-Evensen 1987). From the reading of Norberg-Schulz, Thiis-Evensen is inspired by the discussion of architectural experience as a psychological phenomenon, and from Robert Venturi he continues the discussion of the architectural elements as valuable in themselves, as form elements, without any considerations of external, worldly matters such as technology, sociology or economics (Thiis-Evensen 1987). Both Thiis-Evensen and Alexander therefore try to uncover the specific elements from which architecture is built and in a pragmatic way clarify the relationship between thinking, building, and dwelling. However, their approaches are slightly different (Seamon 1998). Thiis-Evensen focuses on the formal elements and describes all the different formal ways in which the floor, wall and roof can be shaped [ill. 102]. The analysis is clear and thorough for each of the elements, but how the single elements interact with each other and what experiences that interaction results in are not as clearly expressed. Alexander, on the

102. Illustration from Thiis-Evensen showing different designs of a roof and the directions that are underlined through these designs (Thiis-Evensen 1987).

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other hand, has a focus on these networks of interaction between different architectural elements and human beings, but the system is not very logical and the patterns seem fairly random; it is not very clear why those 253 specific patterns are picked out (Seamon 1998). Another attempt to describe architecture from a set of parameters is seen in Simon Unwin's book *Analysing architecture* (Unwin 1997). Unwin's model is built up around basic elements (floor, roof, walls, paths, openings etc.) and modifying elements (colour, texture, scale etc.). Like Alexander and Thiis-Evensen's theories, it is also a suggestion as to how to describe the phenomenological perspectives and correlations of architecture in a more structured manner. All three theories thus include the human experience and suggest a framework for working with different architectural elements, but neither of them suggests an actual way of assessing the architectural qualities, as their background is in the subjective field of phenomenology. However, many theories during the last fifty years have been focused on such specific measuring of quality, as will be shown in the following section.

1.4.5 Perspectives on measuring of architectural quality

A recent example of a suggestion of how it is possible to investigate the multifarious nature of architecture in a structured manner is the works of the Danish CINARK⁶. This research centre has a more pragmatic approach to architectural quality, than the theorists that have been discussed until now (Jensen, Beim 2006, Jensen, Beim 2003). Through interviews with users, architects, developers and other involved parties, they try to sum up the larger aspects of what good dwellings are. They discuss a wide range of parameters such as aesthetics, utility, economics, and efficiency in production. Their focus is furthermore not only on the product – the final piece of architecture – but also on the process of developing and building. Four approaches are defined; the pragmatic, the academic, the managerial, and the conceptual approach. Those are related to different strategies that are defined by dichotomies such as architecture as autonomous vs. dependent discipline, project vs. process orientation, innovative vs. evolutionary method, intuitive vs. explicit collection of knowledge (Jensen, Beim 2006). CINARK's research through these projects is to a large extent conducted through qualitative studies; interviews and case studies. As a quantitative research model with a pragmatic approach Sven Hesselgren's questionnaires on experiences of urban environments and buildings could be mentioned as an example. Hesselgren primarily uses perception psychology to identify bipolar pairs of words – such as comfortable-uncomfortable, heavy-light, passive-active – that together can give a graph or profile of a specific space

⁶ Center for Industrial Architecture; a research center at the Royal Danish Academy of Fine Arts

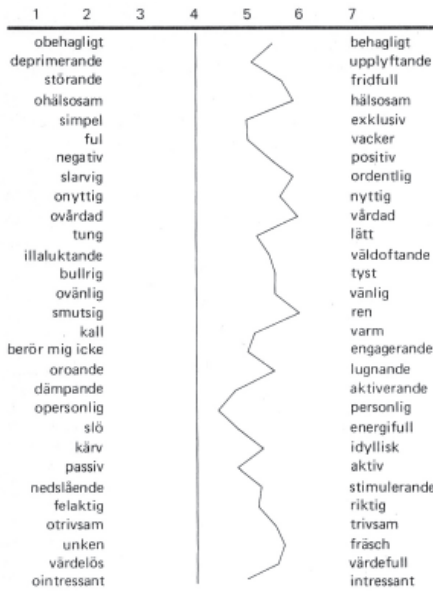


Fig. 11: 13. Värderingsprofil av bild 26.

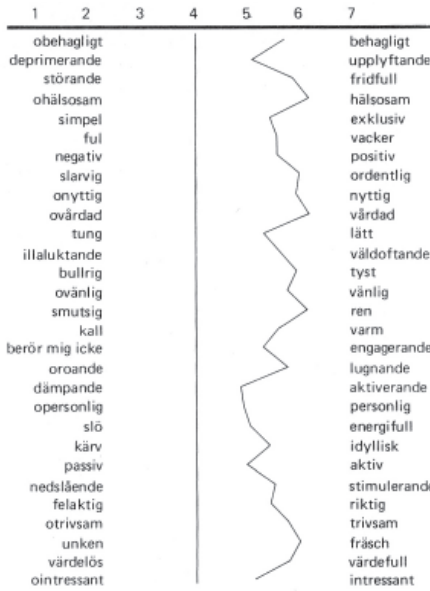
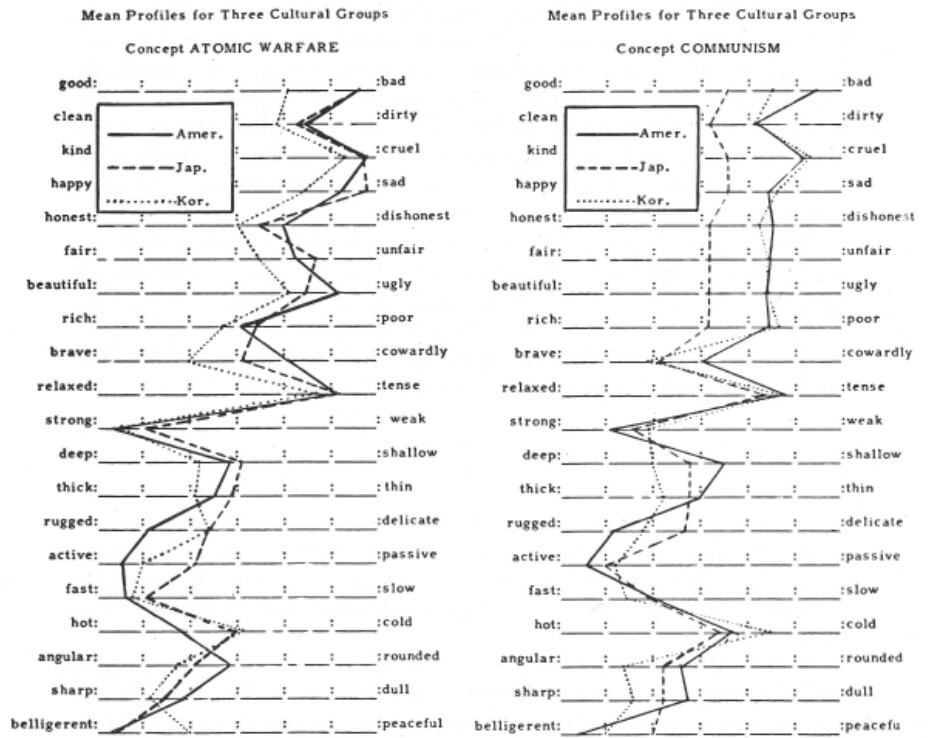


Fig. 11: 14. Värderingsprofil av bild 38.



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or environment [ill.103]. Theoretically, this research builds on the works of for example J.J. Gibson (Gibson 1950), who is one of the main theorists in perception psychology and visual perception, and the psychologist Charles E. Osgood, who uses the concepts of measurement of meaning and semantic differentials, which is a rating scale of bipolar pairs of words for describing how people understand certain notions or words, such as 'atomic warfare' or 'communism' [ill.104] (Snider, Osgood 1969/1972). Another Swedish researcher, Tommy Gärling, conducted a series of experiments of perception psychological character during the 1970s and presented this in a series of four papers (Gärling 1970a, Gärling 1970b, Gärling 1969a, Gärling 1969b). These are laboratory investigations of for example the difference in judgement of depth and size of spaces under different viewing conditions, such as looking with only one eye, looking at the actual space, or looking at undetailed drawings or a photo of the space. This kind of research is inherently focused only on the visual perception of space, and the field of study is very narrow in relation to using the result practically. Therefore the next question must be how these very narrow results can actually be used in the complex field of architecture



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where isolation of one single sense stimulus seems rather impossible. Some efforts have been made during the years to apply these methods of measuring architectural qualities; for example to compare different cultural groups' experiences of specific features of architecture [ill.105] (Imamoglu 2000, Imamoglu 1979). During the last

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103. Examples of two evaluation curves from Sven Hesselgren – making it possible to compare the two analysed environments with respect to the architectural experience (Hesselgren 1977).

104. Examples of curves from Osgood's semantic differential technique analysing the meaning of atomic warfare and communism (Snider, Osgood 1969/1972).

105. Example of houses evaluated by architects and non-architects in Imamoglu's study of the experience of architectural quality and complexity (Imamoglu 2000).

decade, Gerald Franz, for example, has worked with virtual spaces and the possibilities of precision and quick adjustment in different cases that computer generated spaces provide to give a proposal for an empirical method for describing and analysing spaces. However, it is still difficult to use this method to measure more than one quality at a time; it is either dimension ratios *or* colours *or* complexity of composition etc. (Franz 2005, Franz 2006, Franz, Mallot & Wiener 2005, Franz, von der Heyde & Bühlhoff 2005). Gärling later broadens the field of study into investigating the psychological matters of what factors are important when choosing between different urban dwelling environments (Lindberg, Gärling & Montgomery 1988, Aragonés, Francescato & Gärling 2002). Another quite recent and well known example of a similar approach is Bill Hillier who also moves in the field of architectural psychology with his concept of *space syntax* (Hillier 1996, Hillier, Hanson 1990). Through analysis of urban environments and buildings, he defines different sets of rules to how an area or a building should be put together in order to achieve a specific atmosphere; for example minimise crime in a burdened neighbourhood (Space Syntax 2008). This way of looking at building and urban design is much more orientated towards finding clear answers and results regarding specific aspects of building than the phenomenological and the structuralist theories that are more focused on the general aspects of creating good architecture. It can generally be seen that theories of how one can view architecture and architectural quality can have rather different aims and therefore also different potential areas of application. It is possible to see three main clusters of theories; the *classicist/structuralist* theories, the *perception psychological* theories, and the *phenomenological* theories. These have rather different perspectives on *where* the architectural quality is to be found; within some kind of universal law of mathematics, composition, and harmony, in the brain and biology of human beings, or in the more abstract interaction between human actors and the phenomena of the world. Some of the theories that have been mentioned have a foot in more than one theory cluster, such as Thiis-Evensen's structural method of analysing the poetics of architecture. However, in order to simplify and rationalise – and thus make a model of analysis possible – the theories are arranged with respect to their main themes. In chapter 3 there will be a further investigation of the matter in order to form a model for the further discussion of prefab wooden dwellings with a point of departure in the three identified theory clusters. But first, an outline and summary of which questions can be raised from the text so far; what questions will be taken further into the following chapters of this thesis and how will they be handled and investigated?

1.5 THEMES FOR RESEARCH

As has been shown in this chapter, there are several different approaches to handling the concept of architectural quality – the field is wide and stretches out in many different directions. Some of the theories have focus on the viewed, some on the viewer; some have a focus on general discussions, some on the investigation of more specific and narrowly defined matters. But how can this wide range of theories and perspectives be handled in an actual design process? It is not necessarily possible to collect these different perspectives into one definite model that describes all matters of architecture – even if an infinite amount of time was available; or at least it might not be useful to make such a model, as the whole idea of creating a model is to reduce and simplify a matter into a more easily understandable chunk of information, and a model of all matters of architectural quality would indeed not be simple, but an incredibly complex web of perspectives. If only looking at the colours of architecture, it would not be enough to put colour in a simple word in such a model, as it is then not obvious what matters of colours we are referring to; the compositional balance between different elements, the colour’s impact on the human mind, or maybe the cultural associations and use of that specific colour or tone. One could write a PhD on the matter of colour in itself, which has of course also been done (Billger 1999), just as there are treatises on rhythm (Hopsch 2008), composition of form (Akner-Koler 1994/2000), spatial experience (Dahlin 2002), the physical elements of architecture (Thiis-Evensen 1987, Unwin 1997) and so on. However, the fact that architects need to be able to put their knowledge into words and make it visible and understandable to other trade groups still remains. The verbalisation of these more or less tacit matters is important in order to be able to put architectural quality on the agenda in connection with prefab building and thus make it an element as important as economy and technical quality. It is also a key move in order to break the ice between architects and producers of prefab dwellings and get the architects involved in the 95% of the single-family housing market is built without an architect’s involvement. Therefore the first question of this thesis is; *how can we define architectural quality?* Not until this has been done is it possible to move on to the next discussion; *what is the architectural disadvantage and potential of building prefab wooden dwellings?* This question is interesting as the development within prefab dwellings is moving towards a more extensive use of wood in the constructions, and unless we, as architects, want the wooden dwellings to become industrialised behind our backs in the same manner as the concrete building did in the middle of the last century, it is necessary to be on the spot with good and understandable arguments. To enable a discussion of the possible ways of navigating these different fields of interest, it is necessary to define what a good dwelling actually is and how architectural quality can be described in order to be able to communicate these parts of the architects’ tacit knowledge, or intuition, of what is architecturally good or bad. In the following

chapter the methods of this thesis will be discussed in order to find a suitable strategy for finding answers to the questions asked through this introduction. Thereafter follows a deeper discussion of the matter of architectural quality through the three theoretical clusters that are further described. Subsequently, those three theoretical clusters are compared through an analysis of three different dwellings. This analysis concretises and clarifies the effects of the different views of what architectural quality is, but it should also point toward common ideas of what a good dwelling is in order to build a foundation and frame of reference for the analysis of prefab dwellings in chapter 5. After the analysis of prefab dwellings there is a case study of a design process, of the house producer Hjem's cooperation with AART architectural office and the writer of this thesis to develop a new standard house. This contains a description of the methods that have been used, during the early stages of the process, to find consensus, and define a precise and common terminology for aims and expectations, as well as an analysis of the three housing types of Hjem. Last comes a summary and conclusion of the project as a whole. However, before starting any research or analyses, it is necessary to discuss how a project like this can be handled; from what perspectives can it be seen, what theories and methods could be relevant, and how can one make sure that the empirical data set actually can support the conclusions that you want to be able to draw?

1.6 CONCLUDING REMARKS

- Until the 1950s architects were involved in about $\frac{1}{3}$ of all single family housing building, however already in the early sixties this share had fallen down to a few percent due to the massive building activity in this sector. Today only five out of hundred detached single-family dwellings are drawn by architects.
- The suburban single family housing areas make up the fastest growing urbanity in Denmark. It is therefore quite important that architects seriously enter this section of building in order to create an architecturally satisfying and interesting growth in these areas that commonly have a reputation for being monotonous and boring.
- It is not only a satisfying expression and well functioning spatial distribution that are important when people buy a house; an easy buying process and low prices sell as well, which is probably why some of the highly prefabricated houses have become very popular.
- There are many different modes of prefabrication in the production of single family dwellings; they can be put together by prefabricated 2D or 3D elements or have a detail library giving customised houses. Furthermore, both 2D and 3D systems can be more or less open to changes and adjustments according to the user's needs and the site at which it should be placed.
- During the last decade the share of wooden constructions in prefab single family housing has grown rapidly in Denmark. However, there is no contemporary building tradition for wood in Denmark, and it is therefore important to investigate how we can build contemporary prefabricated wooden dwellings in a Danish context and discuss the architectural potential of these, which will be done in chapters 5 and 6 of this thesis.
- Architectural quality has become a point of discussion in a wider group of people through the last decades and different governments have initiated projects to define the matter (DQI, Danish Cultural Canon etc). It is therefore important to broaden and challenge the existing discussions of architectural quality in order to show the width of the matter and make visible the multifarious perspectives on how to work with, and discuss, the more intangible and poetic matters of architecture.
- Three theoretical clusters of perspectives on architectural quality are identified; the *classicist/structuralist* theories, the *perception psychological* theories, and the *phenomenological* theories. These will be further described and investigated in chapters 3 and 4.

2 RESEARCH IN THE FIELD OF ARCHITECTURE

“Architecture has its own realm. It has a special physical relationship with life. I do not think of it primarily as either a message or a symbol, but as an envelope and background for life which goes on around in and around it, a sensitive container for the rhythm of footsteps on the floor, for the concentration of work, for the silence of sleep.”

(Zumthor 1998)

These words from Peter Zumthor indicate the complexity of architecture – it is not only a matter of keeping cold air out or letting a suitable amount of light into a house, but also a more sensitive matter of how several different aspects - pronounced as well as tacit - relate to each other, to the inhabitants, and to the surroundings. As this variety of aspects suggests, architecture is a field that includes many different disciplines; the social sciences, the natural sciences, and the humanities (Mo 2003). When exploring matters concerned with architecture, it is thus important to tread carefully and thoroughly consider which scientific fields you are working within, but it also gives possibilities of mixing methodologies and building bridges between areas which are not commonly connected. This is one of the main characteristics of architectural research that it is important to keep in mind when working within this field. In this thesis, as in many projects dealing with architecture, there is one more aspect that adds to the complexity; the relationship between the practical and theoretical field. This thesis should relate to both of these areas; it should both be useable on the practical level for the cooperation partner (the house producer, *Hjem*), and on the theoretical level it should live up to the demands of the research society.

2.1 RESEARCH QUESTIONS AND AIMS

The theme of this project is to inquire into the architectural quality of Danish prefab wooden dwellings. There is of course a wide range of ways to investigate this according to different research strategies and ontology – within the field of social sciences this might be an inquiry into a group of people’s feelings and experiences in connection with prefab wooden dwellings through interviews or questionnaires; within the natural sciences it could be a discussion of the more physical characteristics of wooden constructions, such as moist regulation, heat accumulation, or sustainability of construction; and finally, within the humanities it could be a discussion of the meaning or history of architectural quality as a concept that describes the totality of a wooden

dwelling (Mo 2003). Therefore, the first step in this research project will be to define the overall framework and content of the inquiry through a research strategy in order to be able to propose an appropriate answer to the research question (Brodersen 2008).

The matters that should be discussed or answered through this thesis:

- 1) Architectural quality is commonly used in architectural discourse, but it does not seem to be a well defined concept. Is there a core of elements that form a general definition of architectural quality?
- 2) Prefab dwellings often seem to be looked upon as a lower class of dwellings – should it not be possible to build prefab dwellings of high architectural quality?
- 3) Wood is increasingly often seen in contemporary Danish building and is used as a cheap, strong, light and environmentally friendly material, but what about the aesthetical values seen in relation to the Danish tradition of building in stone and heavy materials? How can we build contemporary wooden dwellings in a Danish context?

The aim of the investigation, discussions and conclusions of this thesis is to improve the reader's (mainly architects, but also producers of single family dwellings) ability to:

- 1) Understand and discuss architectural quality in a more varied manner.
- 2) Identify the most common pitfalls in relation to architectural quality in prefab single family housing.
- 3) Consider wood as a material that can contribute to architectural quality in respect to many different aspects (not only technical).

The research strategy is formed with offset in, and in relation to, these questions and aims for the thesis.

2.1 SYSTEM OF INQUIRY

Architects often start their research projects by asking ‘what is architecture?’, however they seldom agree on the answer to this question, and therefore they will not get any further. Linn Mo instead suggests that the first question should be ‘what is architectural research?’ as this will provoke a discussion of appropriate strategies for working with matters of architecture, which is more fruitful (Mo 2003). According to James Snyder, the editor of the book *Architectural Research*, the whole definition of research is a systematic inquiry with the aim of creating knowledge. By using the word systematic, he implies that in research it is necessary to have a particular strategy for how information is categorised, analysed, and presented. Such a structuring, and the term systematic, could easily seem related to positivist methods (Groat, Wang 2002). Indeed, it is reductionist, but this is a label that could be placed on both in-depth interviews and on a laboratory experiment series. All research is reductionist as it necessarily includes some kind of reduction of complex phenomena or experiences to smaller pieces of information that can be categorised (Brodersen 2008, Groat, Wang 2002). There are many different strategies through which this reduction can be achieved. Philosophical schools of thought, such as critical theory or postmodernism, can form a background for the research and thus provide a *system of inquiry*. Within these different systems of inquiry there can be many different methodologies for structuring the research (Groat, Wang 2002). Generally, the systems of inquiry can be divided into two groups; the qualitative and the quantitative systems. Qualitative systems are characterised by not being structured by any general formal standards, and this gives a high degree of flexibility in the experiment design. The focus is on understanding or interpretation, and the perspective is often humanistic or phenomenological. The knowledge produced in such systems describes phenomena holistically and is often related to dynamic situations, relationships and social frames. The quantitative systems on the other hand are generally well structured according to formal standards, and therefore the level of flexibility in experiment design is not as high. The focus is on general description and prediction, the produced knowledge is fragmentary or sequential pictures of partially variable relationships, and the perspective is often positivistic or natural scientific (Andersen 2002).

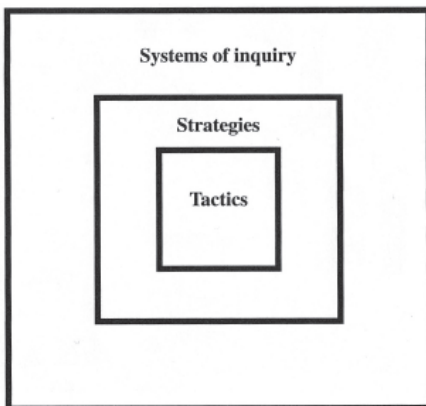
Especially in a multidisciplinary field, such as architecture, it is important to keep in mind that the system of inquiry can span from the most positivistic to the most naturalistic or phenomenological paradigm, as researchers within multidisciplinary fields who work mostly or completely within one single paradigm tend to judge all other research as seen from the same paradigm, which means that a discussion is raised of what the *real* research is. However, each system, or paradigm, can provide a

useful frame of reference for architectural research, and Groat and Wang thus argue that in architecture, an adherence to a specific paradigm or style does not in itself assure quality – we have to acknowledge that there exist both good and bad examples of that style and be open to other styles or paradigms when relevant (Groat, Wang 2002). In this thesis the questions are mainly related to description and interpretation of different phenomena (the concept of architectural quality, Danish wooden dwelling etc), and consequently the investigations will mainly relate to qualitative systems of understanding and, more precisely, a humanist perspective.

2.2 STRATEGIES

Robert Yin describes the research strategy as ‘a logical plan for getting from here to there’, where ‘here’ is the research question and ‘there’ is the knowledge that comes as a result of the research (Yin 2003). The plan should guide the researcher through the steps between *here* and *there*, i.e. in the collecting of data, the analysis of data and so on. But it is also more than a work plan – the main idea of a research design is to avoid a situation where the evidence does not answer the original research question (Yin 2003). Groat and Wang clarify the different layers of a systematic inquiry through a diagram of concentric frames describing the relationship between system, strategies, and tactics [ill.106], where strategy (method) is defined as ‘the skilful management and planning of anything’, and tactics (techniques) are defined as ‘any skilful move’. Thus, the strategy is the overall research plan and tactics are the specific techniques used in

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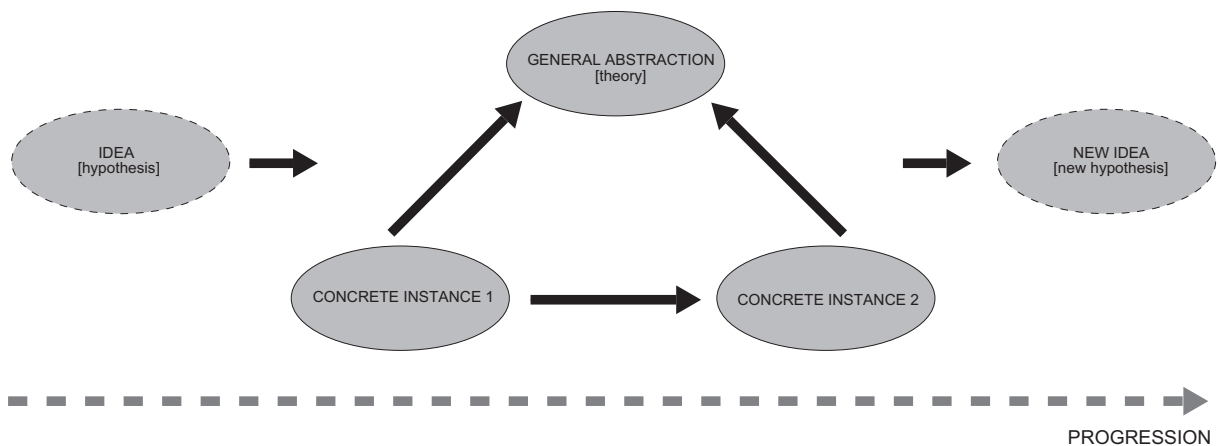
106. The system of inquiry should be a framework for the strategy and the strategy should be a framework for the tactics, which will ensure coherence at continuity between system, strategy, and tactics; however, the frames do not predetermine the matters of their subcategories (Groat, Wang 2002).

107. Illustration explaining the difference between a scientific and a non-scientific progression. In order to work with a question in a scientific manner it is necessary to use some kind of general abstraction theory to get from a concrete instance 1 to a concrete instance 2. Progression without a general abstraction theory is random and non-scientific (Basic graphics from (Brodersen 2008)).

the research (Groat, Wang 2002). The frames do not predetermine the matters of the subcategories but create a framework for the choices made within them – and there should therefore be coherence and continuity between the system of inquiry, strategy, and tactics (Groat, Wang 2002). In the following it will be described how the system of inquiry, strategies and tactics are used and connected in this thesis.

The primary aim of this thesis is to develop an understanding of the great variety of aspects included in the concept of architectural quality and to suggest a strategy for investigating architectural quality – specifically of Danish prefab wooden dwellings. As earlier mentioned, this will be done mainly within the humanist framework, which is what Groat and Wang would call the *system of inquiry* of this project. The next step would then be to define a *strategy* – but how can one, in a logical and systematic way, find an appropriate strategy? Through a model constructed by Lars Brodersen, it is possible to structure the information and aims of a research project and thus clarify the coherency between the different parts. The starting point for this model is that any scientific project should contain three levels of instances: *firstness*, which contains the values, *thirdness*, which contains structures and rules, and *secondness*, which contains the concrete matters of the project. In order to get from one concrete instance to the next, in a scientific manner, it is necessary to apply some kind of intention through the definitions of values (idea), structures and rules (general abstraction theory), which can then be described as the strategy of the project [ill.107]. If these layers are not applied, the investigations will be random and non-scientific (Brodersen 2008). This structure

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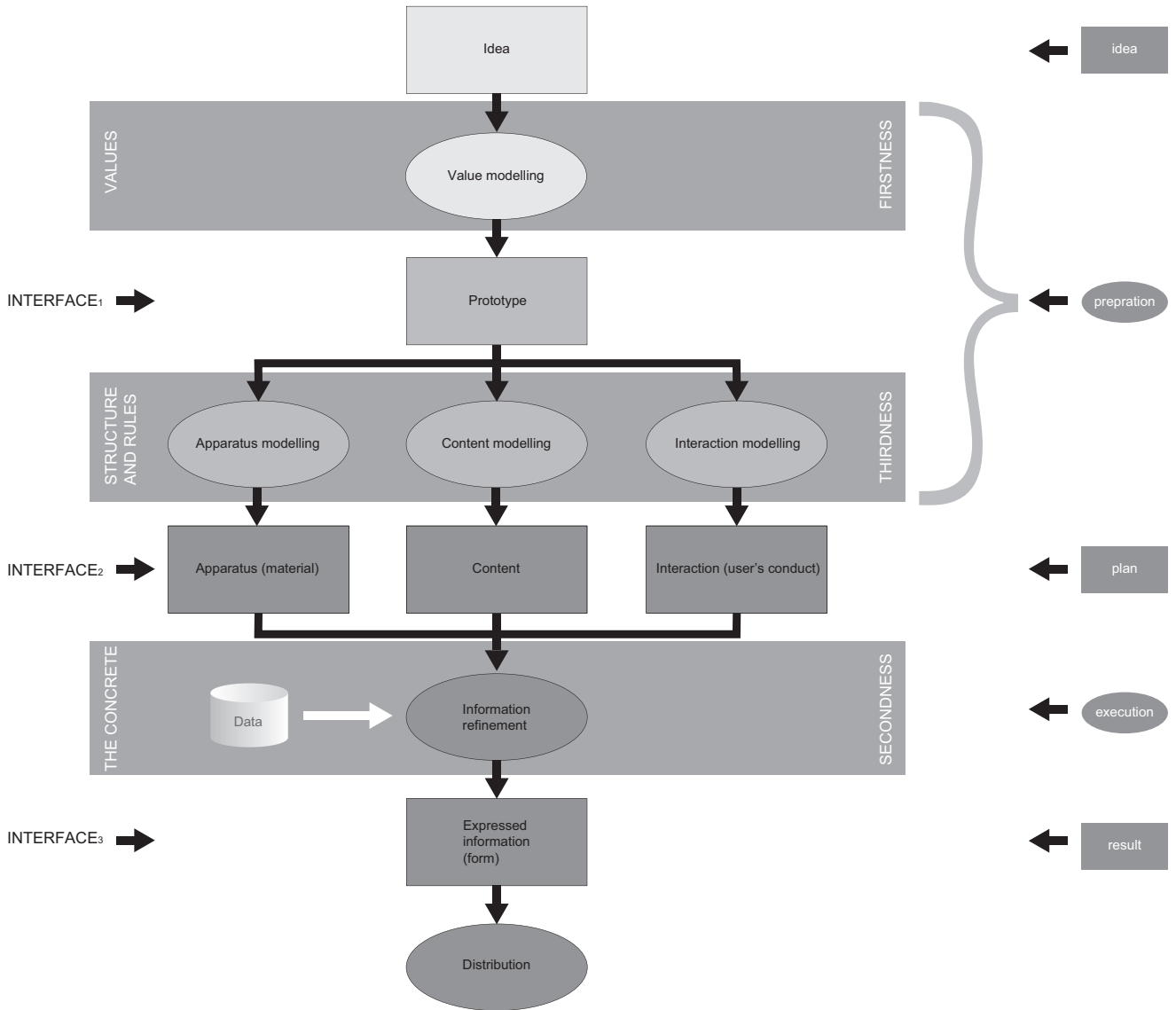
can be applied to the project both in order to clarify the main idea of the whole project, but also in the smaller sections and experiments, in order to ensure that none of the levels are neglected.

In the case of this particular project, seen as a whole, the concrete *instance 1* could be defined as *a mostly technical use of wood in contemporary Danish prefab dwellings* and *instance 2* as *a technically, aesthetically and functionally conscious use of wood in contemporary Danish prefab dwellings*. The manner in which instance 1 progresses into becoming instance 2 is then the overall method of the project, or, in Yin's terminology, how to get from 'here' to 'there'. However, the model can also be used in sections of the project; e.g. concrete instance 1 could also be *an unstructured and subjective use of architectural quality as a concept* and concrete instance 2 *a structured and multifarious use of architectural quality as a concept*. In order to define these different loops, and thus enable a definition of the specific *tactics* for the project, it is first necessary to define the content of the thesis as seen in the top figure on the opposite page [ill.108]. At the top of the figure is the primary research question of the thesis, after this come the *firstnesses*: the state of the art sections drawing up the field of interest and pointing to different subjects that could be topics for investigations of this field. Thereafter comes the first filtering of the information through a specification of the research question, then the *thirdnesses* – the structures and rules of how the investigations should be organised and conducted, and the last level before the actual PhD dissertation contains the *secondnesses* – the actual action and writing of the PhD thesis (Brodersen 2008).

What we need to unfold in order to discuss the strategies and tactics of the project further is the preparation section of the diagram in ill. 108. This should enable a definition of the plan that leads up to the actual action. However, the model in ill.108 only shows the information content of the project – it does not contain time, or progression – and in order to describe the strategies of a research project it is necessary to have the progression included in the model. Brodersen's triangular model describing the progression from a constant instance 1 to a constant instance 2 does, however, include time and can therefore assist in the unfolding of the strategies used in the preparation section of the diagram at the bottom of the opposite page [ill. 109]. The starting point is the main idea and the main results of the whole project, as described before and which can be seen in the end points of the line below. This is the superior loop of this PhD-project. In between these end points are smaller loops, each of them corresponding to a specific strategy and tactics. Every arrow of the diagram could actually be replaced by Brodersen's triangular diagram, where the concrete instance 1 can be defined by the aim of each of the project areas in order to get the progression indicated in the triangular model.

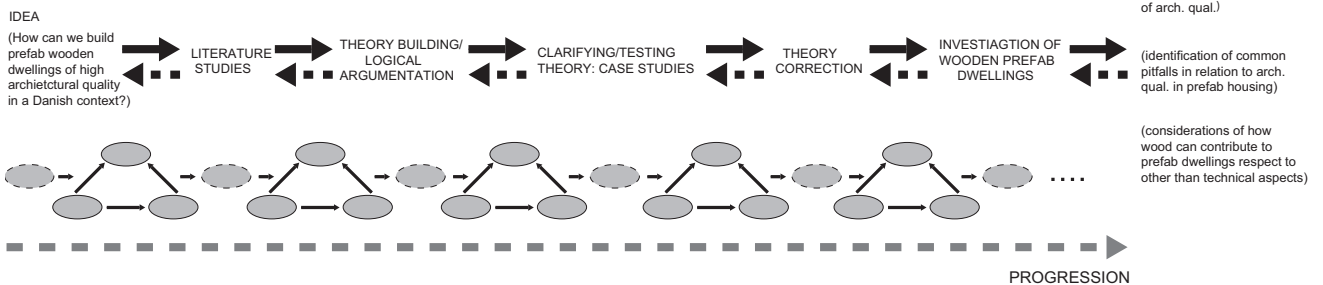
108. Illustration of the content of a project and the relationship between firstness (values), thirdness (structures and rules), and secondness (the concrete) (Basic graphics from (Brodersen 2008)).

109. The project consists of different steps – stretching from the initial ideas to the final conclusions – that each can be described as a loop through which a constant instance 1 becomes a constant instance 2 by means of shifting tactics, or general abstraction theories.

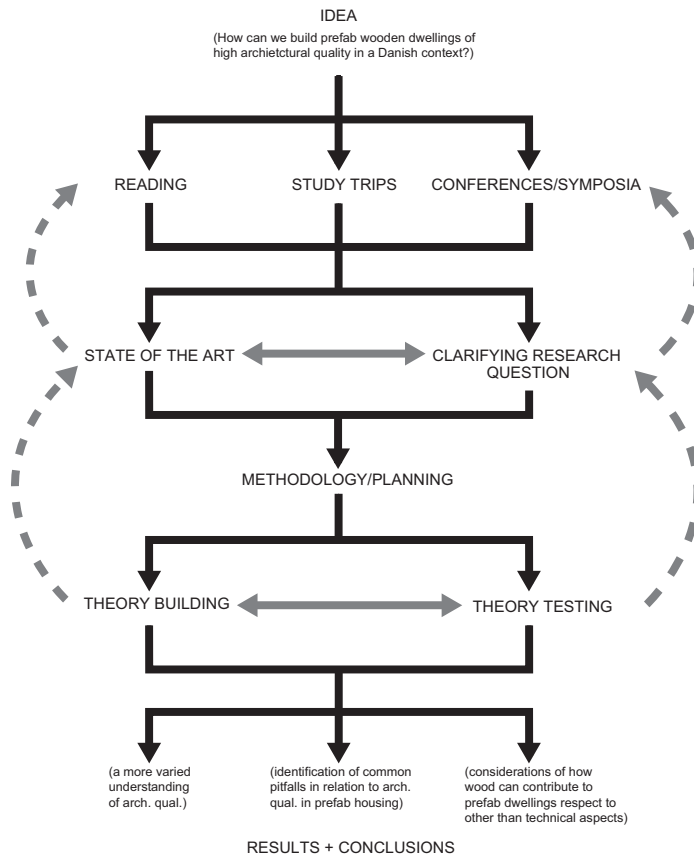


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This can be more deeply described as shown in the diagram below [ill.110], which is a project specific visualisation of the different research areas and steps of the project structure – the project *strategy* in Groat & Wang’s words.



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It has the idea at the top and results at the bottom, just like the diagram on page 75 - however, in between these two instances is not the structure of information, as in the similar diagram by Brodersen (ill.108), but the structure of strategies for getting from the idea to the result. The initial idea is followed by the collection of information – through reading, study trips, conferences, and symposia – which is the foundation of the state of the art and, subsequently, the research question. Hereafter comes the planning and the theory building and testing which leads up to the final results and conclusions. However, the theory building and theory testing can be conducted with many different *tactics* – in Groat and Wang’s terminology – depending on what the aim of the theory is. In this thesis the main aim is a discussion of how to use the concept of architectural quality in a varied and systematic manner and then relating this to contemporary Danish prefab wooden dwellings. According to the humanistic

110. The general structure of the project and how the different steps are connected. This forms the main strategy of this thesis.

approach to the subject, the basis of the project is a discussion of the meaning of the term architectural quality as such. Literature on architecture and related subjects is often an effort to give different aspects of architecture a logical order. This can both be conducted through defining mathematical relations, for example through the use of computer programmes, or through discourses on a specific subject, and in those cases the discussion in itself is the aim of the thesis. This can be called a logical argumentation strategy (Groat, Wang 2002). This thesis will place itself somewhere in between these two poles – the formal/mathematical and the cultural/discursive – as the aim is to define an analytical method to discuss the architectural quality of prefab wooden dwellings. However, the focus is more on the discursive elements than on defining a definite analytical model. The testability of predominantly discursive investigations is a difficult matter, as they are not dependent on falsification of the given thesis, but rather on the subsequent evolving of the theory to other principles, which will become visible over a longer period of time (Groat, Wang 2002). However, as this investigation also strives towards developing an analytical model, through which it will be possible to discuss the architectural weaknesses and strengths in prefab wooden dwellings more precisely, a testing of this model will be relevant. This will be done by the application of the analytical model to comparative case studies at different stages during the process in order to test it, and challenge it, regularly. The first testing of the model is through analyses of buildings that are often mentioned as being of architectural quality in order to see how the model of analysis is expressed in concrete architecture, if the model can assist in catching the main qualities and limitations of the analysed pieces of architecture, and how different styles are placed within the model. Therefore, buildings of different styles should be chosen to cover as wide a range of qualities as possible. In the initial tests, the idea is to detect shortcomings or inconsistencies in the model, whereas later tests of this kind are also done to create reference points for the analyses of Danish prefab wooden dwellings.

In order to make the discussion structured, precise and applicable to prefab wooden dwellings, the project is divided into three superior levels; the first level is a listing and discussion of existing theories of architectural quality; then comes a development of method for discussing architectural quality in prefab wooden dwellings; and third are analyses of contemporary prefab wooden dwellings and a case study of a specific prefab house producer (*Hjem*), which are all supposed to point towards both general and specific strengths and weakness in the design of this typology. In the following sections the different steps, or tactics, of the overall strategy will be described in a more detailed manner.

2.3 TACTICS

2.3.1 *State of the art – review of previous research and literature*

The first triangle, or loop, of the process has its starting point in the main idea of the project, which defines the concrete instance 1 as *an unstructured mass of theories of architectural quality*, and the goal for the first loop, or the concrete instance 2, is *a structured overview of the existing primary theories of architectural quality*. The manner in which this is done is through literature studies; reading and structuring theories. Information can be found in many different formats; books, articles, films, internet – and the search and processing hereof is a research or a literature review (Groat, Wang 2002). It is important to be informed about the literature available within the specific research area as the outcome of the research should expand the body of literature on the subject. A literature review should therefore give more than just a general idea of existing literature and research – it is the foundation for the researcher to competently define the topic of inquiry (Groat, Wang 2002). The literature should be organised in such a way that it covers at least five topics (those are from Chris Hart):

- 1) What are the key sources?
 - 2) What are the key theories?
 - 3) What are the major issues and debates in this topic?
 - 4) What are the epistemological and ontological grounds for the discipline?
 - 5) What are the main questions and problems that have been addressed to date?
- (Groat, Wang 2002)

Structuring the literature according to these, or other, categories can be helpful in order to ensure that the search covers the research area and defines a research question that is neither too general nor too restrictive (Groat, Wang 2002). The following list provides an insight into how key concepts, sources etc. have been organised:

Key sources: Vitruvius, Alberti, Gottfried Semper, Martin Heidegger, Gaston Bachelard, Maurice Merleau-Ponty, Christian Norberg-Schulz, Juhani Pallasmaa, James J. Gibson, Rudolf Arnheim, Sven Hesselgren, Peter F. Smith, Robert Venturi, Le Corbusier, Thomas Thiis-Evensen, Simon Unwin

Key Theories: Classical view (natural scientific), Phenomenological view (humanistic), Socio-cultural view (social scientific), perception (architectural) psychological view (humanistic + natural scientific)

Major issues or debates: Objectivity vs. subjectivity, the possibility and usability of defining architectural quality, architectural quality for whom (user, builder, architect, local society, global society)

Epistemological and ontological grounds for discipline: these fields can stretch from the very positivistic to very phenomenological and it is important to remember that these can not necessarily be merged into one collected view, but can add to understanding of the multifariousness of the subject

Main questions and problems: the unstructured and fragmentary variety of theories on architectural quality

The theories, issues, questions and their interrelationships are presented through a state of the art section in chapter 1 after which they are structured in order to be compared and discussed in relation to each other in chapters 3 and 4.

2.3.1 Logical argumentation strategy

The aim of the second loop is to investigate if there is a core in the concept of architectural quality that is the same for different theories, or if architectural quality is most of all style-dependent. The constant instance 1 is therefore *a fragmented set of views and parameters complicating the discussion of architectural quality*, and constant instance 2 is *a coherent set of views and parameters substantiating the discussion of architectural quality*. In order to progress from constant instance 1 to constant instance 2, the first step is to extract and discuss relevant views of what architectural quality is with offset in the state of the art, through logical argumentation. Logical argumentation is probably one of the most used strategies as all conceptual frameworks must contain some kind of logical coherence and it is useful in supplying a theoretical foundation for a wide range of empirical investigations (Groat, Wang 2002). One of the main strengths is the strategy's ability to contain a very wide range and large amount of different theoretical literature into one single conceptual system. Logical argumentation needs not to be within the boundaries of either numerically (mathematically) or rhetorically (discursive) based knowledge; it can hold as diverse theories as shape grammar theory (ex. Hillier & Hanson), or Vitruvius' classical orders (Groat, Wang 2002). However, critics might raise the question of whether logical reasoning is a research strategy at all since any research strategy needs to have logical coherence. Groat and Wang tackle this by arguing that the focus and strength of the logical argumentation strategy should be the framing of theoretical frameworks in order to explain a wide scope of a certain reality, and therefore research mainly based on this strategy tends to have the theoretical system itself as its focal point and outcome, rather than having the logical system as a background for other outcomes (Groat, Wang 2002). Furthermore, logical argumentation that does not have a clearly defined foundation of essential concepts and terms might result in an excessive use of different technical terms, and therefore it is important to create useful categories and a simple nomenclature through the research

project. Logical systems can also have limitations in relation to time as they might be tied to a specific era or group of people, in relation to the size of the scope, as it might describe only a small scope of reality, and as a system of logical argumentation does not have a self-regulation mechanism in relation to alerting the researcher to possible lacks such a category has not yet found, and the system must therefore be applied to different relevant venues and be critically evaluated from the onset (Groat, Wang 2002). Through the logical argumentation process, keywords that characterise the different theory clusters are extracted in order to prepare for a comparison and thus get a fruitful discussion of how they differ and compliment each other. The further discussion is based on comparative studies of examples in order to clarify the theory through concrete buildings and then refining the discussion model in relation to the conclusions and findings of the investigations.

2.3.2 Comparative studies for developing a research method

The next loop of the process therefore has a constant instance 1 that can be formulated as *initial untested model for describing architectural quality* and *tested and refined model for discussing architectural quality* as the constant instance 2. Therefore the first comparative study, which is done in relation to architectural quality, is not primarily a study that evaluates and discusses the studied objects, but rather a study of the theories described through the section on architectural quality. Through this process the theory is deepened and a fuller perspective of the matter of architectural quality is achieved. The examples are selected in order to represent different styles which should be architecturally connected to the ideals of one of the theories. Each of the theories should be mirrored by at least one example. It is not necessarily a demand that the buildings are drawn with offset in the theories, but the fact that they share some ideals is enough to draw up the architectural, as well as the theoretical, span. The data collection for the analysis should preferably be visits, however, this will not be possible in all cases, and then drawing, photographs, other visual documentation and presentation material, and texts are used. The data should be from several different sources in order to get a varied picture of the buildings. The analysis model is thereafter corrected, where necessary, with foundation in the discussion of the studies.

2.3.3 Comparative studies as a research method

The forth loop is the actual investigation of architectural quality in prefab wooden dwellings. The starting point, constant instance 1, is *random and fragmentary discussions of wood in Danish wooden dwellings* and the aim, constant instance 2, is *guidelines for a focused and coherent discussion of contemporary Danish prefab wooden dwellings*. This is done through

analyses of contemporary prefab wooden dwellings according to the model which is built and refined through the earlier loops. The idea is to emphasise and clarify the most relevant issues – difficulties as well as potential – in relation to building prefab wooden dwellings in a Danish context. The examples are selected in order to cover as wide a range of different typologies as possible, production methods and use of wood in the buildings. The data collection is done through visits, when possible, and otherwise visual material available in books, journals etc.; preferably from several different sources (photographers and writers) in order to get a varied picture of the houses. Through a discussion of the examples, the difficulties and potentials in relation to architectural quality are extracted in a set of guidelines for what is important to focus on when building prefab wooden dwellings in Denmark.

2.3.4 Case study of development process

The last loop of the process is investigating the practical aspects of discussing and working with architectural quality in a cross-disciplinary environment. The constant instance 1 in this loop is *a theoretical model that has not yet been applied to the practical reality of an architectural development process*, and the constant instance 2 is *a clarification of the possibilities of application of the theoretical model to a concrete development process*. A case study is according to Robert Yin defined as an empirical inquiry into ‘*a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident*’ (Yin 2003). The matter of application of theory to a design process can be said to be such an investigation of a phenomenon that is difficult to separate from its context. A case study can be explanatory, descriptive, and/or exploratory (Groat, Wang 2002). This case study, following the definition of Groat and Wang, includes all three of these perspectives as it is presented as a chronological description (*narrative sequence*) of a process with the aim of exemplifying, clarifying and exploring the application of the theory of this thesis. The strength of this method is for example the possibility to see a phenomenon as embedded in a real context. However, there are also several weaknesses connected to this same aspect; such as the difficulty to draw up the borders of the case, which will cause a (too) complex and multi-faceted set of data, and it can therefore be difficult to draw clear and unambiguous conclusions. It can be quite convincing when done well, however it can be difficult to ensure the replicability of the study to other cases (Groat, Wang 2002). In this thesis there is only one case study, which means that the results will be weaker in their argumentation than if there were several, which, in turn, entails a lack of the possibility of comparing case studies to each other. It should therefore be seen and used as *one* exemplification and indication of the possibilities of application of the theoretical content of this thesis.

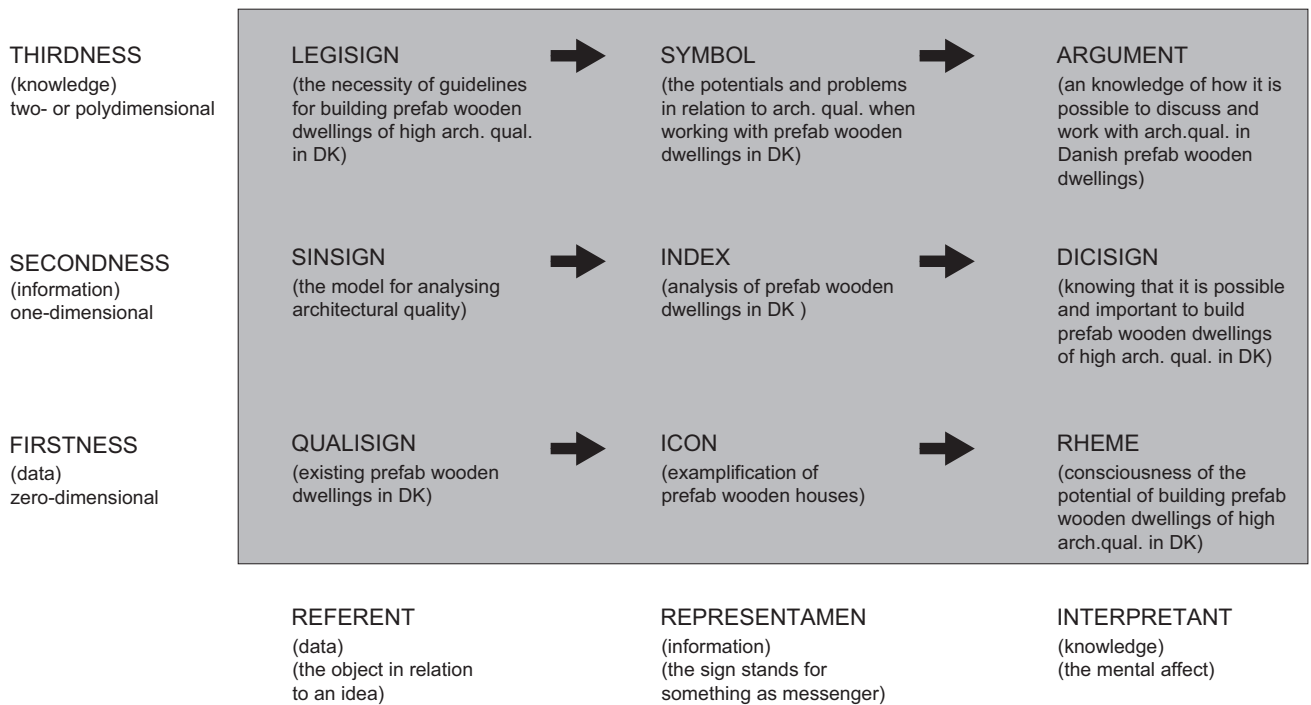
2.4 RESULTS AND COMMUNICATION

The results of the investigations will be collected in a monograph, but are also presented through papers during the process (Appendices 1-2). The aim of such a book is to emphasise the tacit knowledge in the field of architecture and vocalise the matters that architects work with in their daily practice under the common concept of architectural quality. Furthermore, the investigations will be presented more concretely to the cooperation partner *Hjem* through a pamphlet where the theory is illustrated through analysis of their houses. However, it is important to be aware of that any object (e.g. the architectural quality of Danish prefab wooden dwellings) cannot be understood in its entirety, but will be understood as phenomena in relation to different views and foci, as is indicated in the diagram below. Any phenomenon is a product of the referent (e.g. this PhD thesis' chosen part of the object as such), the representamen (e.g. the monograph written and presented in a specific manner), and the ideas in the minds of the interpretants, which are formed in relation to their specific horizon of understanding (Brodersen 2008). Therefore, different ways of presenting the theoretical and analytical content of the thesis are tried out during the process; both through presentations for, and discussion with, the staff at *Hjem* and architects connected to the company, but also through experiments of how to form a common aim of the more intangible matters of architecture in the early stages of the design process of the houses at *Hjem*.

In such a process it is therefore important to keep the aim in mind; what should the interpretant be able to do after having read the thesis? In order to do this it is also necessary to define who the interpretants are – in this case it is mainly architects dealing with prefab single family dwellings. Brodersen (Brodersen 2008) suggests that in order to reach the goals of the project, it is important to cover the three levels of information: firstness, secondness, and thirdness, and this is further described in the model of states [ill.111]. The column to the right in the grey box is not the producer's responsibility – it is in the hands of the user, even though it is the goal of the project. The column to the left in the grey box contains different referents, concrete data of the object in relation to the specific idea, and the middle column contains information about how this data is communicated by the producer to the user. All of the categories need to be represented in a product in order for it to be complete, and this table is thus used as a guide through the development of the thesis. Through these first chapters of the thesis, the thirdness and the firstness of this project have been formed and described and from

MODEL OF STATES

a meta-information model



111

here we will move on to the secondness – the actual action of this PhD project – and the action starts with a deeper discussion, or logical argumentation, of the concept of architectural quality and the development of an analytical model which will thereafter be tested and used in two sets of comparative studies.

2.5 CONCLUDING REMARKS

- The field of architecture stretches across many different disciplines and ontology and therefore the perspective, strategy, and tactics can vary widely depending on the research questions of a project.
- This thesis has its focus on discussion, investigation, and interpretation of quite intangible matters, which places it mainly in the humanist tradition.
- In order to secure that the questions asked in each chapter are answered in a suitable manner, a starting point (*constant instance 1*), a goal (*constant instance 2*), and a *tactics* are defined for each chapter, and these will together lead from the initial idea to the desired result of the thesis as a whole. The single loops, or tactical steps, should relate to the ontology and the overall strategy but are not defined by those.

111. Table showing the different levels of the project: firstness, secondness, and thirdness. The column to the left defines what the data, or referent, of the project is, the middle column describes how this data is communicated, or represented, through this specific project, and the third column establishes what the goals of this communication are. However, this is a matter of understanding and interpretation by the reader, which is why it is important to be aware of whom the interpretants are (Basic graphics from (Brodersen 2008)).

3 ANALYSING ARCHITECTURAL QUALITY

“All history is inescapably conditioned by a mode of beholding, and one can no more write an absolute history than one can achieve an absolute architecture.”

(Frampton 1992)

As seen in the introduction, and as the quote from Kenneth Frampton above indicates, the question of what the absolute, or perfect, architecture is, is impossible to answer – it *‘is conditioned by a mode of beholding’*. Therefore such perspectives are neither right nor wrong, but only different in their focus on the matters, or qualities, of architecture. This thesis takes a general view on the matter of architectural qualities, with the aim of showing the wide range of possible perspectives and aspects, still being well aware of the universes that each of these themes contain, as mentioned in chapter 1. Instead of looking at the single elements that architectural quality might consist of, the focus will be on different *ways* of looking at architecture – an overview and grouping of different ways of beholding. The aim of creating such an overview and grouping is to enable a clarification of the differences and commonalities between the theories and to make the width of architectural quality visible – to articulate the often unspoken matters and tacit knowledge in order to make it easier to communicate and discuss architectural ideas with non-architects. In this chapter the second loop of this PhD project will be investigated in order to reach the goal of *a coherent set of views and parameters substantiating the discussion of architectural quality*. Through chapter 1, several different theories and currents of architectural quality were mentioned. Three main theoretical clusters were identified – *structuralism*, *perception psychology* and *phenomenology* – and in this chapter those three clusters will be further described. From each of the clusters there will be chosen three keywords that can be used for their analytical comparison in the latter part of this chapter where the keywords will be used to analyse three different dwellings in order to make visible what the theories actually mean in concrete pieces of architecture and to create a foundation for the discussion of architectural quality in prefab wooden dwellings, which is also the goal of the third loop; *a tested and refined model for discussing architectural quality*.

3.1 THE LOGICS OF ARCHITECTURE – CLASSICISM AND STRUCTURALISM⁷

The efforts to divide and analyse architecture in a structural manner have, as mentioned, been a recurring motif through architectural history; stretching from the Vitruvian triad of *utilitas*, *firmitas*, and *venustas* (Kruft 1994), over the Renaissance and modernist architects, to more recent theorists and architects such as Robert Venturi, Christopher Alexander, Simon Unwin, and Thomas Thiis-Evensen. These have the aim to describe the qualities of architecture through particular elements arranged in a certain structure in common. But they all have slightly different perspectives; Robert Venturi for example, as mentioned in chapter 1, turns against the Modernist purity and focuses on the qualities in variation and contradiction, but at the same time Venturi underlines that the contradictions and complexity must exist in a unity and totality that frame these in a harmonious manner, as in a Greek temple (Venturi 1966/1977). Complexity and contradiction are everywhere in architecture, Venturi argues:

“Architecture is form and substance – abstract and concrete – and its meaning derives from its interior characteristics and its particular context. And architectural form is perceived as form and structure, texture and material. These oscillating relationships, complex and contradictory, are the source of the ambiguity and tension characteristic to the medium of architecture.”

(Venturi 1966/1977)

When Venturi speaks of the qualities of architecture, they are only related to form and material – the matters of sociology, economics and other earthly relations are not of particular interest in *Complexity and contradiction*. Some twenty years later, Thomas Thiis-Evensen wrote a book with inspiration from Venturi’s book from the 60s, which adds the layer of human interaction with architecture, as he is also inspired by the Norwegian phenomenologist Christian Norberg-Schulz. Thiis-Evensen studies architectural archetypes with the aim of defining an architectural grammar. Archetype is in its most original meaning Greek for first form or original model, and it can therefore be understood as the foundation for all subsequent variation and combination (Thiis-Evensen 1987). Thiis-Evensen’s grammar of architecture is based on three main archetypes – the floor, the wall, and the roof – which through history have been modelled into a wide range of different forms. There are three goals of making such a grammar Thiis-Evensen explains:

⁷ Structuralism is a humanistic current with e.g. the anthropologist Lévi-Strauss as a front figure. In linguistics, structuralism is a way of analysing language in a structural system of the smallest meaningful elements, and Lévi-Strauss mainly used it to describe structures of kinships and myths in different cultures (Schmidt 2000). Here the term structuralism is borrowed and used as a concept to describe architectural theories trying to define an underlying structure in the architectural experience.

“[...] the first is to classify the archetypes in a concentrated overview, the second is to attempt to describe them in order to point out the potential expression which exists within them. The third goal has to do with the following question: Will the expression be at all perceived by the user, and does not the experience of architecture vary from person to person? The aim of this goal must then be to show that there is a common language of form which we can immediately understand, regardless of individual or culture.”

(Thiis-Evensen 1987)

He searches for the commonalities of the qualities of architecture – that which is not related to personal history, memories, dreams and ideas. Each of the basic elements (floor, wall, and roof) is described and classified in relation to the elements’ major form, their construction system, surface treatment, and openings in the major form. In each of these areas Thiis-Evensen defines archetypes that are general solutions, independent of time, place and function. The main elements are described in relation to *what* they do and *how* they do it. The three elements have one fundamental function in common; they delimit the exterior from the interior [ill. 112-114].

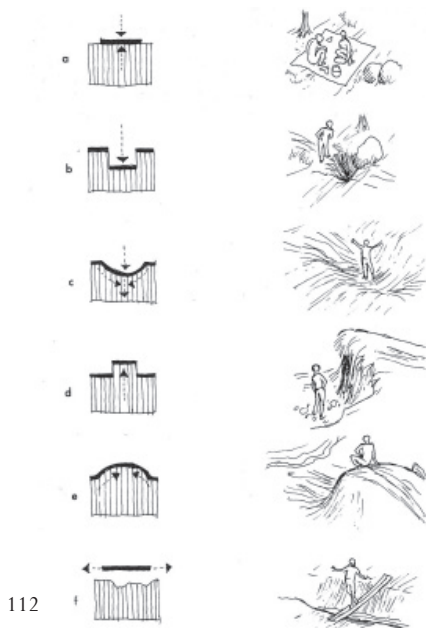
112. Thiis-Evensen: *The floor of architecture to the left and the floor of nature to the right. Different variations in height and slope give different experiences* (Thiis-Evensen 1987).

113. Thiis-Evensen: *Different types of walls and the directions that are underlined by these designs* (Thiis-Evensen 1987).

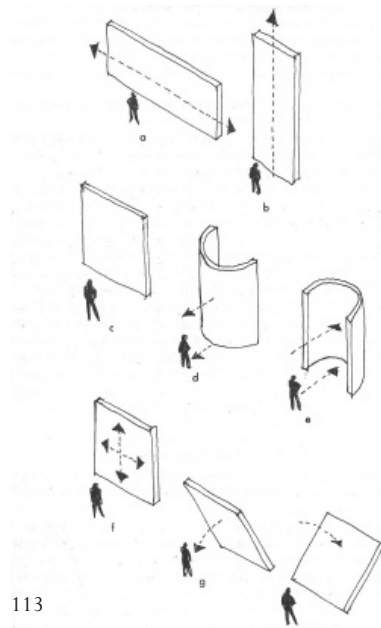
114. Thiis-Evensen: *The five basic roof typologies* (Thiis-Evensen 1987).

“The exterior space that is bounded by the roof exists over us (the sky), the walls adjoin the exterior space that is around us (the landscape, people), and the floor defines the exterior space that is beneath us (the ground). In other words, the elements of the roof, wall and floor all do the same thing – they balance the forces of inside and outside. The battle between these forces is an existential prerequisite for mankind.”

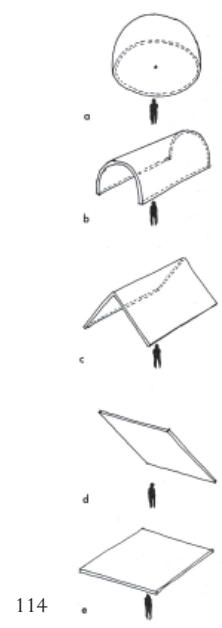
(Thiis-Evensen 1987)



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This delimitation in practice operates between opening and closure, and every work of architecture must define itself between complete openness and complete closure. Three concepts are decisive for how architecture defines itself in this span; *motion*, *weight*, and *substance*, where *motion* describes the dynamics or balance in composition, *weight* describes how the composition shows its heaviness in relation to gravity, and *substance* describes the materiality of the elements (Thiis-Evensen 1987). These three concepts are parameters through which architecture is given its existential expression in relation to stylistic and regional variations. Architecture's existential expression – as described through the design's motion, weight and substance – is based on our experience with natural phenomena, which means that they will be common to all, or at least most, of us. Thiis-Evensen describes this through the example of seeing a door at the opposite end of a room. We can go through the door in our minds before actually going through it. In this way it acts as a sign. But the actual experience of going through the door will depend on the height and width of the doorway, the thickness and characteristics of the wall and so on. We act in coherence with the character of a space; walk quickly through a corridor and solemnly in a broad space [ill.115-116].

Simon Unwin similarly divides architecture into basic elements, such as different area defining floors, focus points, walls, roofs, paths and openings [ill.117-122] (Unwin 1997). These basic elements can be differently combined with each other and other, modifying elements such as light, colour, temperature, texture and scale [ill.123-125] (Unwin 1997). The matters of geometry, scale, materials, and direction, seen in relation to the human body, are a fundamental in Unwin's method of analysing architecture. However, he also includes aspects of the site and invites other senses than vision into

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115. Different spaces make us behave in different ways – we walk swiftly through a corridor (Photo: Ida Wraber).

116. In larger spaces, such as churches, we walk more solemnly and slowly (Photo: Ida Wraber).

117. Unwin: defined area of ground (Unwin 1997).

118. Unwin: wall, or barrier (Unwin 1997).

119. Unwin: lowered area, or pit (Unwin 1997).

120. Unwin: roof, or canopy (Unwin 1997).

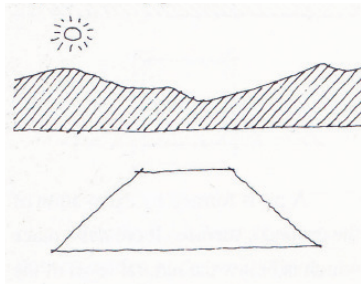
121. Unwin: path (Unwin 1997).

122. Unwin: opening, or doorway (Unwin 1997).

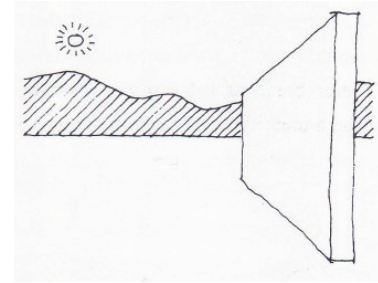
123. Unwin: a roof light that defines a place of light (Unwin 1997).

124. Unwin: a tent defines a place of shade (Unwin 1997).

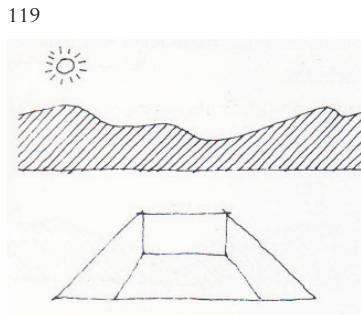
125. Unwin: scale – at first look one sees a man standing on quite a small stage, but look again, and imagine that the white man is a stage accessory and that the small black man between his leg is the human sized element; the idea of the scale changes rather dramatically (Unwin 1997).



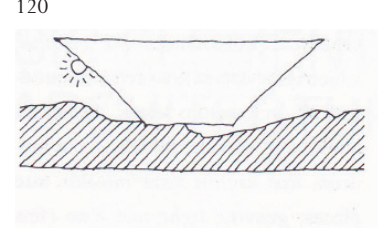
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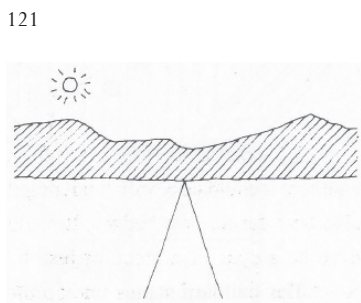
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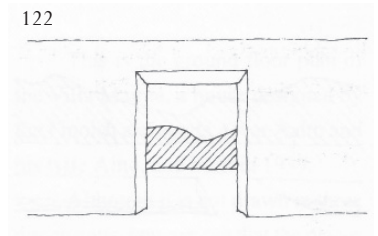
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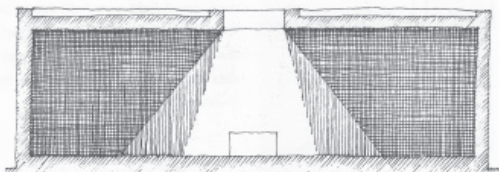
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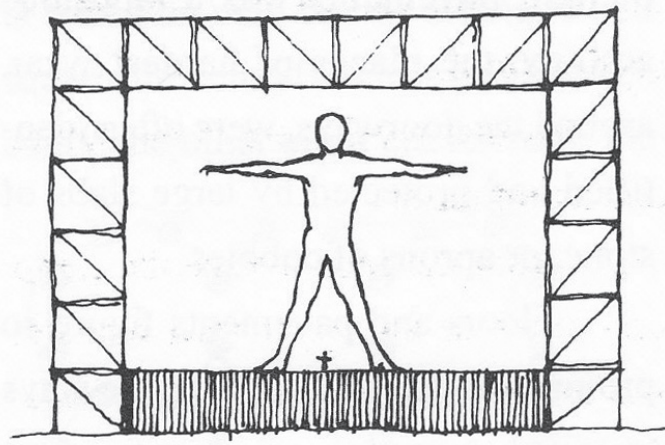


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the architectural experience, even though it does not take up much space in the case studies presented towards the end of Unwin's book, *Analysing architecture* ((Unwin 1997)). Unwin therefore, like Thiis-Evensen, places himself and his method on the border between the objective and the subjective matters.

The matters of material, form and experience of architecture are also main elements in tectonics, which is a concept dealing with the intersection between aesthetics and technology. The term of *tectonics* has been used in architectural theory for several centuries, and the word originates from Greek where it has two primary meanings in the field of architecture; the theory of the inner structure of a work of art, and the shaping and joining of form-elements to a unity. Theorists such as Karl Bötticher (19th century), Gottfried Semper (19th century), Eduard Sekler (20th century), and Kenneth Frampton (20th-21st centuries), have discussed the term of tectonics during the last few centuries. The main point from Bötticher's treatise on tectonics is that every work of architecture can be divided into *Kerneform* and *Kunstform*; the structural and the representational (Hartoonian 1994). Tectonics, according to Bötticher, is the concept that ties all the elements of a building together to a whole [ill. 126] (Frampton 1995). Semper, too, makes a division between the technical and the symbolic issues, but furthermore emphasises the importance of coherence between material, and method of production. He divides the building into four basic elements; the hearth, the earthwork, the framework, and the screen wall, which are all either technical or symbolic [ill. 128] (Hartoonian 1994). The knot is regarded as the oldest and most elementary constructional part by Semper [ill. 127] (Frampton 1995). Therefore, the joint is crucial for Semper, and, in his opinion, it is from the transitions between building elements that the beauty of architecture emerges. Frampton suggests that tectonics is a means to reveal the inner essence of a

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126. In a temple, such as the Hera temple at Acropolis, one can both clearly see the *kerneform* and the *kunstform*, however, it is not just a matter of a decorated structure – there is a system tying everything together to a unified whole (Gympel 1996).

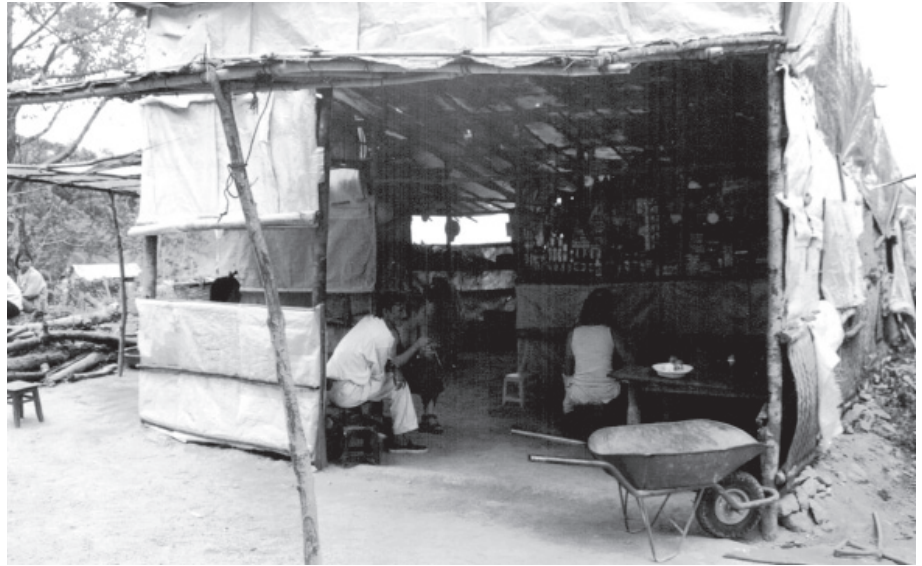
127. Semper defines the knot as the oldest construction – here seen as Japanese knotted grass, signifying landmarks, compared to the Western script (Frampton 1995).

128. Road workers' dining room in Vietnam: earthwork, framework, screen wall, and hearth (Photo: Ida Wraber).

129. Construction by Nervi: in the joints the character of the construction is underlined (Nervi 1965).



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building. Therefore, he proposes logic constructions in order to clarify the structure of a piece of architecture, and make it immediately understandable. Also in Frampton's theory the joint has an important position – the joint is where elements and materials meet, and it is therefore a crucial point in the telling of the logic of a construction. In the joint, the story of materials, overall structure, and laws of nature are embedded, and it is thus the most tectonically important element of an architecture [ill.129] (Jameson 1997). The theories of tectonics thus add a poetic layer to the relationship between form, material, and technology, and are not as focused on proportions as some of the other classical and structuralist theories, but rather relational aspects tied to context, time, users, culture etc. This places these theories on the border between structuralism and phenomenological theories, which will be further discussed later in this chapter.

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These structural theories of architectural beauty all discuss the matter of a composition's dimensions and the interrelationship between these dimensions – that is the harmony and complexity of *proportion and order*. The classical architects and theorists do this very concretely and precisely whereas Venturi, Thiis-Evensen, and Unwin include it more implicitly and handle it more freely in a mix with other aspects. Furthermore Vitruvius', tectonic theory, Venturi, Thiis-Evensen and Unwin all mention the interaction between *form and material*, whereas the renaissance theorists primarily focus on form and composition as such. Common to them all is the idea of the interaction between microcosm and macrocosm – how everything is connected. The Renaissance man inscribed in a square and a circle is a sign of this particular matter, Venturi through his example of the temple, and lastly Thiis-Evensen and Unwin as themes through their book constantly jump between *detail and unity*, while discussing what effect they have on each other.

Keywords: *Proportion and order, Form and material, Detail and unity*

The structuralist way of thinking is generally focused on the composition in itself, and considers the architectural object to be the bearer of architectural quality. Architectural quality can therefore be put into structures and rules, defined by elements and modes of putting these elements together. The theory of perception psychology, on the other hand, turns this completely around by claiming the opposite; that the architectural quality is created as a result of the human bodily functions and reactions, and that the objects are just sources of stimuli that do not contain any qualities in themselves.

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3.2 THE PERCEPTION OF ARCHITECTURE – PERCEPTION PSYCHOLOGY

Already in the 17th century the Spanish Jesuit Balthasar Gracian spoke of the human ability to separate the beautiful from the ugly without help from the intellect, and he defined this pre-conceptual judgement as the matter of *taste* (Christoffersen 2006). This ability to mechanically judge shapes and spaces is especially important in the art of architecture as it is an apprentice and experience-based craft where much of the knowledge and criteria are implicit (Christoffersen 2006). From this point of view, architectural quality and aesthetics is a matter of an immediate feeling that appears in each individual, such as content, disgust, well-being, or discomfort. These kinds of human reactions to our environment are described through studies of perception psychology. Aesthetics is thus not seen as an innate quality of artefacts, but something added or formed by the human mind (Arnheim 1974, Smith 1979). The main topic for the perception psychologists is the process of seeing – or as J.J. Gibson puts it:

“The visible scene has depth, distance and solidity; the image is flat. How can vision depend on the pictures in the eyes and yet produce a scene which extends to the horizon? The physical environment has three dimensions; it is projected by light on a sensitive surface of two dimensions; it is perceived nevertheless in three dimensions. How can the lost third dimension be restored in perception?”

(Gibson 1950)

This thinking is used in architecture to understand how we perceive our environment and what we find attractive or less attractive when moving around in the world. By means of psychological experiments, two different aspects have been established as central in the human experience of space – unity and variation. The opposite of variation, or complexity, is a low degree of complexity, or monotony. An extremely monotonous environment is unhealthy to human beings and can cause hallucination (Hesselgren 1977). Thus, human beings need some degree of complexity in order to be satisfied; the amount of complexity that seems satisfying is individual and the challenge is to find the level that satisfies the majority. The other matter, unity, is seen when the different parts in a house, a work of art, or a piece of music seem entirely interlaced as one single united body. It is very difficult, if at all possible, to describe how unity is achieved, and it is a part of the artist’s intuition and training. The opposite of unity is shattering, and the two of them can be easily and unconsciously detected by anyone. A high degree of unity is better than shattering, but it must be combined with a high degree of complexity. If a dwelling area for example consists of a series of identical houses, both the degree of unity and monotony will be high [ill.130]. On the other hand; in a modern area of individually built detached houses, the degree of complexity will be high, but the area will often seem shattered [ill.131]. The balance between the

130. When the degree of unity gets too high an area is experienced as monotonous, such as seen in this picture where identical houses are placed on a straight line (Lind, Møller 1996).

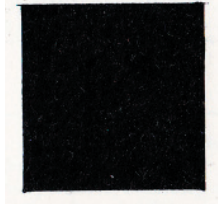
131. In some areas the degree of variation is too high, which gives a sense of shattering, as seen in this picture where houses of different styles, colour schemes, and sizes are lying rather arbitrary, side by side (Photo: Ida Wraber).

two matters of unity and complexity can for example be seen in smaller and older towns, such as the Danish town Dragør, where the houses are not identical, but the overall expression forms a unity [ill.132]. A variation within a certain framework of unity is probably why these small towns are so appreciated (Hesselgren 1977). It is not

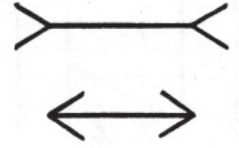
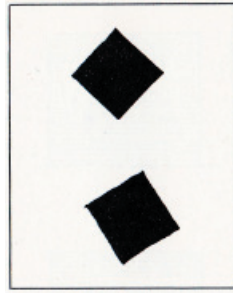


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possible to speak of aesthetics in an isolated element or object – aesthetics is always a result of a relationship between at least two phenomena. A single line or shape without any context cannot be judged in relation to its quality, but by adding another shape tension and relationship are established [ill.133] (Smith 1979). The juxtaposition of visual impressions can cause them to change perceptually; such as visual illusions of interacting lines or colours [ill.134] – their properties in relation to stimuli have not changed, but the way that they are perceived has (Smith 1979). There are four levels of perception psychological aesthetics – first, second, and third order, and limbic saturation aesthetics (Smith 1979). The first order aesthetics is the immediate response to elegance, for example in relation to the main directions in space and the simple shapes, whereas the second order aesthetics contains the experience of tension between principles of complexity and patterns. The third order aesthetics includes the matter of rhyme – the elegant variation of similar patterns – and the limbic saturation aesthetics involves the primitive enjoyment of bright colours and high polished surfaces (Smith 1979). These four aesthetics sensibilities all relate to balance and harmony, which are both contained in the concept of elegance (Smith 1979). Balance can be described as the state of a piece of art where no change seems possible – nothing further can be



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added or subtracted without destroying the unity of the whole (Arnheim 1974, Smith 1979). People strive for balance or equilibrium in all stages of physical and mental existence, as do all organic life and physical systems, it seems, and therefore all kinds of visually balanced art, including architecture, bring enjoyment to man in relation to his broader aspirations (Arnheim 1974). Harmony is a state of at least two entities that are neither exactly identical, nor different to an extent that one dominates the other. Harmonic relationships are supportive to the system, while dissonance seems annoying in the system and causes stress in the human mind (Smith 1979). Harmony is thus a state where the forces of a piece of art are equally strong; this can be accomplished in numerous subtle and complicated ways. A large area of low colour saturation, can for example very well balance a smaller area of high colour saturation, brightness or other interest-attracting values [ill.135] (Smith 1979). However, the equilibrium of

132. In many small older and picturesque areas the houses are not identical, but held within a given framework of a specific scale, colour scheme, style etc., which both gives a sense of unity and variation. Maybe this is why such towns are so appreciated (Photo: Ida Wraber)?

133. A single line or a simple square floating in space, as seen to the left, cannot be judged with respect to its aesthetic qualities. When adding a frame and more elements, as seen to the right, the square gets direction, which gives tension and a composition that can be judged with respect to aesthetic quality (Thiis-Even- sen 1987).

134. A classical illustration: the horizontal lines have the same length; however, because of the application of arrows at the ends of the lines the line at the top seems longer than the one below (Arnheim 1974).

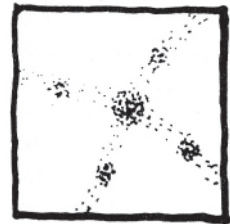
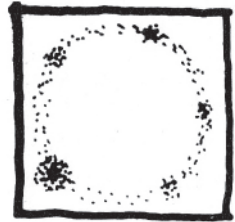
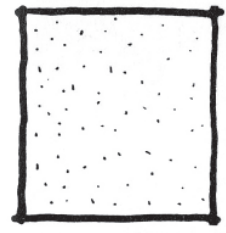
135. A smaller element of a bright colour, such as the diagonal blue column, can balance a larger area of a less attention attracting colour, such as the grey, metal sheet wall behind the blue column (Gympel 1996).

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balance and harmony is not enough to fulfil man's needs in relation to achieving a feeling of content and delight when perceiving art and architecture. Especially one counter-principle is important – dynamics (Arnheim 1974). If balance and harmony were the only parameters, then the preferred art would be perfect cubes or evenly stained canvases [ill.136] (Arnheim 1974). But since this is obviously not the case, there has to be something more in the equation – there has to be something that needs to be tamed and balanced in order to create an interesting piece of art; there needs to be some energy or tension. However, in painting, sculpture, architecture or other similar art forms, nothing actually physically moves and therefore the concept of dynamics has to be metaphoric. The question then is how this metaphor can be described. One of the most common theories as to how this is achieved is that the composition should be shaped in such a way that the observer is under the illusion that the image is actually in motion. Another explanation might be that the observer uses his experience to apply movement to the image – seeing a sculpture of a dancer fools the observer into seeing motion because he is aware that dance includes a specific kind of movement [ill.137] (Arnheim 1974).

In perception psychology the most fundamental issue lies in the balancing of *unity and variation*; too much unity will bore us (to the limit of hallucination), and too much variation makes us over-stimulated and tired. But it is not enough to find the happy medium between boredom and chaotic impressions; human beings also respond to elegance, which can be described through *balance and harmony*. These two are



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136. If balance and harmony were the only factors defining what seems interesting and attractive to human beings, completely evenly stained canvases, such as the one at the top, would be the most well-liked art. However this is not true – human beings also need something that creates tension and dynamics, such as for example seen in the two canvases, which immediately seems more interesting than the first one (Hesselgren 1977).

137. The Guggenheim museum in Bilbao – the shapes of the building gives the illusion of movement, almost as if the metal sheet construction was made of sails waving in the wind (Mitchell 2003).

not always better achieved by a perfectly symmetric balancing of elements, but can also indeed be accomplished through more complex compositional systems. This might be related to one last very important factor – dynamics. Perfect symmetry and rigid systems might be harmonic and balanced, but our eyes are also drawn to items that express some kind of *dynamics*. A dynamic composition makes our eyes wander across the piece of art and keeps us occupied and interested for a longer period of time than a static composition. It simply seems more exciting.

Keywords: *Unity and variation, Balance and harmony, Dynamics*

Perception psychology is quite narrow in its approach as it is difficult to measure the architectural experience as a whole; especially as it only operates with the sense of vision. Rather, the focus is often on a smaller area in order to find the human reaction to an isolated phenomenon; to investigate how a small change affects the experience of a space or a composition as a whole, or to compare different ways of seeing a space, as mentioned in chapter 1. The human being is the spectator, and the space is the objective source of stimuli. A quite different way of seeing the relationship between person and space is phenomenology, through which it is argued that the architectural experience arises from an interaction between man and his surroundings and that such an experience is not just a biological reaction but is also defined by for example memories, expectations, culture and context.

3.3 THE EXPERIENCE OF ARCHITECTURE – PHENOMENOLOGY

As mentioned earlier, architecture is often divided into two parts – the measurable and the immeasurable; or the objective and the subjective. Phenomenology is concerned with the subjective description of phenomena – i.e. it is the opposite of the natural scientific, or biological, way of understanding the world – rather, the phenomenologists wish to describe how phenomena appear to us, as single individuals, and how we *are* in the world (Hyldgaard 2006). According to the Norwegian architect and theorist Christian Norberg-Schulz our primary need in the world, which is in constant transformation, is to gain a foothold in order to create meaning of our perceptions and find reference points that we can relate to. By finding a standpoint from which the world that we interact with seems constant and meaningful, we understand the world, and this gives us a feeling of security (Norberg-Schulz 1963). The world can be understood by human beings through the relationship between things that are near, and things that are far away (horizontally and vertically). These interact with horizons and foregrounds that make up pictures that are meaningful and significant to us (Norberg-Schulz 1997, Merleau-Ponty 1945/2002). In this way the body, the subject (within the body), and the world (around the body) are connected and thus able to communicate (Merleau-

Ponty 1945/2002). It is within the physical body that the subjective experiences take shape; however, Merleau-Ponty argues, the processes has nothing to do with what the physicists, biologists or perception psychologist call stimuli with the logical causality that follows such a concept, but rather it is a part of the re-creation of the world at every moment, and therefore not possible to predict (Merleau-Ponty 1945/2002).

The role of the architect, or any artist, is to ‘reveal’ something in relation to the phenomena of the world – to unveil the essence of something through a specific artistic language. No two persons would reveal something in exactly the same way, and thus we can learn from each other through artistic communication. The Greeks called such an uncovering *alétheia*; a perspective of truth that acknowledges that through the uncovering of some aspects, some other aspects are consequently concealed (Norberg-Schulz 1997). Maurice Merleau-Ponty addresses this complexity through discussing the concept of a cube:

“From the point of view of my body I never see as equal the six sides of the cube, even if it is made of glass, and yet the word ‘cube’ has a meaning; the cube itself, the cube in reality, beyond its sensible appearances, has its six equal sides. As I move around it, I see the front face, hitherto a square, change its shape, then disappear, while the other sides come into view and one by one become squares. But the successive stages of this experience are for me merely the opportunity of conceiving the whole cube with its six equal and simultaneous faces, the intelligible structure which provides the explanation of it.”

(Merleau-Ponty 1945/2002)

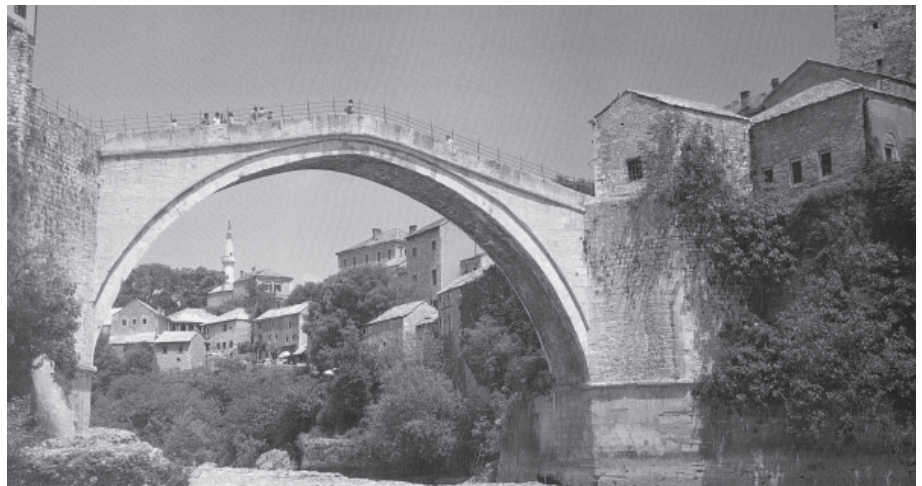
Many theories of aesthetics and architecture focus on what we *see* when speaking of what is pleasant or unpleasant – phenomenology, however, includes all senses when speaking of architectural experience. Juhani Pallasmaa even claims that the skin and the sense of feeling is the most original form of perception (Pallasmaa 1996). In architecture and in the world in general, there are many things that cannot be comprehended by use of sight only, such as the heaviness of a church door, the coldness of an Italian marble floor, the sound reducing properties of a soft wall cladding or the smell from a newly washed wooden floor (Pallasmaa 2000). When introduced to an object we thus immediately try to understand it from as many different perspectives as possible; we see, listen, smell, touch, or maybe even taste it in order to connect the sensations of it into a unity that we are able to remember and recognize. Maurice Merleau-Ponty, however, emphasises that the experience of a phenomenon is more than just the sum of the single sensations:

“My perception is not a sum of visual, tactile, and audible givens: I perceive in a total way with my whole being: I grasp a unique structure of the thing, a unique way of being, which speaks to all my senses at once.”

(Merleau-Ponty 1964)

The qualities of any object are, according to Pallasmaa, rather explained by use of verbs than nouns – i.e. the looking out of a window and the opening of a door; not the window and the door in themselves (Pallasmaa 1994). If no one touches or uses the items, their qualities are therefore non-existent, as the quality only exists in the interactions between the item and its surroundings (Christoffersen 2006, Norberg-Schulz 1997) – this could be a human being opening the door of a house and walking through it, the relationship between a building and its context, or interplay between shape and light (Norberg-Schulz 1997). Also Martin Heidegger underlines the importance of the meeting between an object – or a building – and its surroundings, by saying that every thing should gather the fourfold of earth and sky, the divinities and the mortals (Heidegger 1997). This implies that the connection is not only related to concrete matters, like form and light, but also to the more abstract matters of the sky and the divinities – or poetry and aesthetics. For example the bridge, which is also mentioned in chapter 1, can thus be seen as the obvious; a concrete bridge in a specific material creating a connection between two different banks in a specific manner, but also in a more symbolic way – a bringing together of two areas, cultures, people etc [ill.138]. The symbolism, of an object is not necessarily understood in the same way by different

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138. The Mostar bridge in Bosnia-Herzegovina connects the two separated parts of the town Mostar. During the war the bridge also became both a physical and an abstract sign of the connection between Serbs and Muslims and was therefore destroyed (Dupré 1997).

people – colours, icons etc can have diverse symbolism in different cultures [ill.139-140] – but there are also more personal experiences, memories, and expectations that can influence our experience of an object or a space. For example, Gaston Bachelard suggests that:

“[...] the house is not experienced from day to day only, on the thread of a narrative, or in the telling of our own story. Through dreams, the various dwelling-places in our lives co-penetrate and retain the treasures of former days. And after we are in the new house, when memories of other places we lived in come back to us, we travel to the land of Motionless Childhood, motionless the way all immemorial things are.”

(Bachelard 1997)

In this way our experiences of a piece of architecture always depend on our earlier experiences of architecture, spaces, objects etc. Merleau-Ponty explains this by describing human beings as historical and psychological structures that form our thoughts and actions. This structure has the possibility to interact freely with the world and the objects in it and can thus freely communicate with any part, or phenomenon, of it. But it is indeed a communication rather than simply a matter of receiving stimuli; according to Heidegger, as well as several of the later phenomenologists, the things and spaces around us address themselves to us and encourage us to a certain behaviour; a flying ball will tell us to catch it, we sit down on a chair, we put our garbage in a trash can and so on (Hylgaard 2006).

Attempting to sum up on these quite abstract ideas of how we are in the world – and interact with it – it is first important to underline that according to phenomenology, all experience and perception of the world is a subjective matter which is related to a ***cultural and personal framework of understanding*** that has been formed by memories and earlier experiences. Secondly, many phenomenologists emphasise the importance of understanding perception as a ***multi-sensory experience*** where eye, ear, nose, skin, tongue, skeleton and muscle work together to form an impression. And, thirdly, when speaking of the things in the world and how they appear, the main essence of the objects in the world is to reveal aspects of different phenomena – through the connection of earth and sky, divinities and mortals, as Heidegger puts it. Therefore, the ***relation to the context*** is paramount, and an object is actually nothing – it has no qualities – unless it is seen in relation to something else.

Keywords: *Relation to cultural/personal framework of understanding, Support of a multisensory experience, Relation to context*



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139. *A place for prayer and stillness in Korea – a multicoloured experience (Photo: Ida Wraber).*

140. *A place for prayer and stillness in France – an airy and single-coloured spatial experience (Photo: Ida Wraber).*

Hereby the three theoretical clusters are outlined, and through the summaries and keywords of the clusters, it is immediately possible to see that they have quite different approaches to what the main points are when speaking of architectural quality. It is not just that one theory puts light before form, and another claims that form is the basic of architecture and light definitely comes second; the three perspectives represent completely different ontological currents. Therefore, it is not interesting to find the ‘right’ theory, or to discuss whether *proportion and order* is more important than *relation to the context*. Instead the width of the perspectives in architectural quality will, in the following section, be clarified through applying the theories to analyses of three different dwellings. Hereafter it will be discussed how the commonalities and differences of the theories actually manifest themselves in concrete pieces of architecture, and how they contradict, complement, or reinforce each other.

3.4 CONCLUDING REMARKS

- The idea of building a model for analysing architectural quality is to clarify the wide range of different aspects included in the concept.
- From each theoretical cluster, three keywords are chosen for the further analysis and discussion of architectural quality; Classicism/Structuralism: *Proportion and order, Form and material, Detail and unity*, Perception psychology: *Unity and variation, Balance and harmony, Dynamics*, and Phenomenology: *Relation to cultural/personal framework of understanding, Support of a multi-sensory experience, Relation to context*. These will be further compared and discussed in chapter 4.

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4 CLARIFICATION OF ARCHITECTURAL QUALITY THROUGH EXAMPLES

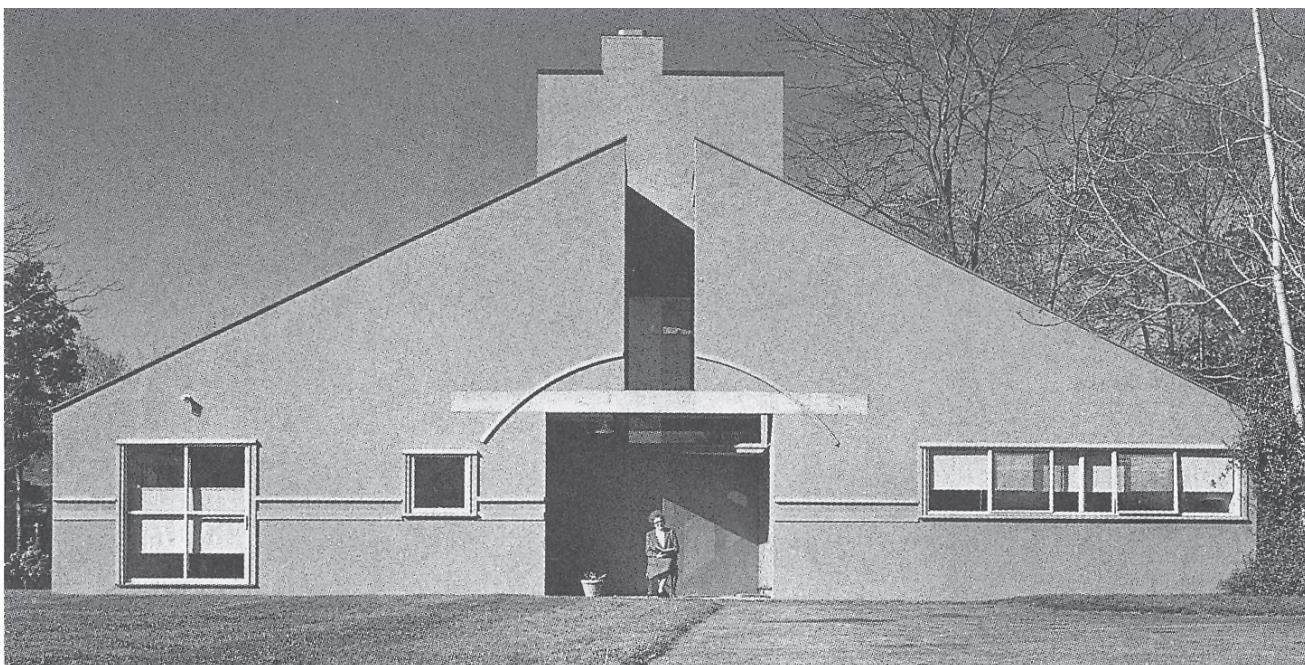
In order to make the discussion more tangible and concrete, three dwellings will be analysed through the three different theoretical clusters in this chapter in order to see which specific features they value, and how differently or similarly they value architecture when actually applying them to concrete examples. The dwellings are chosen with an offset in the literature on architectural quality and dwellings of the 20th century. Dwellings that are often mentioned are probably generally considered to possess some kind of quality by a wide range of people, since they keep popping up as good and interesting examples. The aim is also to find quite different dwellings to analyse in order to see whether the architectural qualities are dependent or independent of the stylistic approach. Therefore the dwellings are chosen in relation to the different theoretical clusters; a dwelling that in some way reflects the same focus as the theories, although it is not necessarily developed with an offset in the theoretical cluster – such clear bonds between theory and practice are seldom seen. For structuralism, mainly early Nordic functionalist pieces of architecture are considered, as they share the pure approach to *proportion and order*, the interest and care for the detail and the connection between *form and material*. For the perception psychological view, also architecture with strong focus on the compositional matters, such as *balance, harmony, unity, variation* and *dynamics*, are considered – for example modernist and postmodernist architecture, which are very formalist in the way that materiality is dissolved and hidden in order to make the formal language the focal point – however, in very different ways in the two stylistic currents. In relation to phenomenology there is a wide range of examples as there are several architects that work both theoretically and practically from a phenomenological standpoint, and the phenomenological architectural literature is filled with examples of concrete examples that do not only relate to formalist aspects but also to *multisensory experience, context* and *cultural and personal frameworks of understanding*. Two of the pieces of architecture that are considered for the testing and clarification of the model – Utzon's house in Hellebæk [ill.141] and Aalto's Villa

141. Utzon's own house in Hellebæk, Jørn Utzon 1952 (Møller 1989).



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Mairea [ill.142] – are typical ‘Nordic’ examples of dwellings, which are simple, but humane, with a care for the site, detail, materials and natural light, but with quite different formal and material languages, and the third dwelling, Vanna Venturi house [ill.143], is chosen because of its strict and deliberate exclusion of other factors than the purely formal and compositional, of course apart from some kind of usability and functionality in relation to the user, even if it definitely comes second. Venturi’s theory is also mainly focused on the visual and formal aspects. However, just like Thiis-Evensen and Christopher Alexander, he also incorporate other aspects such as the relationship between form and material in his theoretical work, which in this thesis has placed him in the structuralist cluster. In his work – and especially the Vanna Venturi house that is often considered to be the first postmodern piece of architecture – the relationship between form and material is, however, not as important as it is in the theoretical part of Venturi’s work, which in many ways makes the Vanna Venturi house seem closer to the perception psychological than the structuralist keywords. Utzon’s house is specifically chosen because of its strict and simple formal language and the relationship between the used materials and the form, whereas Aalto’s Villa Mairea is primarily chosen because of its quite organic and multifarious use of forms and materials but also due to the process of development, which was very long and based on a personal friendship between the architect and the house-owners, which makes a good foundation for a phenomenological development of a house. In the following sections, these houses will be analysed one by one from the three different theoretical clusters. The chapter is hereafter concluded by a comparison and summary of these analyses.

142. Villa Mairea, Alvar Aalto 1938-39
(Gullichsen et al. 1998).

143. Vanna Venturi house, Robert Venturi
1962-64 (Schwartz 1992).

4.1 UTZON'S HOUSE IN HELLEBÆK (1952)

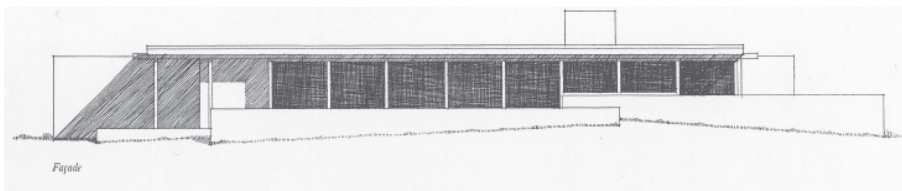
(Lund 2008, Davies 2006, Weston 2002, Møller 1989, Keiding, Dirckinck-Holmfeld 2004)

4.1.1 Structuralism

Keywords: *Proportion and order, Form and material, Detail and unity*

The house in Hellebæk is strictly constructed around a module system of 120 mm, corresponding to a Danish brick plus an adjoining mortar joint. Everything – floor tiles, brick paving, wooden boards etc. – is accommodated in this system, which gives simplicity to the whole and connection between the smaller and the larger elements of the house. The non-bearing secondary structures, such as cupboards, interior doors and light partition walls are also built up around the 120 mm module [ill.146]. The formal language is very strict as well; the purity of the concept can not be disturbed by the secondary functional needs, and thus the bedrooms have no windows but only roof lights. All doors within the house fill out the entire height from floor to ceiling in order to keep the wall surfaces clean and whole, without any disturbing holes for humans passing through. Even though the south and north façades are quite long and low, they have delicate shifts at different points, which make it seem balanced and interesting rather than low and heavy. To the north, the wall forms one long continuous surface, without any interruptions apart from one single door, which is the main entrance door [ill.145]. To the south, the house opens up through a lighter construction of wooden columns and a beam stretching from south to north [ill.144, 147]. In between the wooden columns are glass surfaces, and the contrast between the heavy wall and the lightness of the wooden frames makes up a strong main compositional theme for the house, which is strictly followed throughout the design. The tiles are differently treated in relation to where they are situated and what they will be exposed to; the top bonds in the outer walls are made from severely baked tiles. In the bathroom the same tiles are glazed in white, and the floor tiles in entrance room, kitchen and by the fireplace are made from pressed clay clinkers. All construction elements and joints are visible and used as a kind of decorative elements, which make it easier to understand the relation between material, form and construction.

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144. Towards the south the façade is open and light with large window areas. This is a strong contrast to the heavy back of the building, which is formed by the massive northern brick wall (Keiding, Dirckinck-Holmfeld 2004).

145. The long brick wall towards the north does not have any windows or openings, other than the main entrance door, which means that the bedrooms only have roof lights (Keiding, Dirckinck-Holmfeld 2004).

146. Even the wooden boards of the walls are dimensioned in relation to the module of 120mm, which underlines the simple expression of the house and create a clear line between detail and unity (Keiding, Dirckinck-Holmfeld 2004).

147. In the floor plan the contrast between the massiveness of the north part and the openness of the south part of the dwelling clearly can be seen (Keiding, Dirckinck-Holmfeld 2004).

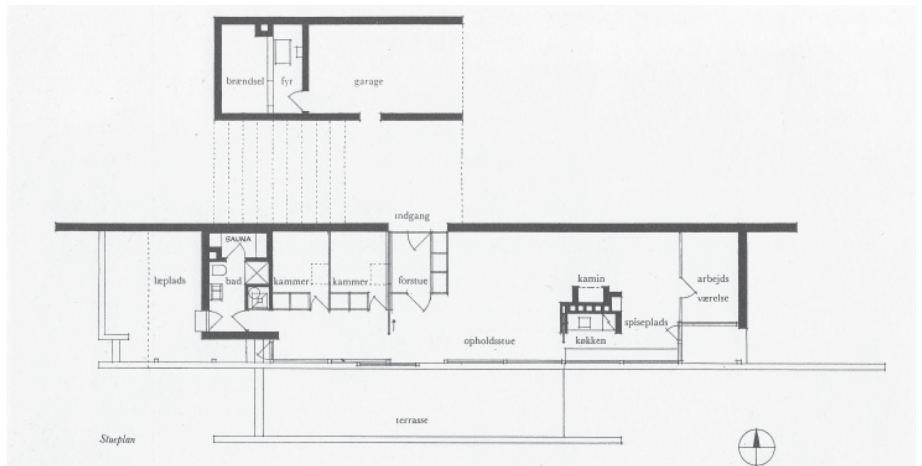


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4.1.2 Perception Psychology

Keywords: *Unity and variation, Balance and harmony, Dynamics*

There is a very strong theme in the design, which is strictly followed and recognisable in all parts of the house – both seen from the inside and from the outside. However, the strictness is not taken so far as to give the house a totally predictable plan or façade sequence. In the exterior, especially the terraces on the south and the west side of the house, and in the interior sliding doors and the fireplace arrangement in the large open space offer possibilities of exploration and variation of the spaces [ill. 148]. The materials and colours also follow a quite strict theme, but small variations in especially the tiles, as mentioned in the previous section, create a play in the composition [ill. 149]. The house is very finely balanced when considering the heavy and the light elements between the horizontal and the vertical (both in the large scale but also the naturally vertical lines of the wood and the horizontal orientation of bricks), and between the strictness and the deviations [ill. 150]. This is also what creates the dynamics in the building, which is otherwise austere orthogonal in its compositional elements; the small adjustments of the exterior terraces to the slope of the site and meetings between the light wooden elements and the heavy brick walls, the play that is created in the bonds of the brick walls where two differently sized bricks form a rhythmical pattern and, in the larger scale, the movement from the calmness of the heavy wall towards the more outgoing and changeable glass wall.

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148. The brick element, containing fireplace with chimney and kitchen arrangements, creates possibility of variation and exploration in the large open space (Keiding, Dirckinck-Holmfeld 2004).

149. The play in the pattern of the brick bonds and the way the wall is finished at the top gives variation in the large brick surfaces (Keiding, Dirckinck-Holmfeld 2004).

150. The heaviness and the lightness of the construction and the verticality and horizontality are underlined where the brick walls and the wooden column-beam constructions meet (Møller 1989).

4.1.3 Phenomenology

Keywords: *Relation to cultural/personal framework of understanding, Support of a multi-sensory experience, Relation to context*

When the house in Hellebæk was built, there were almost no modernist houses in Denmark. Utzon, who had been travelling in America and in Finland and worked for Alvar Aalto and visited Mies van der Rohe and Frank Lloyd Wright, had gained much inspiration from these great architects of the time. Even though the inspiration is clearly visible (for example the references to Wright's Falling Water [ill.151]), the house in Hellebæk is not a copy of an American or Finnish modernist dwelling [ill.152]. It is created without any drawings, but in cooperation with a set of local craftsmen. Along the way a few models were made to sense the result of some design suggestions, but otherwise a dynamic process between the architect and the craftsmen was the method of development. And when looking at the house, it is clear to see that it is a Danish house with the simplicity and lightness of design and the pure use of bricks to different ends. It is a modernism which includes the matter of material, but in such a refined way that every small detail stands out [ill.153-154]. The northern back of the house, which is built in brick, acts as a strong counterweight to the lightness of the glass, and therefore it is still possible to read the house as a Danish standard house even though the larger areas of glass point towards the new currents moving in across the Nordic countries. The house thus represents as meeting between tradition and modernity [ill.155]. The materials used in the house are simple and adjusted according to the context depending on where in the house they are situated. The tiles are not just the same tiles everywhere. In some places they are glazed, and in some places they are extra baked, so if moving around blindfolded, one would be able to sense the elements; their qualities and rationality. Light materials are used for non-bearing structures and the joints of the construction are visible and used as a kind of decoration that also communicates the essence of the manner of construction, which is an important part of the story of the house. The rectilinear composition of the house creates a beautiful contrast to the soft, undulating meadow on which it is located and the forest that surrounds it. The black columns of the wooden construction communicate with the trunks of the woods, and the terraced outdoor spaces create an orthogonal rejoinder to the organic slopes. In this way the house tells the story of the spirit of the site, of Danish building tradition and of contemporary building style.

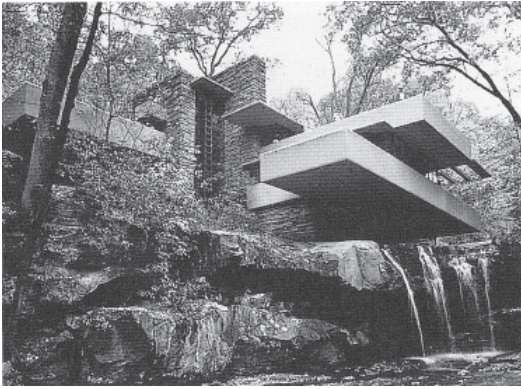
151. Frank Lloyd Wright's Falling Water is also a play between built strict lines of verticality and horizontality, and the undulating nature (Schwartz 1992).

152. In the house in Hellebæk, Utzon is more soft in his design, than seen in Wright's Falling Water, which is makes the house a Danish version of Modernist dwelling (Weston 2002).

153. The dwelling is very clear and simple in its design – from the smallest detail to the complete house as seen for example in the handling of the bricks and the design of the wooden ceiling in this picture (Møller 1989).

154. The simplicity in the choosing of materials – brick, wood, and glass – gives a coherent and simple expression, whereas the multiplicity in the use of these materials create variation as seen here where bricks are used as walls, benches and flooring (Møller 1989).

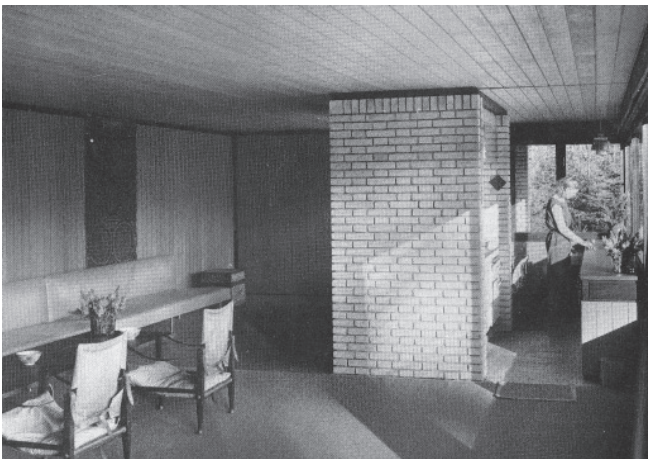
155. The house in Hellebæk has a foot in the new Modernist style, which can for instance be seen in the form language, but also in Danish building tradition, which can for example be seen in the use of materials (Keiding, Dirckinck-Holmfeld 2004).



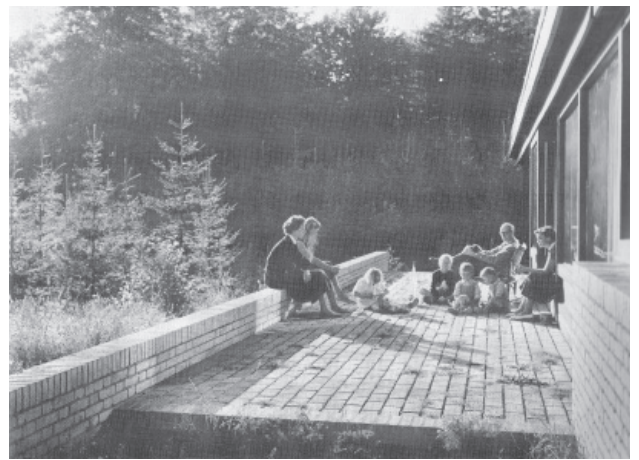
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4.2 ROBERT VENTURI: VANNA VENTURI'S HOUSE IN CHESTNUT HILL (1962-64)

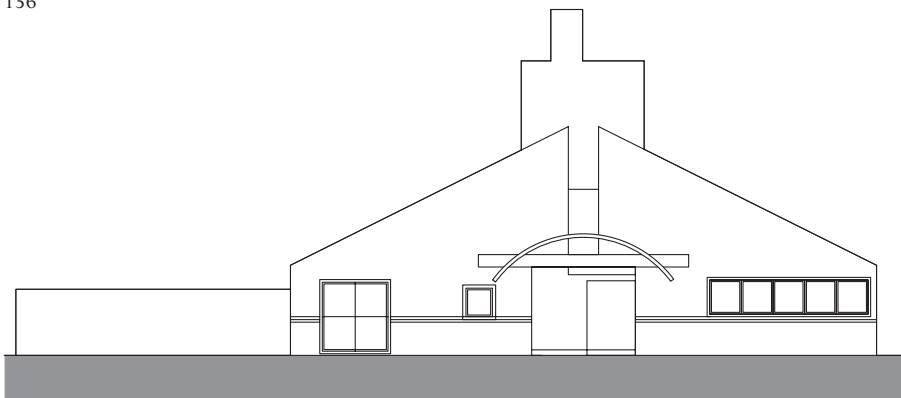
(Venturi 1966/1977, Davies 2006, Schwartz 1992)

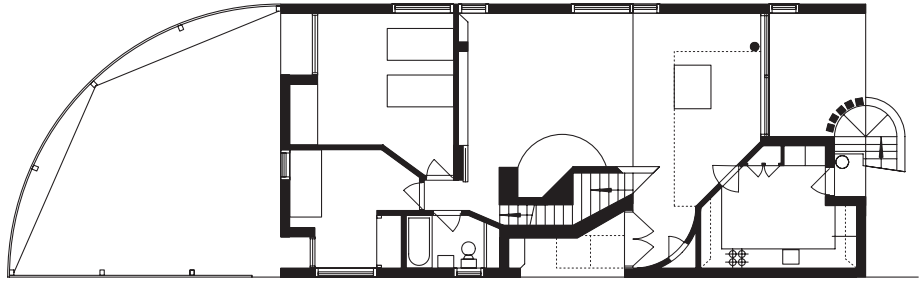
4.2.1 Structuralism

Keywords: *Proportion and order, Form and material, Detail and unity*

In the *Vanna Venturi house* on Chestnut Hill, Venturi, unlike Utzon in his house in Hellebæk, has not tried to be unambiguous and consequent. Rather, he has tried to add complexity and contradiction. There is a clear order in the façade; it mimes the archetype of a dwelling with the shape of the roof and the chimney, but the order is disturbed by some contradictory elements, for example the window placed at the centre of the chimney-like element [ill.159]. The Golden Section is also evident in parts of the composition, although it is veiled by other compositional principles. This can for example be seen in the placement of the windows in the gable façades; in this composition it is not possible to read an order – at least not in the horizontal distribution – and the façade seems quite randomly composed [ill.156]. The main lines of the plan are also quite typical of a dwelling, however, several elements – such as a squeezed in staircase, a half-circular wall, an asymmetric fireplace, diagonal walls and niches – disturb the calmness of the main layout [ill.157-158]. Quite contrary to the case of Utzon's house, the material is not as important in the design of *Vanna Venturi house* as the form and composition are. The material is seen more as a necessity to materialise the wished form than something that interacts with the shapes and gives them character. In the concept of the house, it is not a goal that all the details point towards an unambiguous greater whole, as in the Hellebæk house. Instead, Venturi seeks the dynamics of contradictions and multiplicity. Every element is, in isolation, therefore a design in its own right. The house is indeed based on the simple template of a traditional house with pitched roof, but the single parts do not necessarily reflect that they are a part of this unity.

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156. The gable façade mimes a classical house façade; however, the order according to which the elements are placed on the façade is not clear, but rather filled with complexity and contradiction (Davies 2006).

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157. The floor plan is rather common and traditional in its layout, but around the central staircase the lines are distorted, which adds complexity and compression in this area (Davies 2006).

158. Several different formal elements meet around the staircase and fireplace. They do not seem to be part of a clear hierarchy, but rather clash together with only a minimal consideration of unity and order (Schwartz 1992).

159. The chimney is interrupted by a window, just above the entrance door, which seems to be a contradictory element in relation to the common expectations that a chimney is a massive construction leading from the bottom to the top of a house (Schwartz 1992).

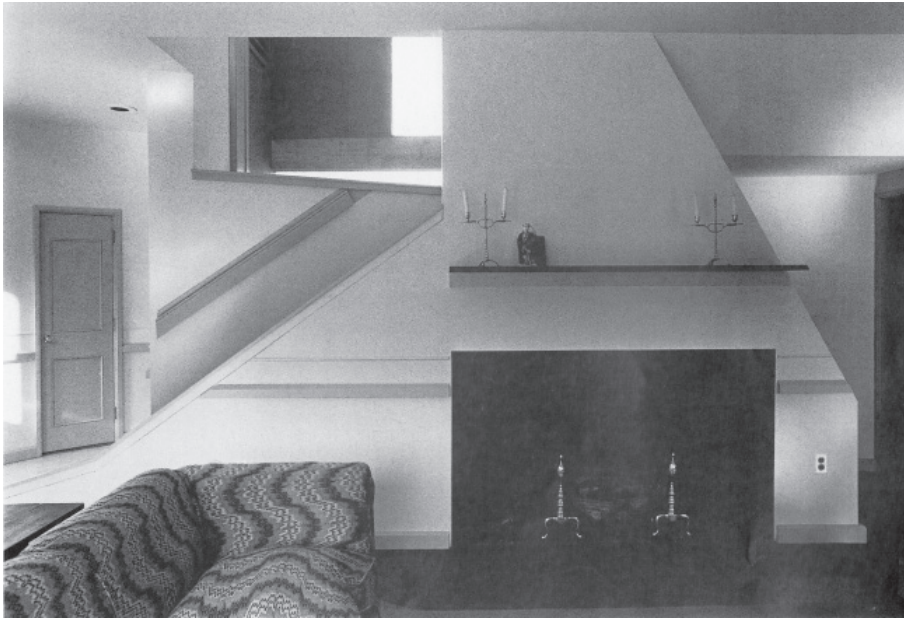


4.2.2 Perception Psychology

Keywords: *Unity and variation, Balance and harmony, Dynamics*

The play of unity and variation seems to be a main theme in the *Vanna Venturi house*. The overall concept is clear on the outside – the archetypal dwelling with sloped roof and oversized chimney – whereas on the inside the single elements such as the fireplace and the stairs are seen as single formal sentences [ill.160], which makes it difficult to detect the quite traditional layout that lies as the foundation of the floor plan. On

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160. The fireplace and the staircase are two strong formal elements that are placed right beside each other and therefore give a complex expression to the room (Schwartz 1992).

an overall level, balance in the interior is reached through a play between a smaller dense area and a larger open section. Within these areas, however, some less balanced relationships might be pointed at, such as the aforementioned formal relationship between stairs and fireplace. Even though the main stroke from the outside is related to classical architecture – symmetry and order – the building contains a large portion of dynamics if compared to the traditional single family houses that it mimes. In all elements there seems to be a movement [ill.161-163]. This is achieved through the use of effects such as diagonal lines, and symmetry and balance between similar – but not identical – elements, which can for example be seen in the front elevation that is almost symmetrical. All elements except from the main outline and the bow above the main entrance, however, are somehow just a little bit out of sync with a perfect symmetry.

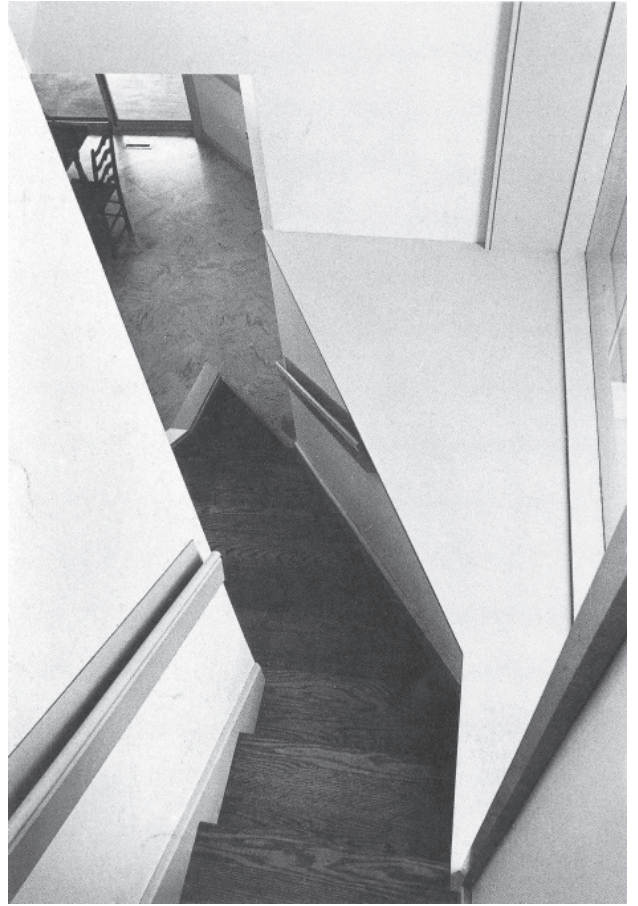
161. Arches are used in both wall and roof elements to create contrasts and dynamics. This example is from the living room (Venturi 1966/1977).

162. Dynamics is also achieved through the use of diagonal lines, as for example seen in the design of the staircase (Schwartz 1992).

163. In this gable façade the diagonal lines are used to achieve dynamics, but as they are part of a symmetric main outline, the composition seems quite calm. The placement of the openings is, however, not part of this symmetry, but they are all a little bit displaced in relation to the main order, which gives the overall symmetry an addition of complexity (Schwartz 1992).

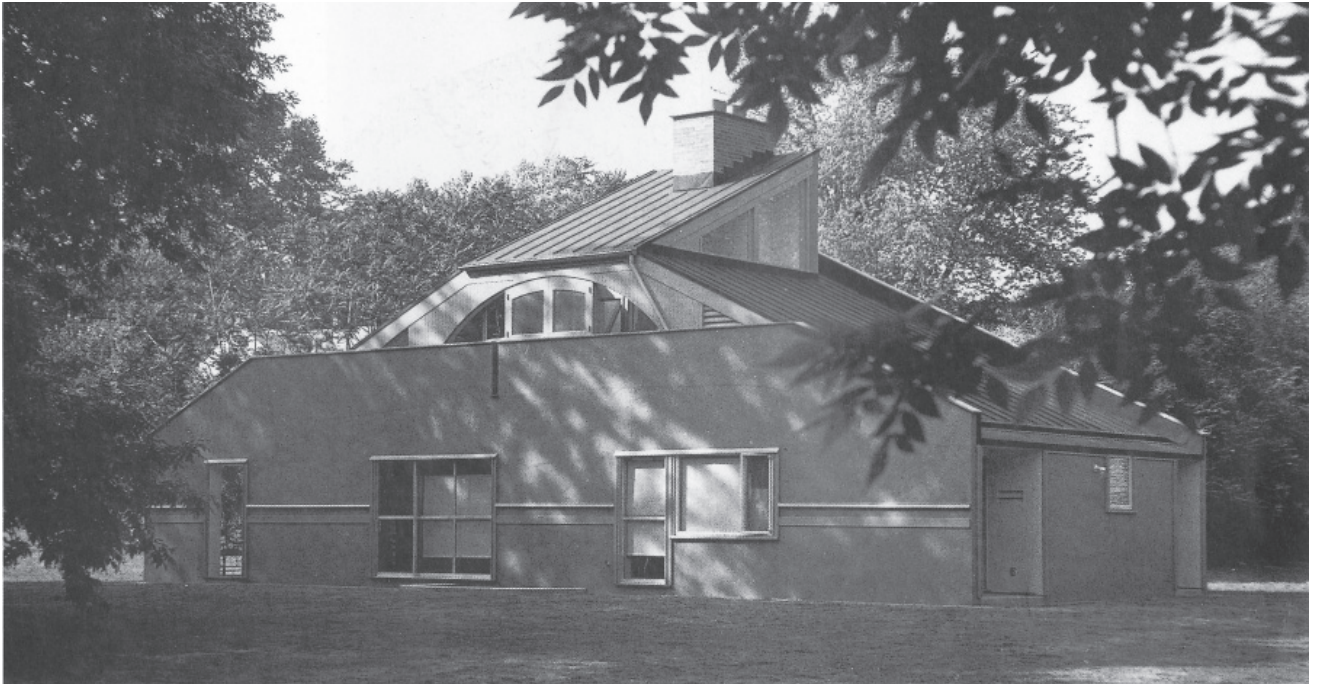


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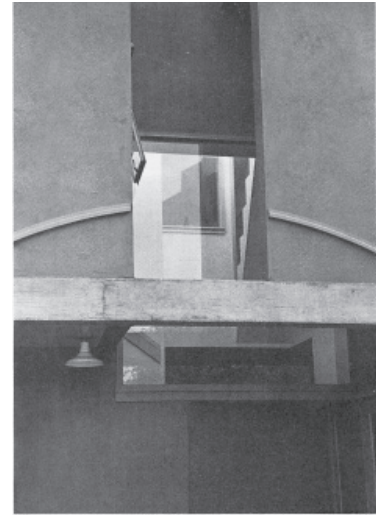
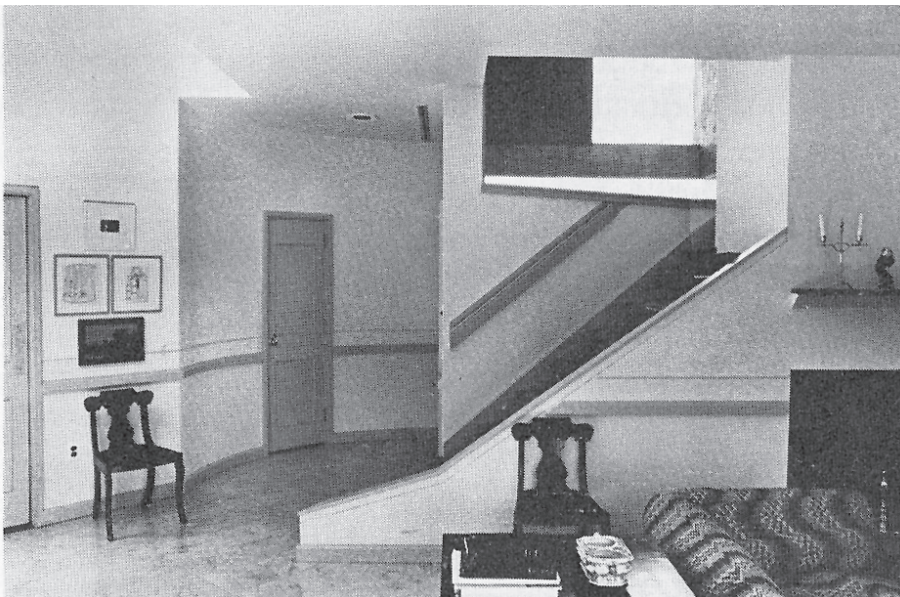


4.2.3 Phenomenology

Keywords: *Relation to cultural/personal framework of understanding, Support of a multi-sensory experience, Relation to context*

There is a definite play of contrasts in the *Vanna Venturi house* [ill: 165-167]. In the façade there is a play between heaviness and lightness; the splitting of the archetypal house mass and the floating of the massive chimney-like construction. The house does in some ways support multi-sensory experiences by using different materials on the floor for different functions and areas, which can be argued to be for visual reasons but also for example for acoustic and tactile ones. However, the spaces are more formal statements than experiments of the relationship between material, form and experience [ill.164]. The relationship between detail and unity is, rather contrary to Utzon's house in Hellebæk, characterised by the denial of a need of congruity between detail and unity, which is one of the corner stones in postmodern architecture. Every line, object, surface or volume is there for its own sake and is a part of a composition, but not in a way through which the likeness is manifest, but rather in a way through which contrast and contradiction appears [ill.166, 168]. The building is more of an experiment of shapes and architectural space in itself than an experiment of the relationship between architecture and contextual matters, such as inhabitants, context, or technology. On the other hand, it is undeniably a comment on the context – or maybe even a revolt against it. The use of the traditional house outline and the obvious breaking of the strict concept of such a composition is a quite clear statement of being aware of the rules of the context, but presenting a wish to break out of the given frames, but this is on a more theoretical than concrete level of how the building relates to the site.

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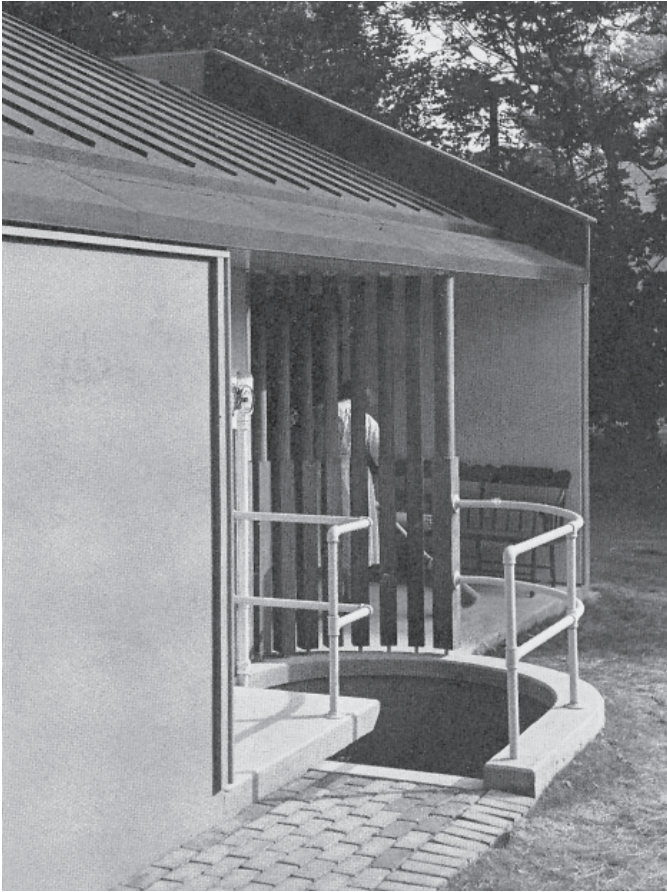
164. The composition is filled with complex and contradictory formal statements – in this corner of the living room an arching wall and dynamic lines from the staircase and the fireplace meet in a complex design (Venturi 1966/1977).

165. The detailing of the meeting between window, chimney, and entrance doorway (Venturi 1966/1977).

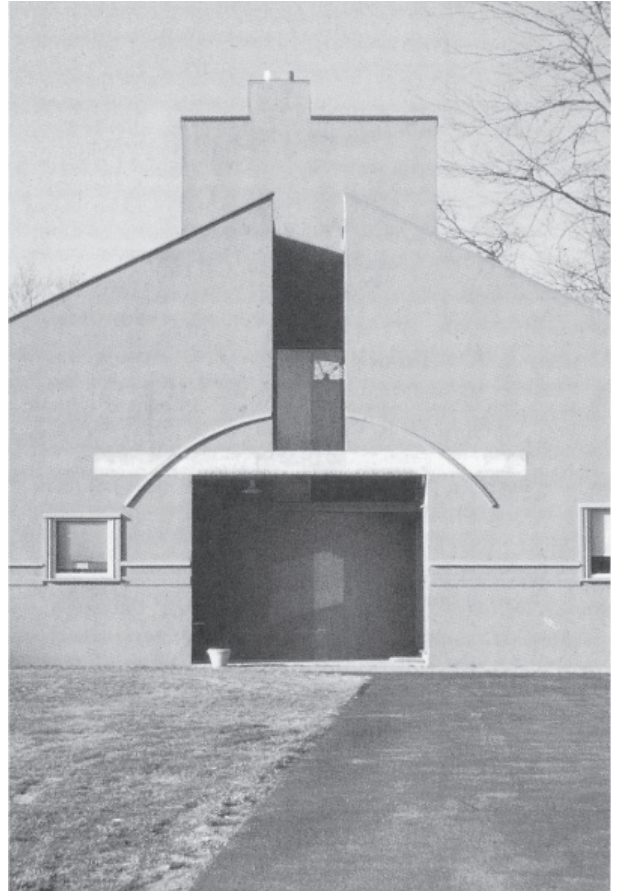
166. The rounded elements and the sharp diagonals are seen in many places of the house – here in the stairs to the cellar and the roof line (Venturi 1966/1977).

167. The play between heaviness and lightness is underlined by elements such as the split of the archetypal building volume and the chimney element floating above glass area (Schwartz 1992).

168. Even in the smaller spaces of the house, such as the bedroom, there is complexity and contradiction. The rounded window and the sharper lines of the ceiling are creating a contrast in the design (Schwartz 1992).



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4.3 ALVAR AALTO: VILLA MAIREA (1938-39)

(Davies 2006, Weston 1999, Weston 1992, Pallasmaa 1998, Lahti, Jetsonen 2005)

4.3.1 Structuralism

Keywords: Proportion and order, Form and material, Detail and unity

There is no clear proportion or order when looking at the façade drawings of *Villa Mairea* [ill.175], but there are clearly rhythmical elements and order in relation to background and foreground that cause the materialised house to appear simpler than its elevation drawings [ill.176]. However, the plan is quite simple in its composition; it has a simple L-shape, with a central entrance hall and the larger wing for the family rooms and the smaller for staff, offices and guests [ill.174]. The villa, like Utzon's house in Hellebæk, relates to different architectural traditions – the Finnish, the Japanese and the Modernist [ill. 169-170] – but it also has a foundation in Aalto's rationalist manifesto from 1930 *Our Housing Problem*, which is particularly evident in the flexible spaces of the ground floor. The spaces are delicately interconnected through materials, flows and well elaborated transitions between inside and outside, private and public. Unlike the *Vanna Venturi house*, every shape of the house seems to have been born together with the material of which it is made. Light organic constructions, protruding bay windows and columns of wood stand as contrasts to the large and heavy white main body of the house [ill.171]. Brick walls sometimes break out of the white mass as reminders of what is beneath, and wood, tiles and rush mats on the floor underline the function of the space. The unity is built on the concept of the simple play of contrast between the soft and the hard; nature and culture, and every part of the building signals this – even the fireplace and the flight of stairs have both elements of hardness and softness [ill.172-173].



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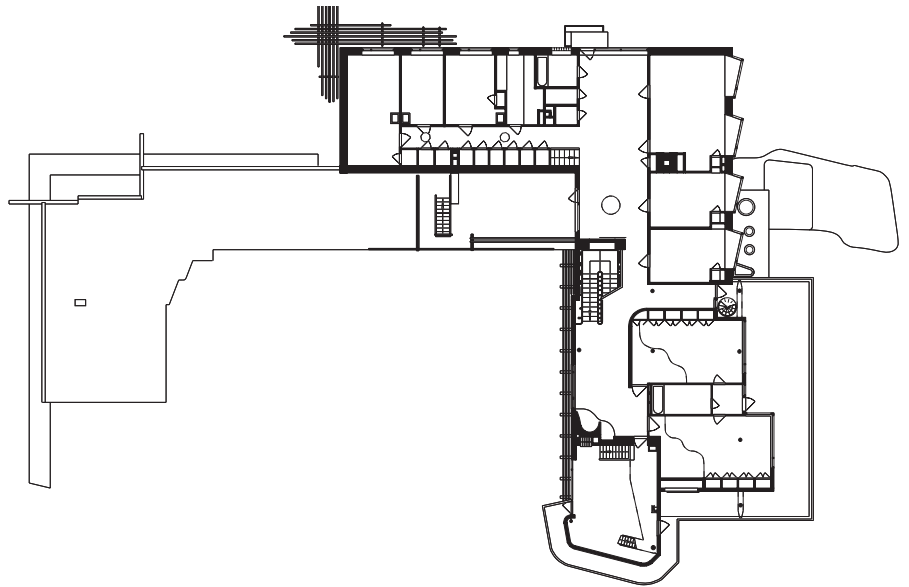


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169. Example of a Japanese space divided by a screen wall (Pallasmaa 1998).

170. The Japanese inspiration can for example be seen in the design of the entrance to the winter garden (Pallasmaa 1998).

171. The bay windows break out of the white plastered brick wall (Lahti, Jetsonen 2005).

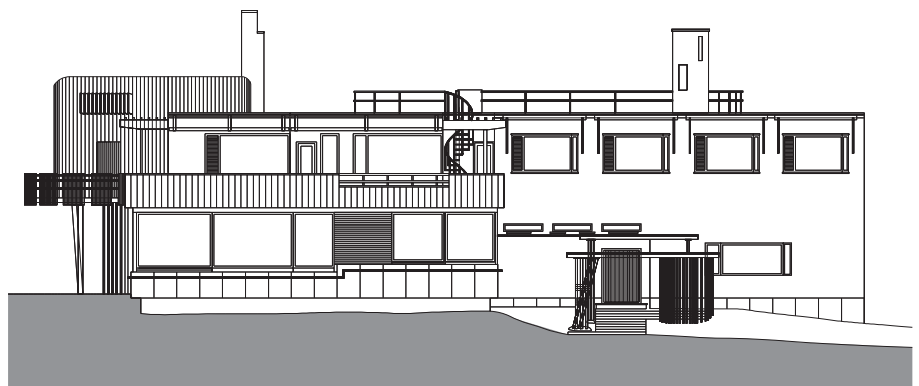
172. The play between soft and hard elements is seen in many parts of the house – for example in the fireplace where the organic and the sharp shapes complement each other (Lahti, Jetsonen 2005).

173. The play between soft and hard in also seen in the concrete use of materials – in the handrail of one of the stairs wood and metal meet to form a robust and elegant finish (Lahti, Jetsonen 2005).

174. The plan is rather simple with its L-shape that holds of one wing for the family and one wing for guests, staff, and offices (Davies 2006).

175. The elevation drawing of the south façade seems quite complex and it does not follow an obvious order or system of proportioning (Davies 2006).

176. The picture of the southern façade seems simpler than the elevation drawing as it has a more clear play between background and foreground which gives a hierarchy and thus order to the façade (Saohide.cocolog-nifty.com 2009).



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4.3.2 Perception Psychology

Keywords: *Unity and variation, Balance and harmony, Dynamics*

The materials – the wood, the white plaster and the tiles – and the play between the sharp and the undulating shapes are the main themes in *Villa Mairea*, and this is also what defines the unity and the variation [ill.178-179]. In every element, as well as in the total experience, there are elements of sharpness and elements of softness [ill.180-181]. In the main façades there are the angular boxes that tie the building to the ground and the softly curved northwest wall that lifts the building and adds to the dynamics of the exterior [ill.177]. In the smaller elements of the building this can for example be seen in the shaping of the fireplace or the composition of the stairs, as previously mentioned. This constant, but delicate, play between contrasts – such as heaviness-lightness, light-dark, angular-organic – gives the building its dynamics, and variation, but within a certain field which makes *Villa Mairea* seem well balanced and harmonic.

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177. The boxes of the composition draw up the horizontal lines, whereas the curved western wall lifts the composition vertically (Lahti, Jetsonen 2005).

178. The contrast between wood and white plaster is a main theme in Villa Mairea. In this example the wood is used modular and angular, whereas the plaster is shaped into an organic design (Pallasmaa 1998).

179. Stone, plaster and bricks, breaking out of the plastered wall – the variation of soft, natural stone and angular bricks give a variation to the composition (Pallasmaa 1998).

180. Organic and angular, soft and hard, wood and plaster – a section of the house capturing the main themes (Lahti, Jetsonen 2005).

181. The massiveness of the organic handle and the lightness of the modular wooden lamellae give the door a complex, but well balanced expression (Lahti, Jetsonen 2005).



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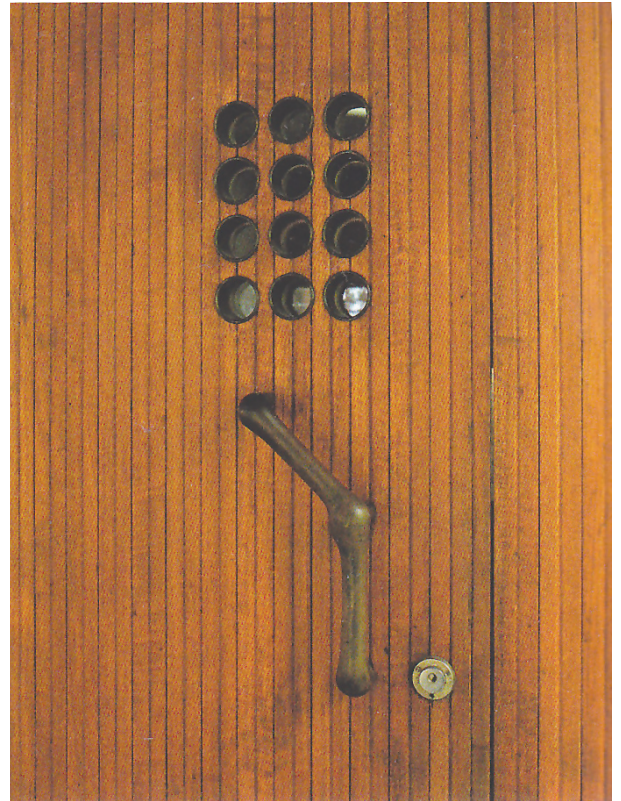


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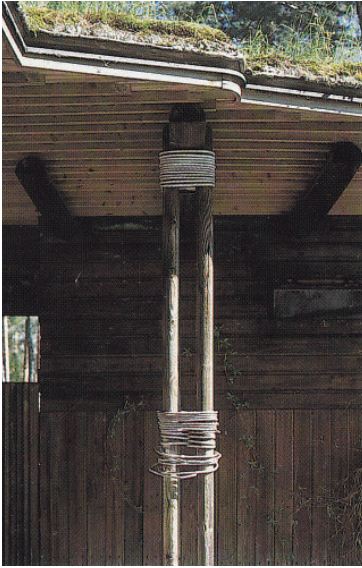
4.3.3 Phenomenology

Keywords: *Relation to cultural/personal framework of understanding, Support of a multi-sensory experience, Relation to context*

Aalto had, in his design of *Villa Mairea*, good possibilities of adjusting the house to the needs and wishes of the users, as those were good friends of his. The house is also, just like Utzon's house in Hellebæk, built specifically for the site, the region, and the time; it has its foundation in the newly born modernism, however, it also has influences from many other places, such as Japanese architecture [ill.183], but those are integrated into a framework and a concept through which the specifically regional matters shine through, as well as the style and needs of the inhabitants. Even if there is no overall visible order in the façades, there are many kinds of repetitions and rhymes, which give the façades rhythm and order in a less classical way. The bay windows, in the larger scale, and the vertical wooden cladding, in the smaller scale, break the smooth, white plastered surfaces with soft, but yet firm, rhythms [ill. 182]. When moving closer to the building, even the plastered surfaces have a rhythm that they inhere from the underlying bricks from which the walls are built, which gives an understandable and tactilely more interesting surface [ill. 184]. Seen from the outside many different contrasts are at play – the dark wood against the white plaster; the porosity of the wooden claddings against

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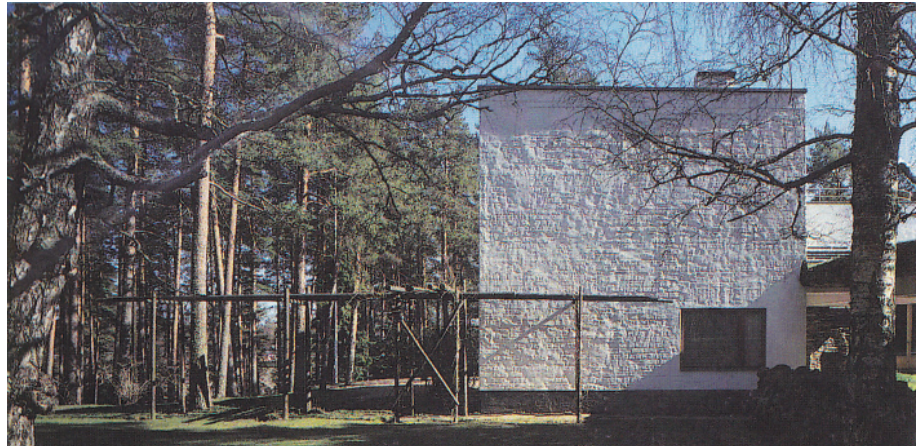




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the massive plastered walls; the angularity and the undulation; both in relation to sight and the sense of feeling. By using the materials as strong architectural elements and letting them speak and give character to the different rooms, you cannot look at pictures of the house without getting a desire to get into the house and touch the different materials and shapes, and experience it with more senses than just your eyes; to for example sit and smell the combination of wood, stone, rush mat, water and greenery of the winter garden [ill.185], to walk on the smooth wood of the flight of stairs, and feel the bound timber construction of the sauna. The surfaces have so many details and embedded structures that you feel the urge to get closer – or farther away – to move around. Even though the house has its foundation in many different traditions, the main themes are constant, in the details as well as in the total experience, and it thus does not seem shattered but rather a strong and coherent unity.

182. The façades do not have a clear order, but are filled with rhythms and rhymes. In the southern façade the bay windows create a rhythm across the smooth plastered wall (Pallasmaa 1998).



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183. The column construction of the sauna has similarities in Japanese architecture with the joints and reinforcements of wooden twigs (Pallasmaa 1998).

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184. Through the plaster it is possible to sense the structure of the underlying bricks, which gives an understanding of the construction and a tactilely rhythmical experience (Pallasmaa 1998).



185. The winter garden – you can almost smell the rush mats, water and greenery, and clearly sense that a visit would give a much deeper experience of the room (Pallasmaa 1998).

4.4 COMPARISON OF THE ANALYSES

	<p>STRUCTURALISM: <i>proportion and order</i> <i>form and material</i> <i>detail and unity</i></p>
UTZON'S HOUSE IN HELEBÆK	<p>Everything in the house is built up around a module of 120 mm; bricks, boards, doors and walls. This gives a strong unity of all elements in all scales. The façades are quite simple, long and low, but they are lightened by well-placed shifts in levels and planes, which create deliberate play in the building. The building is built in bricks, wood and glass; and every material is used in a logical and clear manner. The bricks are also treated differently according to the different functions that they have.</p>
VANNA VENTURI HOUSE	<p>Proportion and order are not the main focus points in this house, which should rather signal complexity and contradiction. The house has quite simple, almost archetypal, outlines both in façade and plan, however many contradictory elements are added to the composition; in the façades the window in the 'chimney' is one example and in the interior, the fireplace and the stairs could be mentioned. Every element is a formal design in itself, and the relation to other elements, materials etc. comes second.</p>
VILLA MAIREA	<p>When looking at the elevation drawings, there are many elements and lines, and it is difficult to see a clear order or system of proportion, but in real life the rhythmical repetitions and interplay between foreground and background make the façades well balanced and simpler than their drawings. The plan is simple and the layout logical and well ordered. Form and material are inseparable in Villa Mairea and the contrast between weight and lightness, soft and hard is reflected in all elements, and in all scales.</p>

Through these overall analyses it can be seen that all three buildings contain architectural qualities, as all they all fulfil many of the keywords from the three theory clusters. Utzon's house in Hellebæk and *Villa Mairea* actually fulfil almost all the keywords, whereas *Vanna Venturi house* is more shifting and does not fulfil all the full set of keywords from any of the categories. The main 'problem' in Vanna Venturi house is the lack of relation to a larger whole due to the sharp focus on the compositional matters of complexity and contradiction. This larger whole is in the structuralist view related to *form and material*, and *order and proportion*, in perception psychology to *balance and harmony*, and to all the keywords in phenomenology. The strengths of the other two buildings are the wide range of aspects taken into consideration in the design; the

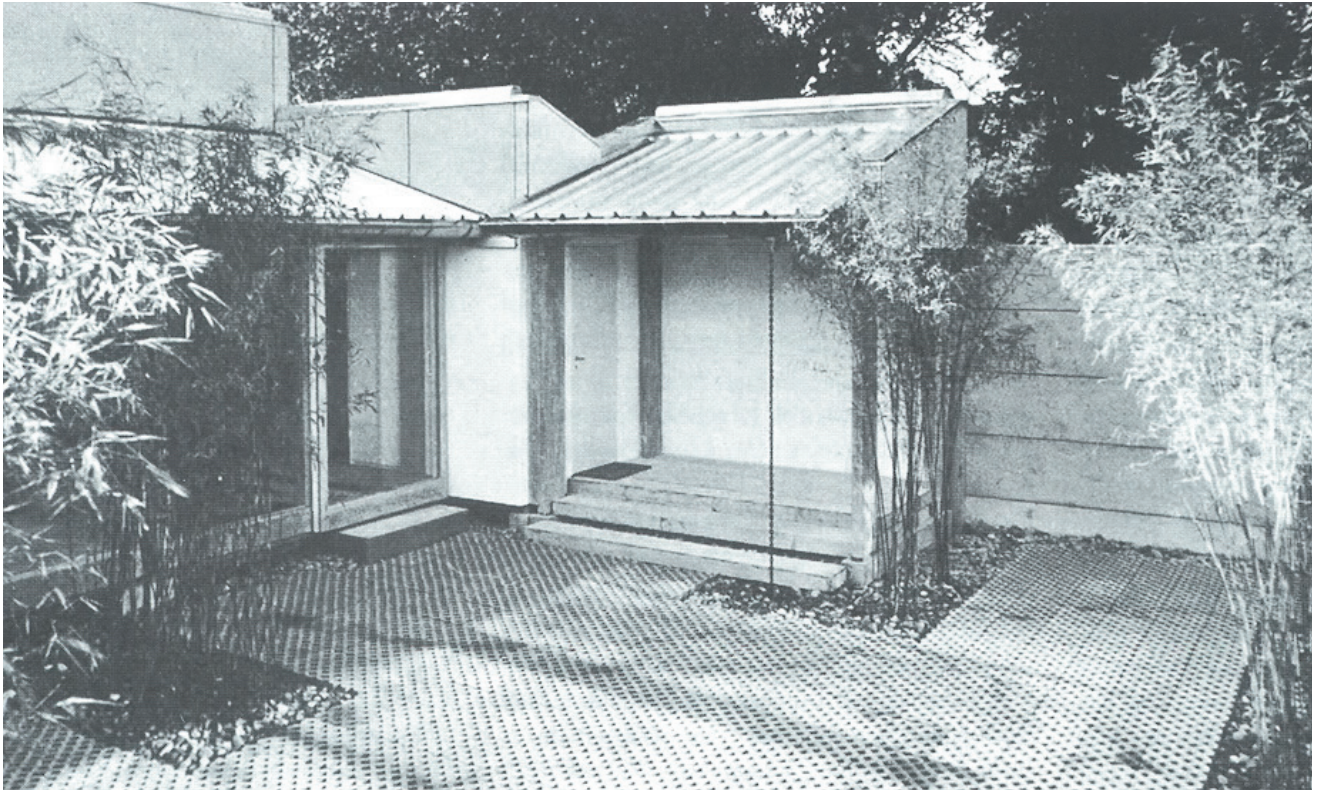
PERCEPTION PSYCHOLOGY: <i>unity and variation</i> <i>balance and harmony</i> <i>dynamics</i>	PHENOMENOLOGY: <i>relation to cultural/personal framework</i> <i>supporting a multi-sensory experience</i> <i>relation to context</i>
<p>The building has a strong formal theme that is followed rather strictly; however there are small variations that work against predictability and static expression. The play between the heavy bricks and the light and changeable glass, and the fact that you cannot see and comprehend the totality of the building from one single spot, creates a desire to move around both in the exterior and interior, which adds to the dynamics of the building. But the building is well balanced as for example seen in the discrete play in the bonds of the bricks and in the fine composition of horizontally orientated heavy walls and the vertical and lifting wooden columns.</p>	<p>The house is one of the first modernist houses in Denmark, but even though the foreign influence is obvious, it is also well rooted in the Danish building tradition. This can for example be seen in the use of the materials and the care for simple and human solutions and details, as well as the strong sense of place. The materials are used according to their qualities and adjusted to the functions that they have; therefore, the house gives an opportunity for a multisensory experience and an understanding of the house in many different layers. The house is clearly designed for the site, which can for example be seen in the orthogonal interpretation of the undulating site in the terraces and the rhyming of the black wooden columns and the trunks of the surrounding woods.</p>
<p>The play between unity and variation seem to be a central theme in this house – however not in a traditional way, but through a constant tightrope walk between archetypal simplicity and the dynamics of contradiction and complexity. Balance is highly weighted in the single elements, but the composition as a whole has some clashes, such as the relationship between the fireplace and stairs, which lacks hierarchy, but balance is then reached in the main composition through open areas that make up for the dense area around the fireplace and staircase.</p>	<p>The building definitely relates to the archetype of the house, which makes it easy to understand it as such, but it also includes formal contradiction to the same, for example when cutting a whole in the chimney to make it hover. The house offers a multi-sensory experience to some extent, however not consequently as a result of the formal focus and the idea of designing each element more or less in isolation. This also leads to the relation to the context, which is obviously not an important aspect as the elements do not even relate to each other internally in the composition.</p>
<p>Villa Mairea has both a simple and varied expression as the play of contrasts is consequent and balanced. The sharp and the undulating shapes are found in different combinations in all elements, and in all scales of the house, which gives a harmonious and well balanced unity. Dynamics occur through the variation and contrasts, through rhythmical repetition and undulating movement.</p>	<p>The house is built specifically for the site and for the users, and the process of developing the right design took several years. The design mirrors both international styles, such as the modernistic current, and the Japanese building tradition, but it still has roots in the local and regional community, the specific site and the users. There are many possibilities of getting a multisensory experience in Villa Mairea – pictures are not sufficient; you want to go there, to feel the tiles and the wood, smell the dampness of the woods, and the sense the cold of the stone.</p>

concrete, near context – the site – but also the relation to materials, users, to cultural aspects, and to stylistic currents. The simplicity and clarity in their design also gives them credit in relation to several keywords – especially in perception psychology and structuralism. Phenomenology on the other hand is more abstract and therefore also leaves more space for interpretation and subjective aspects and beholdings. These wider perspectives cause architecture to expand and place it in a larger context than the one of pure aesthetic composition and evaluation. This kind of perspective therefore also relates to more stylistic matters, which especially the theory of perception psychology does not include. This might be the reason why there are no examples of perception psychological architecture. It is possible to use perception psychology as a tool for

analysing the basic compositions of spaces, shapes and colours. However, in order to make it useable in the sphere of architecture, it is necessary to add more to the analysis in order to get a fuller overview of the architectural quality. On the other hand, it is important to be aware of the stylistic statements in the theories that include more subjective matters. These might be able to give a different perspective of the quality of a building, but the identified qualities might then reflect momentary values related to a specific time, place, or group of people. In order to understand the full quality, then, it is also necessary to build an understanding for those specific times, places or groups of people. A full overview of the architectural qualities of a piece of architecture is thus not considered to be possible to present. What is important is instead to clearly identify the point of interest and then elaborate on that specific field using as many relevant theories as possible in order to open up the wider perspectives hidden inside that delimited field. Within this elaboration the matters of *objective / universal experience*, *subjective experience* (personal abilities, needs, dreams, memories and associations), and different *contextual factors*, such as culture, style, economics, society, technology and site (common abilities, needs, dreams, memories and associations) should all be covered. Universal architectural quality is therefore not a realistic measure as the reduction to objective statements will, inevitably, cut away for example subjective associations and cultural heritage. On the other hand, an attempt to define a more subjective system of measurement will involve an evaluation dependent on time, place, technology and culture, which are variables and thus momentary. In the next chapter, prefabricated wooden dwellings in a contemporary Danish context will be analysed with this same method. This will lead to a discussion of what architectural quality is *in relation to* prefabricated wooden dwellings in this context, but trying to define what the architectural quality of such buildings is in relation to any generic method, theory or definition is not found to be a rational and manageable aim for this project.

4.5 CONCLUDING REMARKS

- In this chapter, the three theoretical clusters are compared through analyses of three dwellings that are often mentioned in architectural literature as good examples, and are thus considered to possess some kind of architectural quality; Jørn Utzon's own house in Hellebæk, Robert Venturi's *Vanna Venturi house*, and Alvar Aalto's *Villa Mairea*.
- These analyses should both clarify the commonalities and differences between the three theoretical clusters and form a frame of reference for the further discussion of architectural quality in prefab wooden dwellings.
- It is suggested that the theories and keywords can be summarised on an overall level in three factors; ***objective / universal experience***, ***subjective experience*** (personal abilities, needs, dreams, memories and associations), and different ***contextual factors***, such as culture, style, economics, society, technology and site (common abilities, needs, dreams, memories and associations).



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5 ANALYSIS OF ARCHITECTURAL QUALITY IN DANISH PREFAB WOODEN DWELLINGS

5.1 CLARIFICATION THROUGH EXAMPLES – DIFFERENT TYPES OF PREFAB WOODEN DWELLINGS

In chapter 4 dwellings that ought to have some kind of architectural quality were investigated in order to clarify the model and set up some reference points for the further discussion of architectural quality in prefab wooden dwelling. The three analysed dwellings are all built for a specific site, and a specific person or family – persons, moreover, who were well known to the architect; Utzon built for himself, his wife and children, Venturi for his mother, and Aalto for personal friends. This chapter deals with buildings which, in their basic system or shape, are not designed for specific inhabitants, but are, in order to utilize the advantages of a prefab process, sought to be generalised to suit many different contexts and customers. The main question is of course if this affects the architectural quality of a dwelling – and if it indeed has some effects; how can these then be seen or experienced? The discussion then moves on to the question of how it is possible to work with architectural quality in prefab wooden dwellings and get the maximum out of both the prefab production and the architectural values. These questions are related to the fourth loop of this PhD, which has the aim of defining *guidelines for a focused and coherent discussion of contemporary Danish prefab wooden dwellings*.

In this chapter the different types of prefab houses will be looked at in order to detect advantages, disadvantages, and potential in different building and design systems. Through this analysis of prefab wooden dwellings, two of the Danish modernist prefab prototypes will be looked at, which are both open systems; the panel building system *Espansiva* by Jørn Utzon [ill.186] and the room sized building block system *Kubeflex* by Arne Jacobsen [ill.187], which have both been mentioned earlier in the thesis as architecturally (but not commercially) good examples of prefab wooden dwellings. The next example is a more closed, but quite popular,

186. *Espansiva* by Jørn Utzon, an open 2D element building system (Espansiva-Byg A/S 1971).

187. *Kubeflex* by Arne Jacobsen, an open 3D element building system (Trapholt 2009).



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standard house; the *ONV house* [ill.188] drawn by *ONV architects* and at the moment administered at the Danish market by the company *M2*. This is also, as earlier mentioned, a house built with 3D room sized modules. A fourth interesting example is *Boase* by the architects *Force 4* [ill.189], which is an experimental wooden building concept for semi-collective city-life on polluted building sites. This project is also a rather closed system – however it uses wood as a more aesthetically leading material than most other

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188. ONV house by ONV, a closed 3D element prefab dwelling (Photo: Ida Wraber).

189. Boase by Force4, a closed 2D element prefab dwelling unit (Force4 Architects 2009).

190. Example of prefab wooden dwelling by the house producer Hjem – the Largo house (Photo: Ida Wraber).

contemporary Danish prefab projects. Mass-customised houses such as *Willa Nordic* will not be included as those are seen as unique buildings with respect to the aesthetical framework since it is only the detail solutions that are standardised. Through the analysis of these four building systems, the discussion will circle around how the openness and closedness of the projects (concretely and potentially) affect the architectural quality of the dwellings, and how wood can be used differently in prefab wooden projects. Hereafter (in chapter 6) there is a more detailed case study of the cooperation between the housing company *Hjem* and the architectural firm *AART*, which represents the fifth loop of this project and should lead to *a clarification of the possibilities of application of the theoretical model to a concrete development process*. First there will be a description and analysis of the methods and tools used through the early stages of the design process in the cooperation between *Hjem* and *AART*, which was intended to develop a common understanding of the concept of architectural quality and a common aim for the house as a whole. Thereafter *Hjem's* three housing types will be analysed [ill.190]. They are all rather closed 2D building systems, and the aim of the analysis is to see the development from the first original *Hjem* house – *Uno* – drawn by a newly examined local architect, to the later examples – *Nova* and *Largo* – that have been through a thorough process of development with running discussions of the matter of architectural quality. Through these analyses, the aim is to get a wide foundation for discussing pros, cons and potential of drawing and building Danish prefab wooden dwellings and the methods and building systems used in the process of development and building those.

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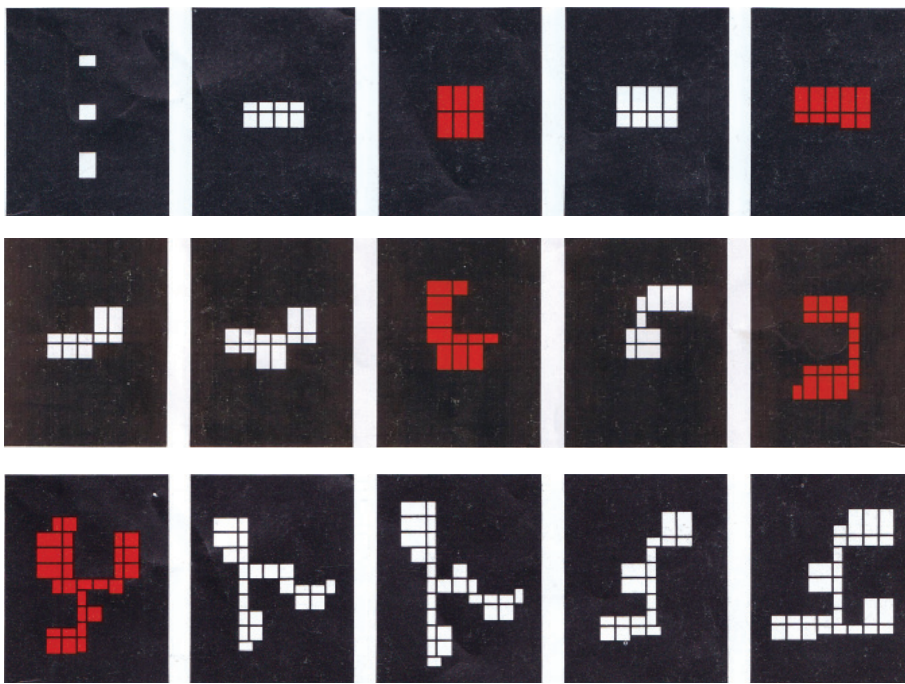
5.1.1 Jørn Utzon: *Espansiva* (1970)

(Utzon 1970, Weston 2002)

Structuralism: *Proportion and order, Form and material, Detail and unity*

It is difficult to speak of proportion and order in relation to *Espansiva* as it is a non-static matter, in comparison to the three dwellings from the previous chapter; it can be constructed as (1) a one wing house with different roof compositions, (2) houses with an angle or a courtyard, or (3) a house with multiple wings [ill.191]. From the plan drawings of the examples in the *Espansiva* sales catalogue, it can be seen that the complexity in proportion and order grows from the first of these three mentioned types to the last. The corridor is the linking element that ties the pavilions together,

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191. *Espansiva* can be composed in numerous ways and therefore it is difficult to speak of the specific compositional matters. The top row shows houses with one wing, the second row shows houses with an angle or courtyard, and the third row shows houses with multiple wings (Espansiva-Byg A/S 1971).

192. The façades can be very simple, symmetric and traditional (Espansiva-Byg A/S 1971).

193. The façades can also become quite complex with different heights, pitches of the pavilion roofs, façade panel composition etc. (Espansiva-Byg A/S 1971).

194. One large pavilion – or one smaller pavilion plus the width of a corridor – match the golden section ratio and seems well proportioned (Basic graphics from (Espansiva-Byg A/S 1971)).

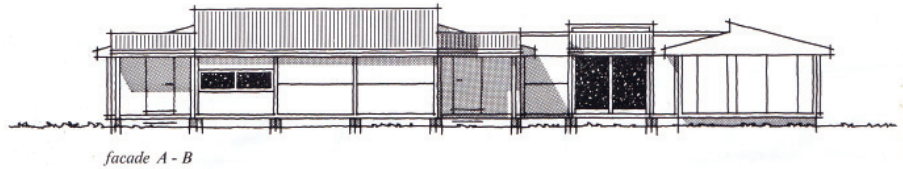
195. *Espansiva* can be used to create dwelling areas that are both coherent and varied as it is an open and flexible building system (Utzon 1970).

196. The joints are clear and exposed, which gives an understanding of the logics of the construction, however, the interior cladding is put on in a slightly peculiar way with diagonal lines which are not found elsewhere in the design (Espansiva-Byg A/S 1971).

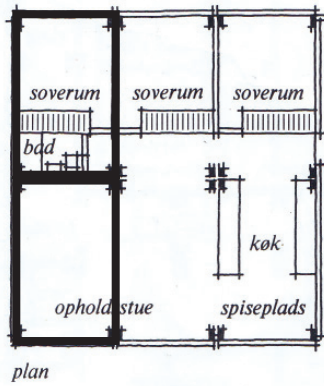
which gives a visual order as those two elements form a recognisable pattern – at least in the floor plan. The dimensions of the single pavilions are well proportioned; the large pavilion in itself and the smaller pavilion together with the corridor element have, seen from above, proportions matching the golden section ratio [ill.194], and seen in elevation, the façades of the pavilions are also well composed viewed as single units. However, as the user can freely decide how the pavilions and panels should be put together, the overall order and proportion can vary widely as can be seen in the two façades in ill.192-193; one is austere with only one window, whereas the other is complex with different pitches, panels and heights. The differences in height are due



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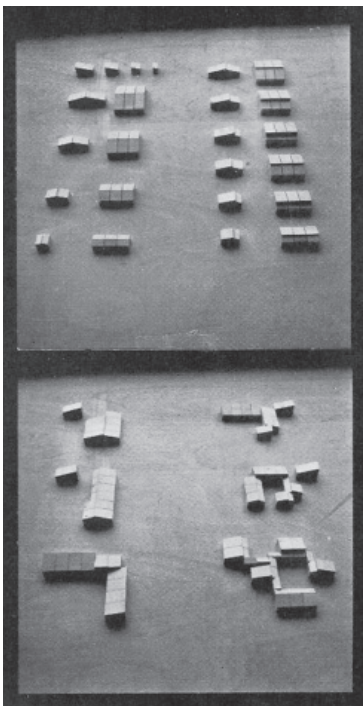
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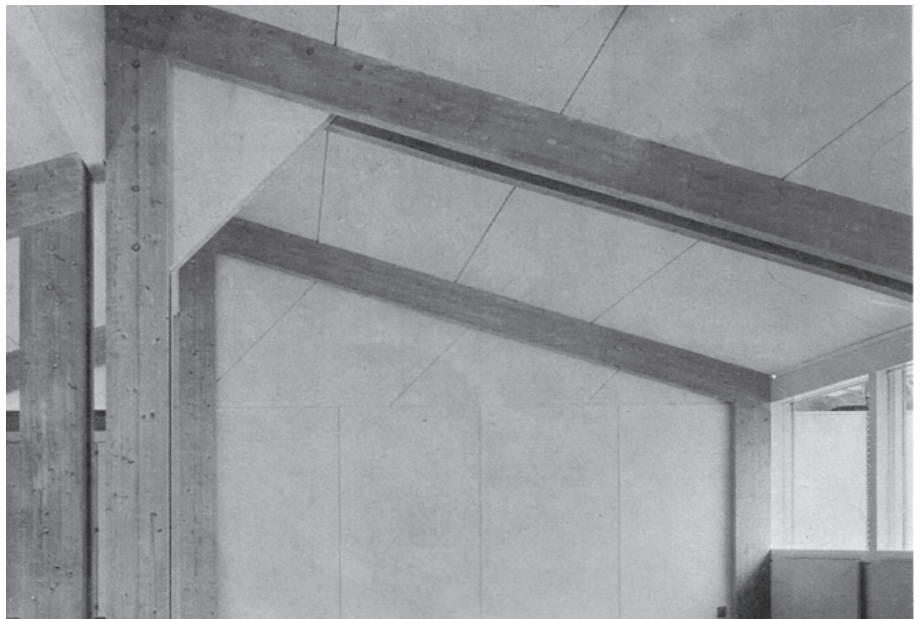
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to the varying depth of the pavilion elements as the roof pitch is seventeen degrees on all pavilions. Form and material are quite closely connected. The wooden frames that make up the basic construction of the building system are also used as visual elements, and the joints are simple and exposed. However, the interior cladding is put together in a slightly odd way, adding a diagonal line that seems misplaced in the otherwise simple expression [ill. 196]. For the envelope of the building, boards of plywood are used with different kinds of openings or whole window panels. The light boards and the large openings underline the lightness of the underlying construction. There is a clear line in the building system of *Espansiva*, and there are logical rules for how the different pavilions can be joined together into a composition. Details as well as unity are simple; however, the multiplicity of elements available gives the possibility for quite complex designs. On the other hand, the system can provide a foundation for constructing whole building areas with dwellings for many families within a certain framework in relation to form language [ill. 195], but with great possibilities for creating variation with little effort and within the framework of one single building system.

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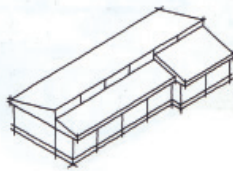
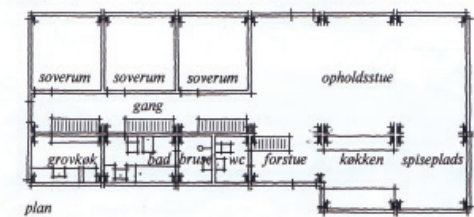
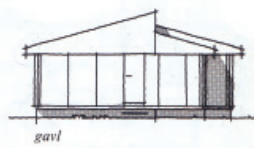
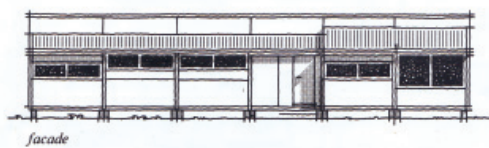


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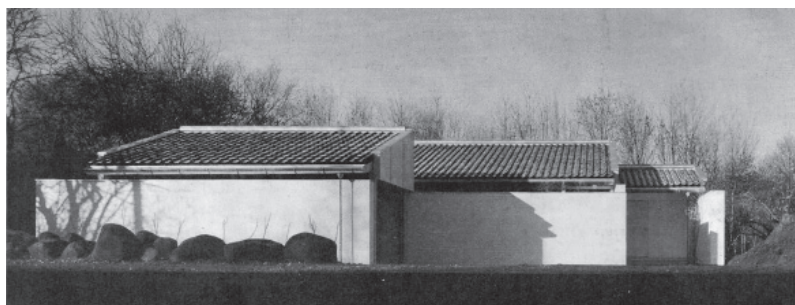
Perception psychology: *Unity and variation, Balance and harmony, Dynamics*

Espansiva has, as indicated through the former section, good possibilities for creating both unity and variation with its large amount of simple building elements – however, it does not have a controlling pattern or limits that ensure a balanced and harmonic composition. The user is free to put the pavilion together as he pleases and clad them with as many different panels as he finds suitable [ill.199]. As can be seen in the drawings from the sales catalogue, the varied panel compositions are put onto the more simple solutions, whereas the simple panel compositions are put onto more complex main forms [ill.197, 200-201]; however as a non-architect, it could be difficult to have a clear overview and a possibility to detect the problems of unity and variation in the planning and buying phase. The system can therefore potentially give a quite varied, but also quite chaotic, expression. A dynamic expression is achieved through the varying types of roof pitches, which are combined in different manners and can be seen both in the interior and the exterior, but also through the possibilities of composing dynamic patterns of movement in the layout and interesting plays of foreground and background in the façades [ill.198]. However, these are only part of the system's potential and one can also compose a building with only the dynamics of the pitched roofs, and a static floor plan and façade.



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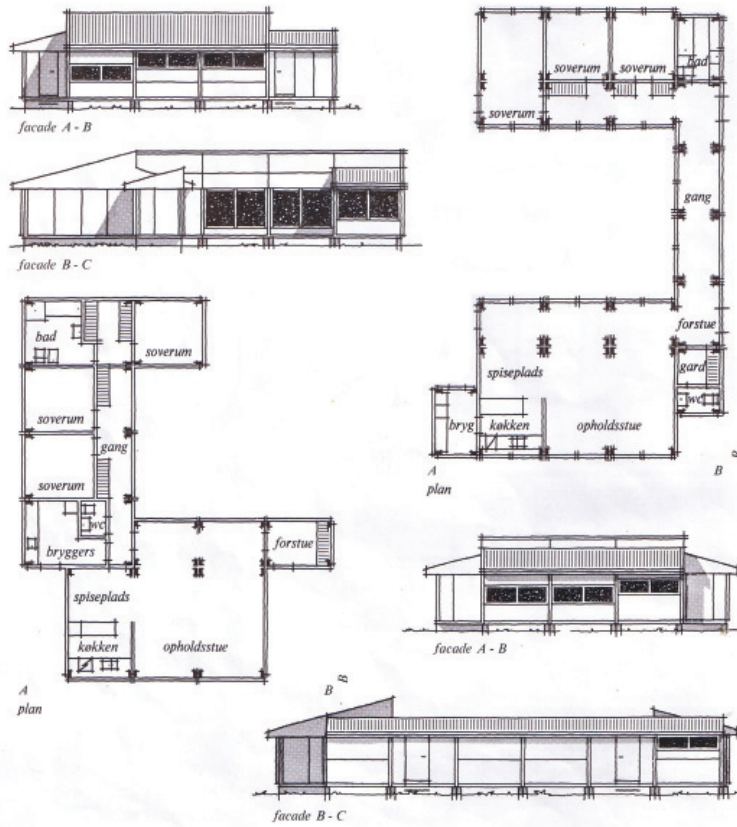
197. Example from the *Espansiva* sales catalogue of a simple main form that have a more complex panel composition with windows in different heights and formats (Espansiva-Byg A/S 1971).

198. With the flexibility in the putting together of the pavilions, it is possible to create an interesting and dynamic play of foreground and background. In this example, which is a prototype of *Espansiva*, the walls of the pavilions furthermore have a brick facing that can be used in combination with the lighter panels (Utzon 1970).

199. There are a wide range of different panels that can be used as claddings for the *Espansiva* pavilions (Espansiva-Byg A/S 1971).

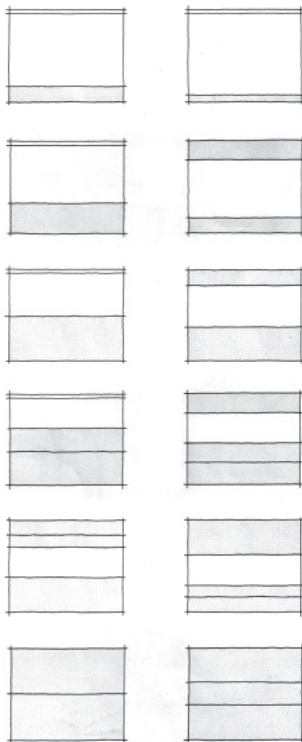
200. Example from the *Espansiva* sales catalogue of a medium complex main form with a medium complex panel composition (Espansiva-Byg A/S 1971).

201. Example from the *Espansiva* sales catalogue of a complex main form with a rather simple panel composition (Espansiva-Byg A/S 1971).

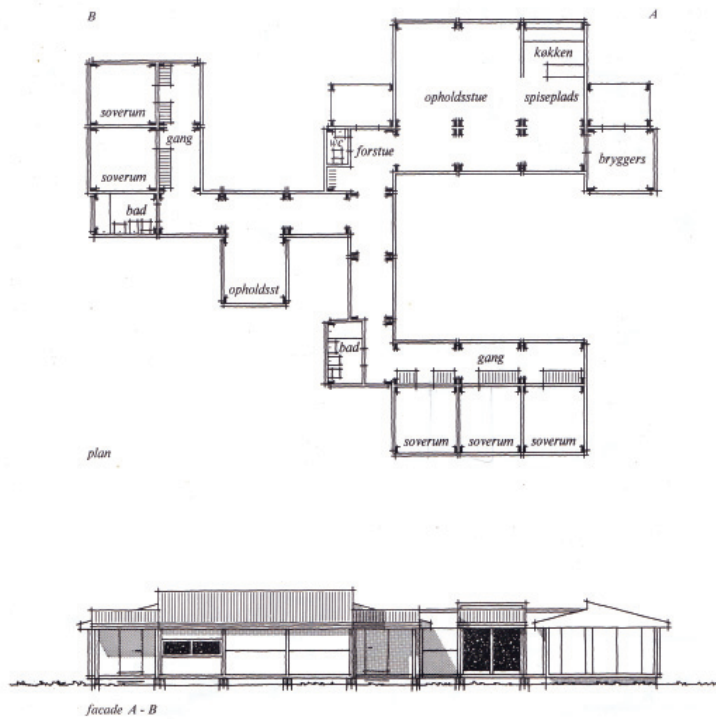


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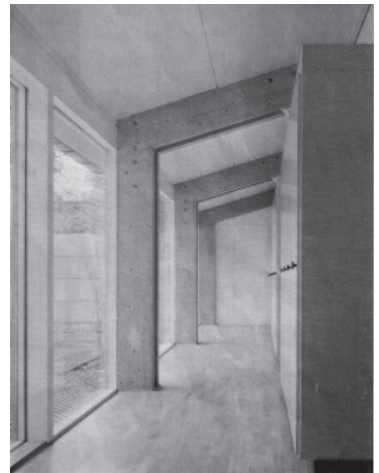
Phenomenology: *Relation to cultural/personal framework, Supporting a multi-sensory experience, Relation to context*

The house is based on an investigation of different dwelling typologies through history and the column-beam construction is chosen as it, for example, can meet the demand of flexible façade solutions. It is then split into modules in order to achieve flexibility in the floor plan as well. The expression of the house seems more Asian, or Japanese, than Danish with the corridor running along the façades and tying all the rooms together, and the exposed wooden elements that are not very common in Danish contemporary building [ill.204-205, 208-209]. However, if comparing with other houses by Utzon, for example his own house in Hellebæk discussed in chapter 4, this is not an uncommon style of composition and it could therefore also be seen as part of the architect's personal mark or style [ill.207]. The composition of the façades, on the other hand, draws associations to common Danish dwellings of the time with the one-sided slope of the roof and regular window composition – and in the prototype in Hellebæk it is even complemented with white plastered brick walls that give clear associations to common Danish dwellings [ill. 198, p.134]. In relation to multi-sensory experience, all materials are raw and exposed to the eye as well as the hand and nose, which potentially gives a varied and multilayered experience when moving around the house [ill.202-203]. When only plywood boards are used as cladding both on the inside and the outside, there is not as much variation in the multisensory experience as when it is complemented with the brick wall. On the other hand, the brick wall veils the light construction of the house and thus has other problems in relation to the phenomenological perspective. Due to the many possibilities of putting the pavilions and panels together [ill.206], there are good possibilities of customising the dwelling to a specific site and user – the question is, however, if the user is able to assess the potential and pitfalls of the system, and how the architectural quality can be ensured as the rules of composition are rather vague and the possible combinations countless.

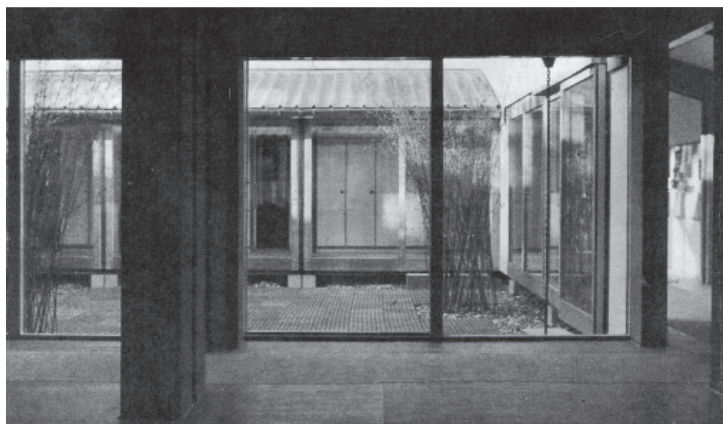


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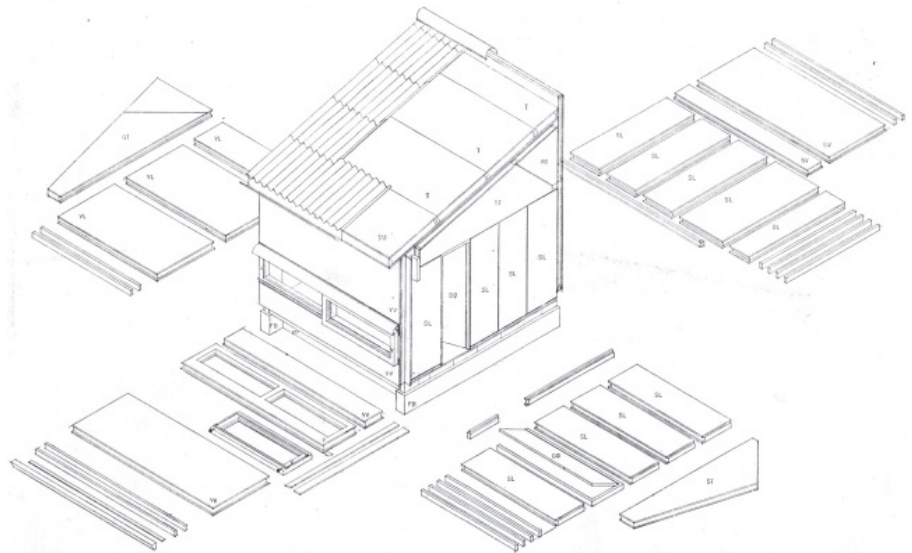


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202. The wooden frame constructions of the pavilions are exposed to eye, nose, and hand around the entrance in the exterior (Espansiva-Byg A/S 1971).

203. In the interior the wooden frame constructions are exposed everywhere which gives good opportunities to sense the materials and logics of the building (Espansiva-Byg A/S 1971).

204. Photo from Espansiva with clear similarities with Japanese architecture in relation to room sequence and materials (Utzon 1970).

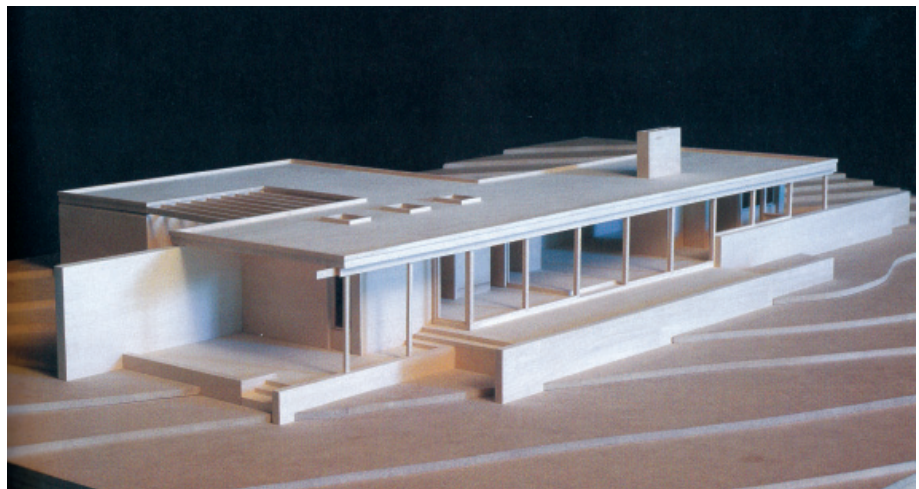
205. Photo from a traditional Japanese house with façades that open up towards an interior central courtyard, as also seen in Espansiva (Photo: Ida Wraber).

206. The building system consists of 3D elements in the shape of pavilions and a wide range of 2D elements that are used as cladding, which together make up a very flexible building system (Utzon 1970).

207. The Japanese inspiration can also be seen in others of Jørn Utzon's houses, for example his house in Hellebæk, and it could therefore also be seen as a trademark of the architect (Keiding, Dirckinck-Holmfeld 2004).

208. An interior courtyard where the Japanese inspiration is clearly visible (Espansiva-Byg A/S 1971).

209. Example of a traditional Japanese interior courtyard with similarities to Utzon's Espansiva prototype building (Photo: Ida Wraber).



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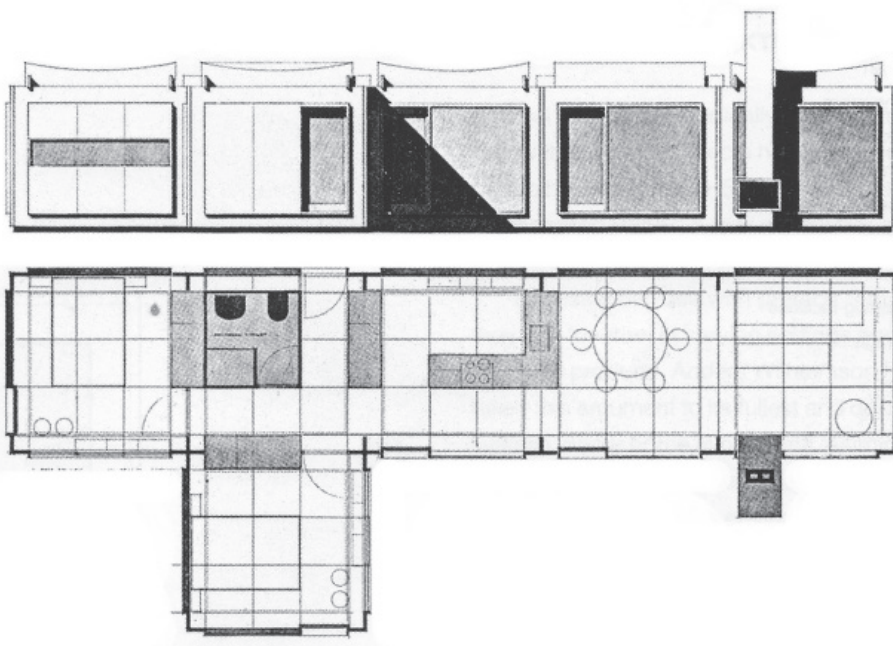
5.1.2 Arne Jacobsen: Kubeflex (1970)

(Åberg, Stenberg 2005, Trapholt 2009)

Structuralism: *Proportion and order, Form and material, Detail and unity*

The *Kubeflex* system is designed as a summer house that can expand in relation to needs and economy. It is very simple in its basic shape with a plan of ten square metres [ill.210] and a wooden framed façade with a hole that can be filled with seven different panels – both transparent and solid in different combinations – which makes the system flexible but less complex than *Espansiva*. The three-part panels of the façades create a play in the otherwise very calm façade composition, and they also add a vertical movement, which is also achieved through the chimney that lies on the outside of one of the boxes [ill.211]. The frames are made of laminated wooden elements, but are painted in a green colour which veils the material properties. However, it is not clad by other materials, so when getting closer, it is possible to touch and investigate the actual construction material. The solid panels are on the inside plaster boards and on the outside light fibre-cement boards, the lightness of which is underlined by the horizontally oriented windows [ill.212]. The house is simple in its details and in its possibilities of composition with only seven different panels available in a coherent design. The possible combinations are also fewer than in *Espansiva* due to the larger and simpler basic element that ensures coherency in the design.

210



210. *Kubeflex* is very simple in its basic shape with a square floor plan and a wooden framework into which seven different panels can be inserted (Åberg, Stenberg 2005).

211. The three part panels give the opportunity of adding a vertical movement to the façades, as seen in for example the short façade of this house. The chimney, which can be seen further back in the picture also adds to the verticality of the otherwise horizontal building (Trapholt 2009).

212. The lightness of the panels that fill the wooden framework is for example clearly seen in the interior where horizontal windows stretch form corner to corner of a room. The wooden framework is painted light green which means that it is not immediately obvious that the construction is made of wood; however the constructional system as such is easy to detect and comprehend (Åberg, Stenberg 2005).



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Perception psychology: *Unity and variation, Balance and harmony, Dynamics*

The sense of unity is dominant in *Kubeflex*, however, there are a few possibilities of achieving variation, such as through the combination of different panels and the application of vertical lines by using the three partite panels or applying a fire-place with a slender, black chimney. If not using these vertical elements or applying a homogenous set of panels to the frames in combination with a completely linear layout, the building might achieve too little variation and thus seem boring [ill.213]. The room sized units in themselves are well balanced in their simple expression and the possibilities of combinations will ensure balance and harmony [ill.214] – the worst that could happen, compositionally, is probably that the building volume gets rather long in relation to its height. Dynamics is mainly accomplished through the play between verticality and horizontality – through the placing of doors, windows and the chimney [ill.215]. The small ‘hats’ on the roof also indicate a slight concave movement; however, these are hardly seen when not looking at the house in pure elevation such as in a drawing.

213. The sense of unity is strong in Kubeflex and if not using the vertical elements available through for example the panel, the variation can become rather low. In this façade the surface and rhythm are broken in a non symmetric manner by the entrance door, which creates a tension in the composition (Trapholt 2009).

214. The interior spaces are also rather calm in their expression and the tension lies primarily in the contrast between opened and closed surfaces, as seen in for example the living room of this Kubeflex house (Trapholt 2009).

215. The chimney is an important element with respect to variation in Kubeflex, as the façades otherwise are quite simple and calm in their expression (Trapholt 2009).

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Phenomenology: *Relation to cultural/personal framework, Supporting a multi-sensory experience, Relation to context*

The house was presented at a Danish housing fair in 1970, but at that time the house was a total flop, as it was too radical an architectural experiment. *Kubeflex* does not look like the common contemporary house, possibly apart from the interior materials and the colours, which are rather typical for the 70s with the grey fitted carpets and green details [ill.216]. The frames bearing the house are exposed but are painted light-green, which makes it more difficult to detect the wood just by looking at it, as for example in Utzon's house in Hellebæk and the *Espansiva* system, but through touch it is possible to sense the warmth and softness of the material. Otherwise, the solid surfaces are clad by fibre-cement and plaster boards which do not provide a very varied or interesting tactile experience [ill.217]. The floors on the inside are however covered with fitted carpets, which provide a visually and tactilely soft contrast to the more hard board materials and the large window panes [ill.218]. The system can be put together to meet the premises and needs of many different sites and users, but the concept and the architectural intention remain clear and recognisable through the possible changes and in relation to materials and compositional possibilities the design is quite strict.

216. *The light green colours and fitted carpets of the interior is typical of the time in which Kubeflex is designed, however apart from this the house is rather different from most other houses of this time which might be why it never got very popular (Åberg, Stenberg 2005).*

217. *Apart from the green wooden framework, the walls are mainly clad by fibre-cement or plaster boards, which do not give a tactilely interesting experience (Trapholt 2009).*

218. *The fitted carpets act as a soft contrast to the large hard surfaces of glass and plaster-boards (Trapholt 2009).*

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5.1.3 M2: The ONV house by ONV Architects (2000)

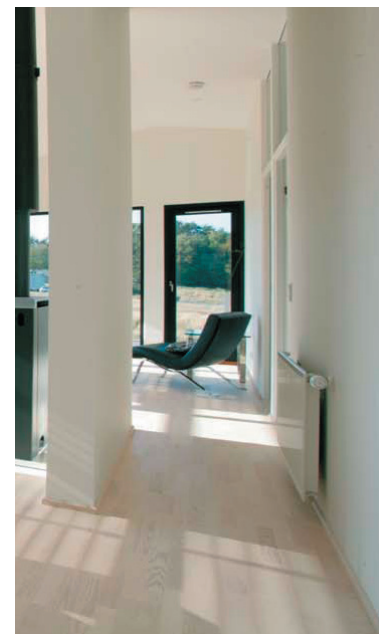
(Kindt 2004a, HP3 , Juul 2008)

Structuralism: *Proportion and order, Form and material, Detail and unity*

The ONV house has a very simple basic shape, especially in relation to *Espansiva*; it is a quite regular box, however, some models have a terrace which is created through a subtraction of material from the main body, and other types have the possibility of adding a wooden terrace on one of the longer sides of the building volume [ill.219]. The façades are well proportioned with both symmetrical and golden ratio proportions, and the windows are only of a few kinds, but not always ordered according to an obvious system [ill.222, 224]. The solid box is the primary theme in the design, but in the models with a terrace within the main body, the lightness of the construction appears clearer, as the box is visually dissolved into a more frame-like construction [ill.225]. The exterior of the house is clad with wood, and the detailing indicates that the construction is light; for example in the large holes into which window panes or slender wooden lamellae panels are inserted [ill.222]. On the inside, however, only the floor is clad with wood and other surfaces are white plaster boards, which does not reveal the light construction of the house, but rather indicates a heavy, massive construction [ill.221]. The details are pure and simple, completely in line with the main concept, as for example seen in the ceiling solution for the canopy over the terrace [ill.220, 223].



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219. All versions of the ONV house are simple in their layout. In some version terraces are cut into the main body and in some versions a terrace can be added along one of the longer façade – this possibility is indicated in the plan drawings through a row of terrace doors along this façade (M2 2008).

220. The details are simple and robust – especially in the exterior – such as for example seen in the corner and gutter solutions (Photo: IdaWraber).

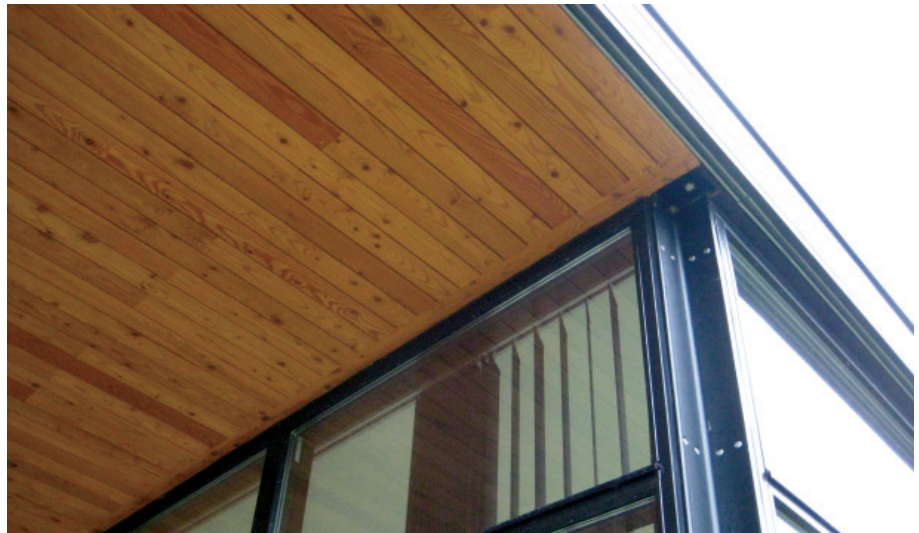
221. In the interior one cannot see that the dwelling is a wooden house, but it rather looks like a heavy construction dwelling. Most surfaces are clad with white plaster boards (M2 2008).

222. The façades are simple and well proportioned. The large windows and the areas of wooden lamellae indicate that the construction underneath the cladding is light (M2 2008).

223. The wooden cladding of the terrace ceiling is robust and simple underlines the main concept of the ONV house (Photo: Ida Wraber).

224. The façades are simple, but the openings are not always placed in an immediately understandable order (Photo: IdaWraber).

225. The basic shape of the ONV house is a simple box with slightly pitched roof, and different styles of terraces – in this case a terrace that has been cut out of the main volume. This also lightens the expression of the box and makes it clearer that it is a light wooden construction (Photo: IdaWraber).



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Perception psychology: *Unity and variation, Balance and harmony, Dynamics*

The simple shape of the building is rather predictable in relation to what happens around the corner [ill.227-228]. The variations lie in the placement of the windows and doors, and subtractions and additions to the basic shape. The unity is therefore very strong in the expression, whereas the variation is just enough not to make it boring to look at – you want to move around corners to see the composition of the next façade, but the surprise is not remarkable. The house is balanced and harmonious in its expression with a strong kinship between the façades, but with a soft play between opened and closed, massive and light. The massiveness and lightness are most visible in the exterior; in the interior the play of light and different views and direction through the house and the contrast between opened and closed are more significant as the house has a closed side and an opened side, and some smaller interesting light inlets [ill.230-231]. The slight slopes of the roofs are not enough to create a concrete dynamic line in the design [ill.226], but the dynamics is more hidden in the composition of the single façades and through the connection of the spaces, just as in *Kubeflex* - especially the largest version of the *ONV house* has a dynamic floor plan with the possibility of circular patterns of movement between the rooms [ill.229]. The patterns of movement in the houses are not clearly drawn up through corridors or the like, but the large family-room is the centre of circulation. The different house types (sizes) have differently interesting family-rooms in relation to the complexity of the circulation possibilities, and different degrees of immediate reading and comprehension of the space and the connection to other spaces. The ones with a subtracted terrace are more complex and give a more interesting space to move around in.



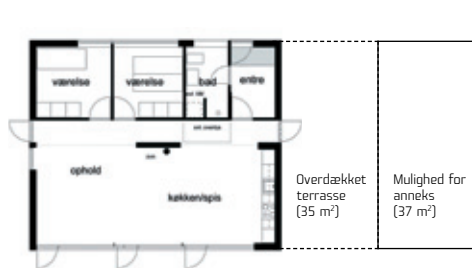
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226. The pitch of the roof is not strong enough to give dynamics to the exterior composition (Photo: Ida Wraber).

227. The façades have quite a strong kinship – the variations are created mainly through the placement of the openings in the façades. There is a play between openness and closedness that create a variation and dynamics in the façade (M2 2008).

228. The kinship of the façades are quite strong – this simple gable façades gains tension from the asymmetric composition of the openings and lamellae panel (M2 2008).

229. The plan drawing to the left has a very simple layout with only little dynamics in the pattern of movement created through the possibility of moving around in a circular way through the corridor and the kitchen-dining area. The drawing to the right has a higher degree of dynamics in its pattern of movement, as there are several ways of moving around and different circles that makes it less predictable than the plan drawing to the left (M2 2008).

230. In the interior there is a play between massiveness and lightness between the closed back wall and the opened façade towards the terrace. In the massive side there is a play of light from smaller, secondary light inlets, such as the ones seen in the ceiling in this picture (M2 2008).

231. The open and light side of the interior, which stand as a contrast to the more massive back wall (M2 2008).

Phenomenology: *Relation to cultural/personal framework, Supporting a multi-sensory experience, Relation to context*

From the exterior, the house clearly has the expression of a wooden house; it looks like a scaled up regular wooden case. The types that have terraces, which are subtracted from the main volume, most obviously appear as light constructions, but the panels of slender wooden lamellae and the large windowpanes that have a dissolving effect on the otherwise rather heavy basic shape, indicate that the construction is not massive but a framework construction [ill.239]. In the interior, the house looks more like a traditional, heavy construction Danish dwelling with the plaster board walls and ceiling [ill.237], but on the terrace, the detailing is very coherent and pure, and the wooden lamellae of the ceiling frame the space and underline its lightness [ill.236, 238]. These materials do not add much to the multisensory experience of the interior, whereas the wood gives the exterior a more multilayered experience [ill.232-233]. In the interior, the wooden floors and the natural stone and wooden wall lamellae in the bathrooms provide the most interesting multisensory experience [ill.234]. However, the neutral materials and colours are quite flexible in relation to suiting a wide range of buyers. There are not a lot of possibilities to adjust the dwelling to specific sites and users, as in the cases of *Espansiva* and *Kubeflex*. There are, of course, different house sizes to choose from, and these can be expanded with one more module [ill.235]. A terrace can also be added to some of the models and the house can be mounted on different footings depending on the terrain on which it is placed [ill.239], but in relation to material combinations and different spatial needs, there is not much that can be customized.

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232. *The wooden lamellae lie a bit further out than the areas clad with wooden boards, which together with the distance between the single lamellae give a sense of depth to the façade (Photo: Ida Wraber).*

233. *The lamellae elements are also used as shadings for the terrace, and here they also create a multilayer façade that adds to the sense of depth in the design (Photo: Ida Wraber).*

234. *In the interior the stone floor tiles and the wooden lamellae on the walls of the bathroom give the most interesting multisensory experience (M2 2008).*

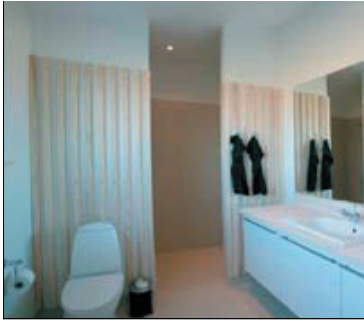
235. *The floor plans are quite rigid when it comes to possibilities of adjustments according to a specific site and customer, but there is a possibility of expanding the house with more 3D building element if the need of space increases, as seen on the plan drawing (M2 2008).*

236. *On the terrace the design and detailing are very coherent and elegant – all working together to explain the house a contemporary and elegant wooden dwelling (M2 2008).*

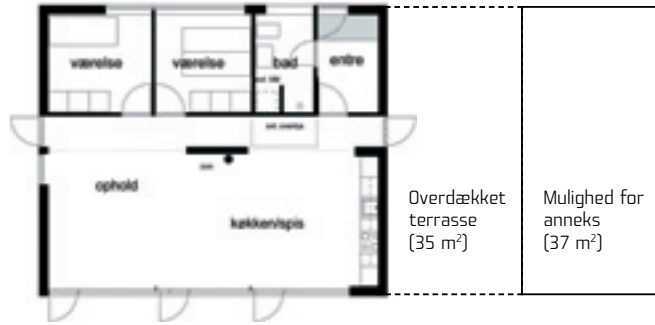
237. *In the interior the dwelling looks more like a traditional Danish heavy construction, rather than a light wooden construction, with its white plaster board walls (M2 2008).*

238. *The detailing of the terrace is simple and elegant, and thus underlines the main concept (Photo: Ida Wraber).*

239. *Seen from exterior the ONV house is clearly a wooden house – it has the expression of a scaled up wooden box and the large opening and light lamellae panels indicate that the construction is light. The house can be integrated differently on a building site – here it is built on a footing allowing for a space underneath the main house volume (M2 2008).*



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5.1.4 Force 4: Boase (2001)

Structuralism: *Proportion and order, Form and material, Detail and unity*

The basic shape of the Boase dwelling unit is quite simple, just like the *ONV house* [ill.242]. The composition of the long façades is playful with large holes and protruding elements [ill.243], whereas the short façades are without openings as these sides, in many instances, lie closely together with the short side of another unit [ill. 244]. The large elements of the façades are balanced around the vertical central axis – not in a symmetrical manner, but still harmoniously [ill.243]. It is obvious that the construction is light as the openings fill a large part of the façade, and also due to the fact that they are deliberately placed without larger bearing areas in between them [ill.245]. The corners are also cut away and replaced by massive columns that underline the relationship between the bearing construction and the protecting surface. The wooden boards that make up both the interior and exterior surfaces are obviously non-bearing elements [ill.240], just as in *Espansiva*, which further indicate that there is a framework construction hidden underneath. However, the plate material is sometimes found in round shapes in the design, for example in the window corners, which does not seem as natural and raw as the main expression could call for [ill.241].

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240. The plywood boards are used both in the interior and in the exterior as a cladding material (Force4 Architects 2009).

241. The plywood boards are sometimes bent into rounded shapes which does not seem as natural and raw as the main concept and most of the other detailing (Åberg, Stenberg 2005).

242. Three Boase dwelling units in a group. The basic shape of the dwelling is a simple box (Force4 Architects 2009).

243. The longer façades are playfully designed with protruding elements and large asymmetric openings, whereas the shorter façades are completely without any openings or other inserted elements. The compositions of the longer façades are balanced around the central vertical axes (Force4 Architects 2009).

244. The dwelling units are placed in smaller groups where the shorter façades sometime lie closely together and therefore these have no openings (Force4 Architects 2009).

245. It is possible to see that the construction is light as there are large openings covering much of the longer façade and the corners are cut away and replaced by columns, which underline the idea of the construction as bearing columns and enveloping light boards (Force4 Architects 2009).



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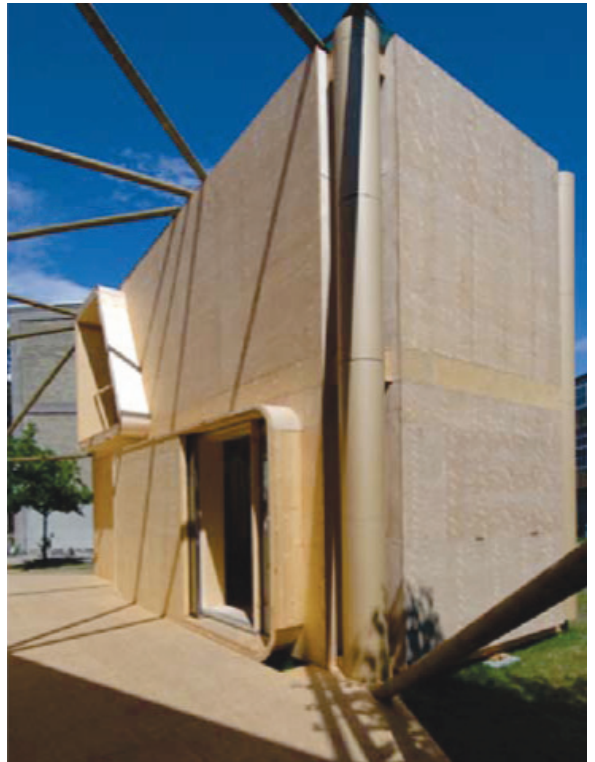


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Perception psychology: *Unity and variation, Balance and harmony, Dynamics*

The simple box shape has both a large detailing in the shape of window areas and protruding elements, however there is also a secondary division into differently sized wooden boards that gives a more multilayered and complex façade, such as also seen in the plastered walls of *Villa Mairea* that have many different levels of detail [ill.247]. The two long façades have a strong kinship even though they are quite different in their specific composition – the two short façades have no attributes and are calm counterweights to the two more expressive sides. The façades are composed around the central vertical axis and a balanced design is achieved through a play between solid and void, and dynamic and static lines [ill.246]. There are dynamic lines in the concrete elements in the façades but also being drawn up by the elements seen together – across the longer façades. The interior space of the dwelling unit is very simple, but the division into two floors gives a slightly more interesting spatial experience as it gives a sense of airiness at the same time as it is not possible to view all corners of the dwelling immediately when entering [ill.248-249].

246. *The longer façades have both large asymmetric openings and protruding elements, which creates a play of dynamic lines, mass and void. The longer façades are dynamic, but well balanced around their central vertical axes (Force4 Architects 2009).*

247. *Apart from the large scale design of openings and bays in the façade, there is a smaller detailing creating variation when getting closer to the dwelling unit; the plywood boards are cut into different sizes of plates which are put together in a varied and rather random manner, which create a play in the large wooden surfaces (Åberg, Stenberg 2005).*

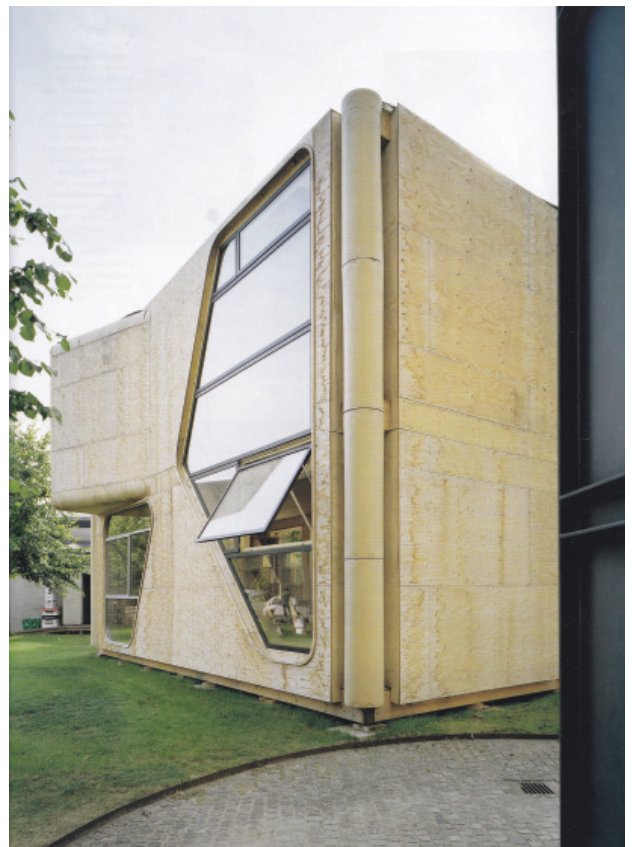
248. *The division of the dwelling in two floors gives dynamics to the rather small space, as it is not possible to overview the whole dwelling at once when entering the house, even though there are no doors or internal walls (Force4 Architects 2009).*

249. *The upper floor also consists of one large room which gives a sense of airiness in the quite small dwelling unit (Force4 Architects 2009).*

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Phenomenology: *Relation to cultural/personal framework, Supporting a multi-sensory experience, Relation to context*

The *Boase* dwelling unit is quite different from the traditional Danish dwelling both in relation to materials and form language [ill.250-251]. However, the shapes and the materials suit the main concept of an environmentally friendly dwelling area, by signalling forward thinking. When the units are put together and put onto stilts, above a forest of soil cleaning willow trees, the message of communal thinking and care for the nature will be signalled by the soft, dynamic shapes, raw and warm wood and the textile that is stretched out between the single dwelling units. The wood is used both on the outside and on the inside to create a raw, but still soft environment that neither needs filling of the joints, nor paint [ill.252-254]. The wood does give an opportunity for a multisensory experience, however the experience is not very varied when it comes to the materiality – the wood has not got a contrasting element except from the textile covering the common spaces in between the single dwelling units, such as for example seen in *Villa Mairea* or Utzon's house in Hellebæk. The concept is quite specifically designed for polluted city plots, but in spite of this, it will probably stand out in most Danish towns and cities where the vast majority of housing is built of bricks or other heavy materials. However, the specific combination of dwelling units and the common spaces can be differently designed according to the site and the surroundings. The single dwelling units are very characteristic, and due to the minimal spaces and the open plan concept in two storeys, there is not much that can be changed in the layout. This is in line with the concept of trying to make an efficient dwelling for a flexible lifestyle where one moves, together and apart from partners, in and out of cities and countries, and needs cheap city dwellings for shorter periods of time.

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250. The Boase project is created for polluted city sites, where its willow forest should clean the site in a period of years. However both the form language and the use of materials are quite different from the traditional Danish city building. It would probably stand out in its expected context, but also underline the environmental perspectives integrated in the design (Force4 Architects 2009).



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251. Common Danish city building in Copenhagen; the traditional material is brick and the houses are ordered into a rather strict structure of blocks with an open court or garden in the centre – which is very different from the Boase concept (Photo: Ida Wraber).

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252. The joints of the construction are exposed and underline the raw concept of the Boase project (Åberg, Stenberg 2005).

253. The wooden boards are used as exterior cladding and does not need any filling or paint, but can stand as a raw board that can give experience to both eye, hand, and nose (Force4 Architects 2009).

254. The wooden boards are also used internally as surfaces that neither need filling nor paint in order to function. Rather they give the dwelling a raw and warm expression, which goes well together with the main concept (Force4 Architects 2009).



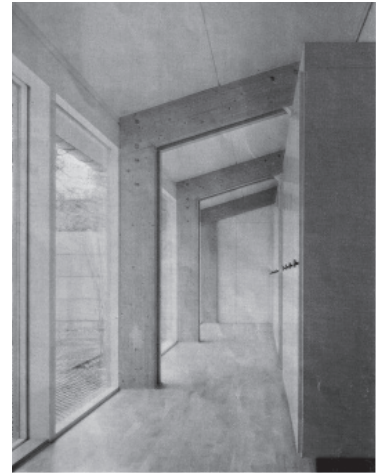
5.1.5 Summary

It can be seen that the four dwellings have quite different conceptual backgrounds and, therefore, logically different themes of importance – especially in relation to the openness, or flexibility, of the system. In the table below is a summary of the four analyses that will be used for the further discussion.

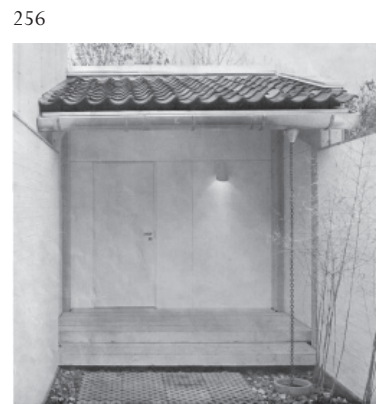
	<p>STRUCTURALISM: <i>proportion and order</i> <i>form and material</i> <i>detail and unity</i></p>
ESPANSIVA	<p>Proportion and order are difficult to speak about in general terms as the different elements can be freely put together. The single units are, however, well proportioned and the single façades follow quite clear and logical orders. The house is a clear wooden framework construction with light board materials to create enclosure. The wooden frames and their detailing are visible, and this creates a raw and simple expression stretching from detail to unity.</p>
KUBEFLEX	<p>The main volumes are very simple in their basic design, and, mainly, the panels are also simply composed. When put together, clear orders and proportions therefore appear. The construction is exposed and marked with a light green colour, and the boards, inserted into the frames, are clearly light screens. The house is very simple both as a whole and in the detail.</p>
ONV HOUSE	<p>The basic shape is very simple; a regular box with a slightly pitched roof. In the façades, the windows are of few kinds and they are placed in a clear order. The solid box is the main theme; however, the lightness of the wooden construction is expressed through the larger subtractions of materials from the main shape and the panels of light wooden lamellae that are inserted into the façade. From the inside this is not as well expressed as the walls and ceiling are clad with white plaster boards. Both detail and unity are otherwise pure and simple.</p>
BOASE	<p>The basic shape of the Boase dwelling unit is a simple box. The composition of the façades as well as the layout of the plan is simple, but playful. The façades have large elements (windows and protruding bays) that are arranged around the central vertical axis; not symmetrically but still balanced and well proportioned. The wood envelope is exposed and the light framework that lies underneath is indicated through the large holes in the façades and the lack of larger bearing columns between the openings. The main concept is raw and simple, but playful. The round corners do not seem as raw and simple as many of the other details, but they are instead playful.</p>

<p>PERCEPTION PSYCHOLOGY: <i>unity and variation</i> <i>balance and harmony</i> <i>dynamics</i></p>	<p>PHENOMENOLOGY: <i>relation to cultural/personal framework</i> <i>supporting a multi-sensory experience</i> <i>relation to context</i></p>
<p>In relation to unity and variation in the pavilions and the panels, there is a potential for creating a variation within a unified framework, but the freedom of choice also gives the opportunity of creating something less balanced and harmonious. In relation to dynamics, the sloped roofs create dynamic lines, both outside and inside the house, but the different slopes can be put together to form confusion or conformity, as well as the interior patterns of movement can be vastly varied.</p>	<p>The house, in many ways, seems Japanese with the corridors lying along the façades, the possibilities of outdoor enclosures and massive wooden frames. However the façade panel compositions are reminiscent of contemporary Danish dwellings. All materials are simple and exposed, which gives possibility for a varied and multisensory experience when moving around the house. The system can be customised to many users and sites, however, the possible choices are so many, that the architectural quality might not in all instances be a given.</p>
<p>The unity is quite strong and will most likely be apparent through all possible combinations, but the variation might become a bit weak if not using the possibilities available for creating a play in the dwelling. This can mainly be achieved through placing the chimney and the vertically oriented panels suitably. This is also the main manner in which dynamics can be achieved in the exterior, whereas in the interior, the patterns of movement can be differently interesting depending on the composition.</p>	<p>Kubeflex was too radical for its time when it was presented in 1970, but it has thereafter been praised by architects. The main construction of the house is made of wood, but it is painted so that it can only be detected visually if standing very nearby or by touch. The board materials used do not give a specifically interesting multisensory experience, whereas the fitted carpets give a soft contrast to the otherwise rather minimal and raw expression. The main concept is strong and will probably shine through all possible combinations, but there are at the same time both spatial and compositional possibilities of customisation in relation to site and users.</p>
<p>The main concept is strong and secures the unity of the design – the variation is quite discrete, and there are only few surprises when moving around the house. The interior spaces, as well as the different façades, share a strong kinship. The most remarkable variation of the box is the terrace that is cut into some of the house types. Both the interior and the exterior are well balanced and harmonious with a play between solid and void, massiveness and lightness, which is also what mainly creates the dynamics both inside the house and in the façades. The patterns of movements shift in the different models as does their complexity.</p>	<p>The house immediately appears as a wooden construction; a wooden box. The box gets its visual lightness from the subtraction of massive material in the shape of large window areas and notch forming a terrace, and through the insertion of lighter lamellae panels or large windowpanes. In the interior, this is not experienced as clearly as most surfaces are white plaster boards. The most interesting multisensory experience is therefore also seen in the exterior. In the interior the most interesting multisensory experience is in the bathroom which has a cladding of nature stone. There are not very many possibilities to customise the dwelling to site or users. It is prepared for an additional volume on one of the short edges, and it can be put onto different footings according to the terrain at the site.</p>
<p>The façades have several layers when it comes to variation. The main form is simple and the openings and bays are few and large and characteristic; harmoniously placed around the central axis. The boards that make up the envelope are cut into different sizes, which create a playful variation when getting closer to the house. Two of the façades are totally clean and calm, and the other two are quite dynamic, which creates a well balanced whole. In the exterior, the dynamics is given by the diagonal line in and between the windows and bays. In the interior, the dwelling is rather small but with a variation in the spatial experience as the dwelling is two-stories high and cannot be seen as a whole immediately when entering.</p>	<p>Neither the material nor the shape is traditional for Danish dwellings, however they signal the concept of forward thinking and environmental friendliness quite well through the softness, rawness and the dynamics of shape and material. The wood is used both as wall, floor and ceiling in a manner that does not give associations to Norwegian ski cottages, but in a rather contemporary manner. It is flexible and simple and does not need filling or paint to look complete. The wood does not, however, have a contrast other than the textiles covering the spaces between the dwelling units. This could have given a more multilayered experience. There are not any possibilities for customisation in the single dwelling unit, but only in the larger composition of several units.</p>

What is interesting in this analysis is to compare the dwellings through a discussion stretching vertically across the cells – i.e. comparing the pros and cons of the four dwellings in relation to the three theoretical clusters – thus being able to identify general as well as specific pitfalls and potentials. Starting with the structuralist theory cluster, it is clear that a closed system is naturally better able to ensure elaborate and intentional proportion and order. In *Espansiva* there are so many possible combinations; differently sized pavilions with sloped roofs of different heights and a wide range of panels that can be freely used in numerous kinds of designs. It is not possible to foresee how the users might put them together and thus ensure aesthetic and spatial qualities. *Kubeflex* is also flexible but still more closed than *Espansiva*. The basic module is a characteristic box of light green wooden frames, in which only seven different panels can be inserted. The boxes can be put together in many different ways; however, they have such a clear concept that it will shine through no matter how they are put together. The panels are also very simple and therefore no big aesthetic harm can be done when combining them. The matter of form and material has less to do with the prefab aspect and more to do with the general design concepts. Here the four dwellings are all quite different. *Espansiva's* wooden frame construction is mainly seen from the inside of the house and through the larger openings of the façades [ill.255]. However, the boards of the façades are obviously not bearing but form a light envelope, which indicates the light construction underneath [ill.256]. In *Kubeflex*, the light green frames can be seen both from the outside and the inside, and the screens in between them are also obviously light [ill.257-258]. In both these cases the basic construction also forms the aesthetical foundation in relation to rhythm and order. The framework construction in itself is less important in the *ONV house* and the *Boase dwelling unit*. Here the idea of a light wooden box is more important, and the surfaces are used as the aesthetic scene for expressing this. Both projects have a very simple basic box shape and use large holes in the façade to



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explain the lightness of the bearing construction. In some types of the *ONV House* there is a large terrace, which is carved out of the main shape, and also light panels, of slender wooden lamellae, that underline the lightness and give a multilayered and airy surface [ill.259]. In the *Boase* dwelling the long façades have very large window areas with only little material between them, which makes them look light and the corners have been cut away and replaced by wooden columns that are also the stilt that the dwelling units stand on [ill.260]. This underlines the idea of the design as being a combination of

255. In the interior of *Espansiva* the wooden frames are an important part of the architectural expression (*Espansiva-Byg A/S* 1971).

256. The wooden frame construction can be seen by the main entrance. The cladding is made of light wooden boards, which underline the lightness of the construction (*Espansiva-Byg A/S* 1971).

257. In the interior of *Kubeflex* the panels filling out the frames sometimes are split horizontally by a window, which underlines the lightness of the construction (Åberg, Stenberg 2005).

258. In the exterior the panels is in another level than the green frames, which give depth to the façade and make it seem lighter (Trapholt 2009).

259. The light construction of the *ONV house* is emphasised by the notch that forms the terrace and the panels framing the openings. Together they dissolve the otherwise rather heavy main shape (M2 2008).

260. The *Boase* dwelling unit has large holes in the façade that shows that these are not bearing. This is further accentuated by the corner detailing, where wooden columns meet the light enveloping wooden boards (Force4 Architects 2009).

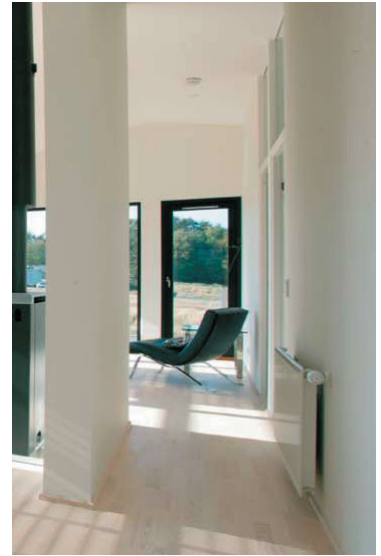


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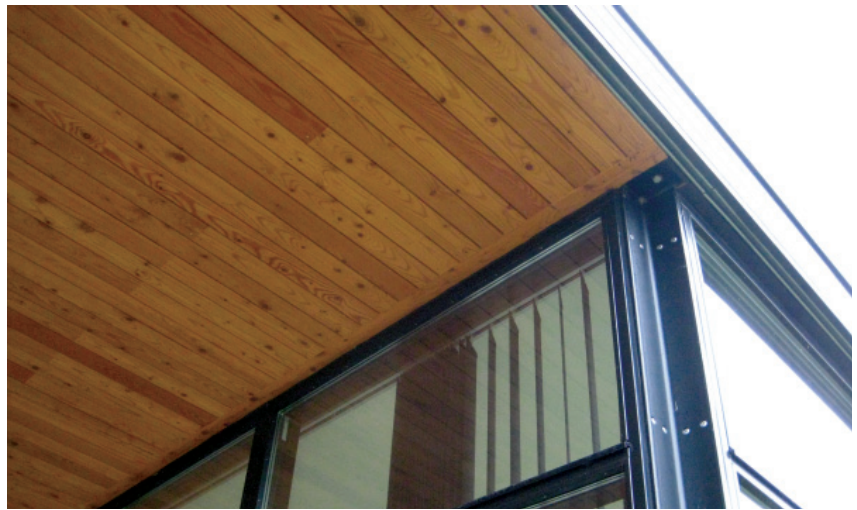
columns and beams, as bearing construction, and surfaces, as a thin protecting envelop. In *Boase*, the wooden boards are used both on the inside and the outside of the dwelling, which gives a coherent expression in relation to material and form, whereas in the *ONV house*, the inside of the dwelling has a quite different expression from that of the exterior; the interior is dominated by white plaster boards and therefore looks like a traditional heavy construction house [ill.261]. The last keyword for the structuralist perspective, detail and unity, does not have much to do with prefab as such either, but more with the general design. Of course there is the possibility of refining details as they are going to be used several times, but mostly it is a matter of design. All of the four dwellings have clear and pure details. The details are simple and exposed and especially *Boase* has a raw detailing that goes together with the concept, whereas for example the *ONV house* has a more sophisticated detailing working with the more refined concept [ill.262-263].



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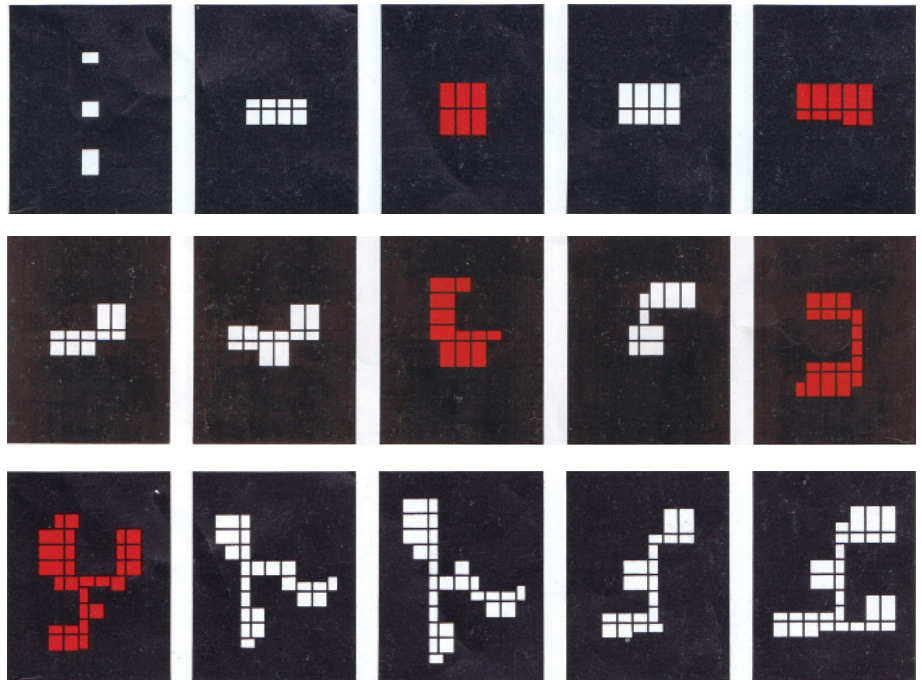


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The keywords of the perception psychological view are all quite important when speaking of prefab dwellings as those are aspects that should be ensured through the design of the building system. A very flexible system makes it more difficult to ensure such compositional matters. In Utzon's *Espansiva*, it is for example very difficult to foresee the actions of the builders due to the amount of possible combinations. The house can become extremely simple, maybe only a single box with a singly pitched roof and unvaried façades, or extremely complex with courtyards, labyrinth corridors and inharmonious façade compositions [ill.264]. Just below in complexity falls Jacobsen's *Kubeflex*, which has a more solid base – the ten square metre frame box – that can only



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be filled out by seven different panels. The light green frame box is more characteristic than the pavilions of *Espansiva* and the possibilities of combining boxes and panels are not so multifarious that the main expression will be as varied as in *Espansiva*. The worst thing that could happen in *Kubeflex* is probably that the façade and the spatial sequence could become a bit unvaried. In the *ONV House* and the *Boase* dwelling, the matters of perception psychology can be secured and will be more or less precisely repeated in every dwelling of the types.

261. In the interior of the *ONV house* the white plaster board surfaces dominate, which means that it has an expression similar to a heavy construction dwelling, rather than a light wooden dwelling (M2 2008).

262. The detailing of the *Boase project* is raw in accordance with the main concept (Åberg, Stenberg 2005).

263. The detailing of the *ONV house* is elegant and pure in accordance with the main concept of the building (Photo: Ida Wraber).

264. The *Espansiva building system* is very flexible and can form very simple and traditional Danish houses with doubly pitched roofs, but also complex buildings with different courtyards, wings and roof pitches (*Espansiva-Byg* A/S 1971).

In relation to the phenomenological view, there are many interesting aspects in connection with prefab wooden dwellings. The matter of multisensory experiences, however, is more related to the design practice, but not less important when speaking of dwellings constructed of wood. When speaking of both prefab and wooden dwellings, the first keyword (*relation to cultural/personal framework*) is very important. Dwellings in Denmark have traditionally been built by craftsmen in heavy materials. Prefab dwellings have a reputation for being boring, and wooden dwellings are often looked upon as less sturdy and of a more temporary character than the traditional brick house. Therefore, building prefab houses of wood can be quite a challenge in a Danish context. The *Boase* project plays with the associations with temporariness, and, together with the fact that wood is viewed by many as an environmentally friendly material, it goes well together with the concept of temporary communal dwellings for polluted city plots. The raw wooden boards are used both on the inside and on the outside of the dwelling units,

which gives a coherent expression [ill.265-266]. In the *ONV house*, wood is only used on the outside (apart for some wooden floors in the interior). In the exterior, it works well and it is possible to understand the dwelling as being a light construction whereas seen from the inside it could as well be made of concrete or brick [ill.267-268]. There is not much play with the material and the conceptions of it. The two examples from the 70s use the wooden frames as exposed ornaments and are ahead of their time. *Espansiva* can nevertheless be composed in a manner so that it looks rather traditional from the outside [ill.269], but in many of the combinations it looks more Japanese than Danish with the corridors along the façades, massive wooden frames in the interior and around the entrance, and floating borders to the surroundings [ill.270-271]. The Japanese

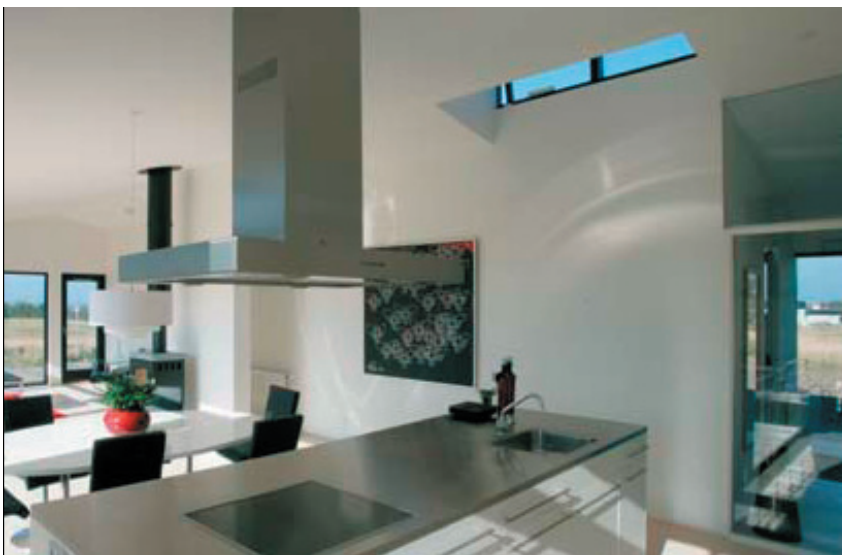


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associations, however, underline the idea of the house as being a wooden construction and might additionally be a mark of the architect's style. *Kubeflex* is not understood as a specifically 'wooden' dwelling, as the laminated wood used for the framework is painted light green, but it is indeed understood as a light construction. In relation to supporting a multi-sensory experience, the houses are quite different. The *ONV house* is rather interesting experienced from the outside with façades of multilayered character and different kinds of wood and other pure materials such as metal and glass. However, on the inside, the tactilely poor material of plaster board dominates the wooden floors and fine natural stone of the bathroom. In the *Boase* dwelling, wood, on the other hand, is everywhere, which indeed underlines the raw concept, but does not give a very

265. All surfaces of the *Boase* interior are made of wooden boards (Force4 Architects 2009).

266. The surfaces of the exterior of *Boase* are made of the same wooden boards as the interior, which gives a coherent expression (Force4 Architects 2009).

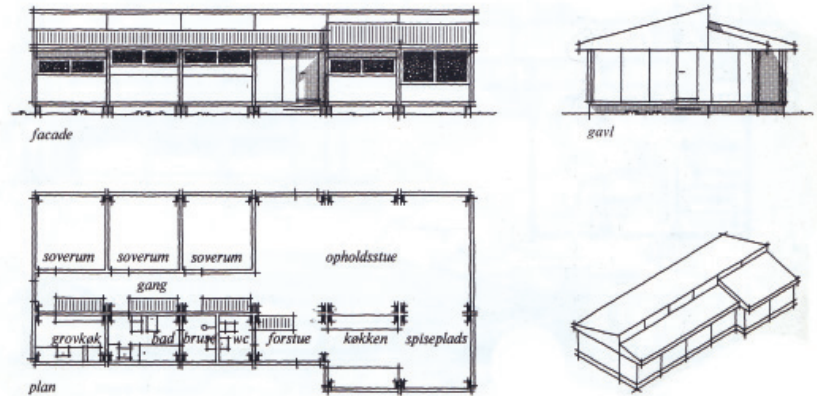
267. The interior of the *ONV house* is dominated by white plaster boards (M2 2008).

268. The exterior of the *ONV house* is clad with wood, which gives a split between the interior and the exterior expression (M2 2008).

269. A rather simple version of the *Espansiva* building system with a traditional Danish form language (Espansiva-Byg A/S 1971).

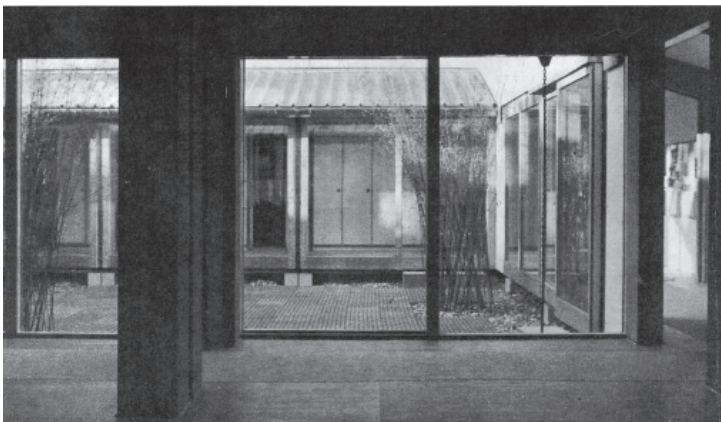
270. In the interior *Espansiva* is however not as traditionally Danish; it has some likenesses with Japanese dwellings in relation to the openness towards the surroundings, or a courtyard, and the corridors that are placed along the façades (Utzon 1970).

271. Example of a traditional Japanese dwelling, where the likeness to *Espansiva* can be seen (Photo: Ida Wraber).



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varied experience, as for example seen in *Villa Mairea* in chapter 4 [ill.272-273]. In *Espansiva* there is a contrast between the board materials and the wooden frames which gives a more complex experience [ill.274], and in *Kubeflex* the situation could have been almost the same had the wooden frames not been smooth and painted. However, in *Kubeflex*, the hard materials stand in contrast to the soft fitted carpets, which to some degree give the room variation [ill.275]. When it comes to the possibility of adjusting to different contexts, users as well as plots, the degree of openness of course means a great deal. The *ONV house* and the *Boase complex* are the most fixed units, and they do not give many possibilities of customisation. The *ONV house* can be put onto different footings and the combination of several *Boase* dwellings can be adjusted, but the *Boase* dwelling unit in itself cannot be customised. *Espansiva* can be composed as to be placed on many different kinds of plots, as can *Kubeflex*, but especially *Kubeflex* would stand out in a common area of single family houses with its flat roof and green colours. There are

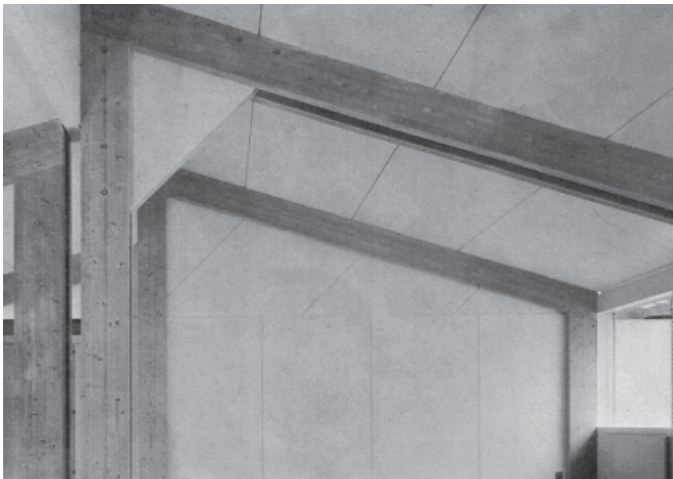


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not many possibilities to adjust materials or colouring according to the neighbouring houses. However, different spatial needs of the customer can be fulfilled in both projects – most flexibly in *Espansiva*. The flexibility, though, is, as also seen in previous sections, problematic in relation to other aspects – in particular if the customer himself has too many possibilities of freely putting bits and pieces together.

The main issues in the three theory clusters that are specifically important in relation to the architectural quality of prefab wooden dwellings are therefore related to *flexibility* and *experience of form, logics, and material*. These factors are each reflected through several of the keywords and are differently handled in the analysed dwellings. Flexibility can be a problem in relation to the matter of *proportion and order* in the structuralist view and the complete set of keywords in the perception psychological view. A high degree of flexibility in a system will give few possibilities of controlling the result and the final composition, as seen most clearly in the case of *Espansiva*, whereas a lower degree of flexibility in the construction give good opportunities of securing the visual and compositional aesthetics of the dwelling, such as seen most clearly in the *ONV house* and the *Boase* dwelling unit. On the other hand, flexibility is positive in relation to the matters of *relation to cultural/personal framework*, and *relation to context* in a phenomenological view, as flexibility in this context provides the possibility of adapting the dwellings to users, sites and wider contextual factors. This is very important to the assessment of the architectural quality, as is also seen in the analysis of the customised houses; Utzon's house in Hellebæk, *Vanna Venturi house*, and *Villa Mairea*. Flexibility is therefore an important issue as it is neither a good idea to have a too high nor a too low degree of flexibility if aiming at creating a dwelling that should be perceived as being of high architectural quality to a large group of people and at many different sites. The *experience of form, logics and material* can also be related to several of the keywords; *form and material* and *detail and unity* in structuralism, and all the keywords of the phenomenological view. Here can be seen quite a big difference between especially two of the dwellings analysed in chapter 4 – Utzon's house in Hellebæk and *Villa Mairea* – and the prefab dwellings analysed in this chapter. In the two unique dwellings, there is much focus on the materials; how and where they are used in relation to functions and the constructional logics. In Utzon's house in Hellebæk, this is for example seen in the varied use of bricks, and the play between the heavy and the light bearing elements, and *Villa Mairea* is a journey through different materiality, textures, temperatures and scents. In the analysed prefab dwellings, the detailing of the materials is less elaborate, maybe as a result of the demand on low cost. The interior surfaces of *Kubeflex*, *Espansiva* and the *ONV house* do not provide the same kind of experience of variety and meaningfulness in relation to the total concept of the dwellings. The *Boase* dwelling, on the other hand, uses the raw wooden surfaces; however, they are everywhere which does not provide a variation in the experience of

272. *The surfaces are not very varied in the interior of the Boase dwelling unit (Force4 Architects 2009).*

273. *In Villa Mairea the surfaces are varied; only in this small section can be seen natural stone, bricks, both plastered and raw, and a lacquered wooden floor which together give an interesting multisensory experience (Pallasmaa 1998).*

274. *In Espansiva there is a contrast between the wooden frames and the light boards, however the variation is not strong (Espansiva-Byg A/S 1971).*

275. *In Kubeflex there is a contrast between the hard industrial materials and the soft, grey fitted carpets, but nor in this prefab dwelling the multisensory experience is very varied or interesting (Åberg, Stenberg 2005).*

the materiality – but it does indeed reflect the construction of the building. *Espansiva* and *Kubeflex* also expose the prefabricated framework construction and use it as an important part of their aesthetical expression, whereas the prefabricational logics are hidden in the *ONV house* where horizontal boards of wood cover the joints between the 3D elements. A focus on these two points - *flexibility* and *experience of form, logics, and material* – could therefore cover many of the aspects that are important when working with prefab wooden dwellings, and care and elaboration in relation to these could add to architectural quality of this building typology. Parallel to the process of developing this model for analysing architectural quality, there has been a more practical approach to the matter of architectural quality in prefab wooden dwellings; the participation in a project of developing a new house for the prefab house producer *Hjem*. In the following chapter this process will be described and reflected upon, and thereafter the houses of *Hjem* will be analysed according to the previously used model in order to see the difference between the older and newer houses on their repertoire. It is the intention that this deeper case study should give a more detailed understanding of how a specific company works with the described keywords and aspects of architectural quality and clarify the background and work that has led up to the model of analysis presented in this thesis.

5.2 CONCLUDING REMARKS

- In this chapter, four different Danish prefab wooden dwellings are analysed; Jørn Utzon's *Espansiva*, Arne Jacobsen's *Kubeflex*, *ONV's ONV house*, and *Force4's Boase* dwelling unit.
- The analysed dwellings represent a wide range of different modes of production; both 2D and 3D systems and opened and closed systems.
- It is suggested that two factors are especially important when dealing with the architectural quality of prefab wooden dwellings; *flexibility* and *experience of form, logics, and material*.

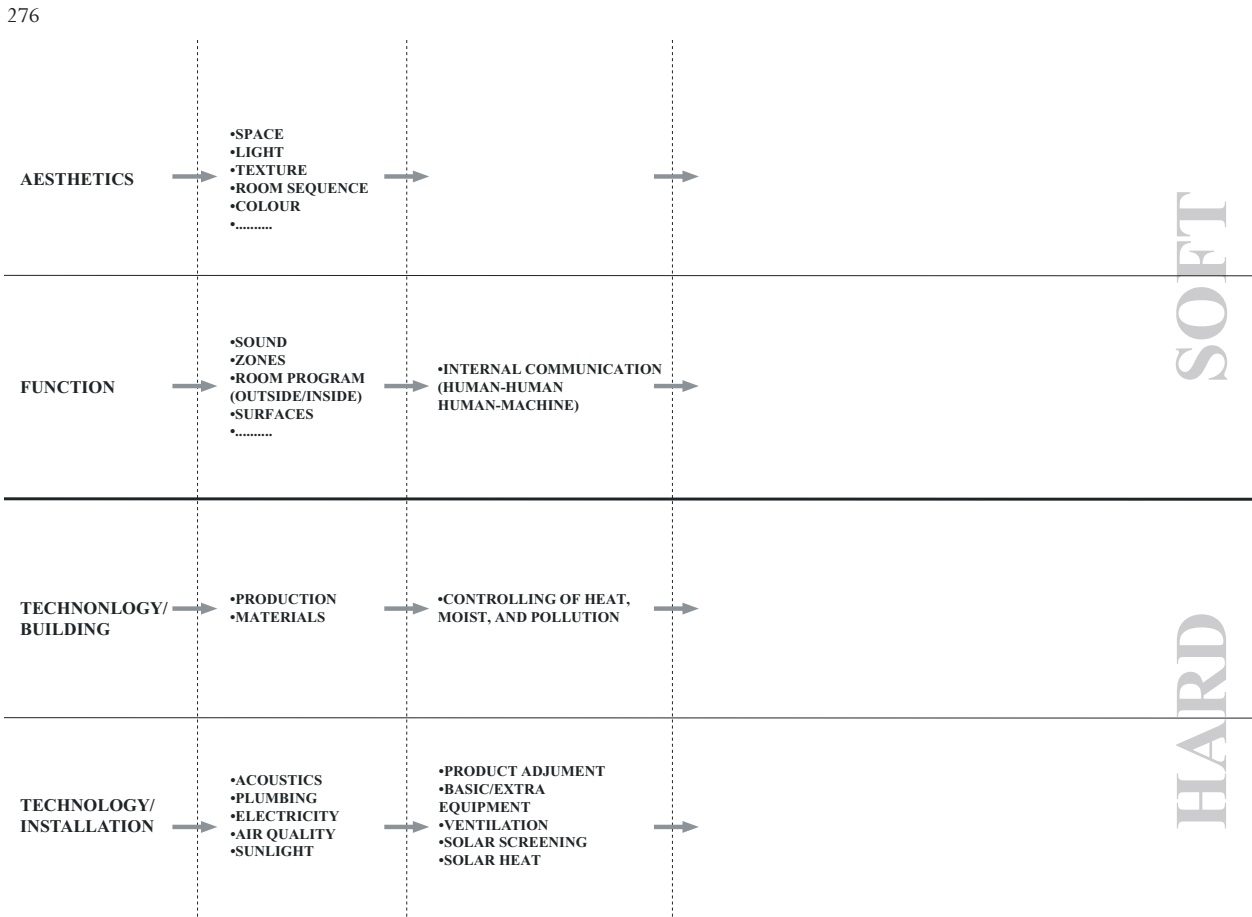
6 CASE STUDY: HJEM

6.1 THE COOPERATION WITH HJEM

Hjem is a co-sponsor of this PhD thesis and especially in the early stages of this PhD and in the parallel design development of two new dwelling types at *Hjem*, there is an interactive process between this project and the company. During the early stages of the design process, the values, visions, and qualities are central issues, and this is therefore an interesting period in relation to the project as the main aim of such a process is to find consensus among the different participants of the development team about what the softer values of the dwellings should strive towards, and by which means it is possible to get there. The main idea has therefore been to try out different ways of presenting, talking about, and working with the intangible matters of architectural quality, rather than designing or suggesting particularly architectural qualitative solutions. A group of last year students at Architecture and Design at Aalborg University also took part in the cooperation in the early stages of this PhD project, forming a working and discussion group for architectural quality of prefab dwellings. One of these projects worked with a quantitative investigation, sending out questionnaires to architects inquiring into the architectural quality of specific dwellings and discussing the results of these (Bilde 2007). Another project focused on the phenomenology of dwelling in relation to prefabrication (Frier 2007), and a third project attempted to create a model for analysing architectural quality (Vestergaard, Stær 2007). The first model for analysing architectural quality was defined in cooperation with the last group, and it was subsequently presented at a conference dealing with architectural quality at the Welsh School of Architecture in 2007 (Appendix 1). The model was then refined and presented at another conference, *Architectural Inquires*, at Chalmers Technical University in Gothenburg, Sweden (Appendix 2). Through this process, the working theme and the model was altered and refined. The model was, however, also challenged and refined through the development process of the concrete house of *Hjem*. Through the process of cooperation, between *Hjem* and the writer of this thesis, certain key events took place where the interaction was more intense than at other times. Before analysing the dwellings of *Hjem* there will be an overview of some of these key events in order to get an understanding of the process that has led to the new dwellings in *Hjem*'s repertoire, and these two sections together should give a more specific understanding of the pros and cons of Danish prefab wooden dwellings – or as expressed in the *constant instance 2* of loop 5; *a clarification of the possibilities of application of the theoretical model to a concrete development process.*

6.2 DEFINING THE VALUES AND VISIONS

In the very early stages of the development process, a schedule of the main fields within architecture was drawn up, through which the focal points of this PhD project were visualised [ill.276]. The ‘soft values’ were not precisely formulated at this point, but it created an initial understanding of the aim of the project. Hereafter the vision and value definition process began. This was done through the first meeting with the key-persons in the development team at *Hjem* where the participants each formulated what they found important in the existing houses, what might be missing and which new factors they might want to incorporate in a new design. The discussion was quite open and broad. My assignment was subsequently to create clusters of those visions and values and formulate a written ‘manifest’ that could be used during the process to keep the goal visible to the, sometimes shifting, participants in the development team. By having this piece of paper containing both short punch lines and further developing texts, the idea was to be able both to inform about the concept in a few lines, but also to make sure that the different participants had (more or less) the same expectations to the different punch lines.



6.3 CHOOSING THE ARCHITECT

In order to find the concrete form for these visions and values it was decided to find an architectural office to cooperate with. The investigation process started by putting together a small catalogue of companies whose profiles could match the visions and values from the last stage of the process, and it was also a wish that the company had a ‘good name’ in the business as well as among non-architects. Meetings were held with several companies where the vision was presented and the company got a possibility to present their working process and approach to architecture. Among these, especially one younger company, *AART*, stood out as having an open process with an interest in finding new approaches to every new assignment in addition to having an interest in cooperating with people from a wide range of different disciplines. This seemed as a good basis for a productive cooperation, and their repertoire of built houses seemed contemporary and shifting, but with a consistent care for materials and details. On this background an agreement was made between *AART* and *Hjem*, and the design process began.

276. *The first step was to define the content of a project dealing with architecture, in order to being able to discuss what this specific thesis will focus on. Architecture is split into soft and hard values, with the subcategories aesthetics, function, technology/building, and technology/installation. It is underlined that this thesis deals with the values from the soft categories.*

277. *Sletten by AART near Silkeborg in Middle Jutland. This scout house is built from simple and raw materials with many visible joints that explain the logics of the construction. Wood and bricks are used in a simple and pure manner, and together they form a contrast between lightness and heaviness, cold and warmth (AART 2009).*

278. *Unikaplan by Friis & Moltke for the house producer Frydkjær is a suggestion to a contemporary version of the traditional single family brick house (Friis & Moltke 2009).*

6.4 STARTING THE DESIGN PROCESS

The first meetings were used to gain a common ground for the project. A study trip for all design team participants was organised where the first stop was a visit to *Sletten* near Silkeborg (an example of *AART*'s architecture) [ill.277], where they had the possibility to point at different concrete matters of importance to them and clarify why these specific matters are important. Thereafter a new single family housing area was visited where there were discussions about trends and typologies, and a contemporary example of an architect drawn standard house was visited (*Unikaplan* by *Friis & Moltke* for *Frydkjær*) [ill.278]. When actually standing inside the areas and the house, many interesting and

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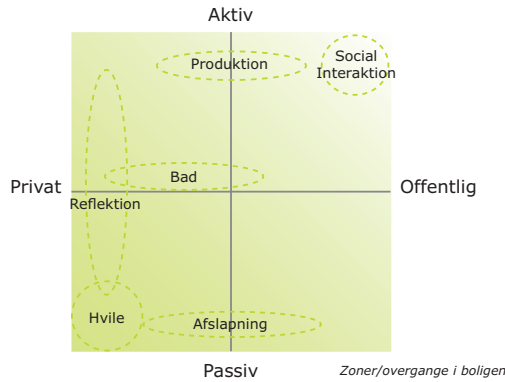
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279. In this first model for describing architectural quality the concept is divided into three levels which relate to the superior matters of form, organisation, and space. The first levels are parameters, or main elements, of architectural experience, the second level are the more concrete concepts of how to materialise and shape the first parameters, and last are the project specific demands and conditions given by the users, society, and site. The idea is to discuss one level at a time and then move from level to level through the iterative process of designing a house (Vestergaard, Stær 2007).

280. The suggestion to how a contemporary wooden dwelling could be designed from the students Anne Nordahl Vestergaard and Lotte Stær, Department of Architecture & Design, Aalborg University (Vestergaard, Stær 2007).

is built on the theory from the former presentation, was presented (Anne Nordahl Vestergaard and Lotte Stær, Aalborg University). It contains an analytical part where *Hjem*'s dwellings are analysed, and a practical part where the students give a suggestion as to what a contemporary single family dwelling in wood could look like [ill.280]. Throughout these two first presentations, there was a focus on the diagrammatic aspects of explaining, presenting and finding consensus in relation to architectural quality, and it was suggested to use the diagram as a tool during the design process. The third presentation of the day was by an anthropologist (Ida Wentzel-Winther, Århus University), who is doing research on the matter of home – how we make a home and what elements are important in this process. Through this presentation, the focus was more on the practical and sociological aspects of dwelling – such as the fact that the home is a place for personal clutter and private things, which are not in the magazines. Thus, new questions were raised such as how we can build dwellings that can hold this clutter and still live up to the dream of the perfect glossy magazine home, as well as the question of how we can build dwellings that can potentially become the mirror of the dweller's personality, such as the contemporary current of individuality would demand. The day was concluded by a longer discussion where the inputs from the day were reflected upon and certain points of interest drawn up – both concrete matters which had been seen in the earlier visits, but also more process oriented matters, such as a will to try to work with the diagrammatical descriptions of the dwelling's architectural quality. On the basis of this workshop day the architectural office in cooperation with the writer of this thesis put together a program, in text, diagrams, and pictures for the further, more concrete, design process.

-  Synsans
-  Høresans
-  Lugtesans
-  Fysisk kontakt

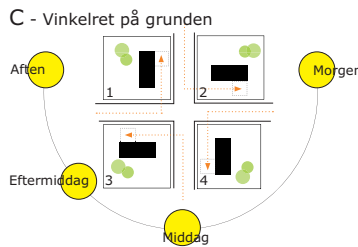


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Orientering

Solforhold i primær ude/inderum

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281. The different rooms and zones are defined with respect to their active/passive and private/public character – the pictograms to the left indicate that all senses should be considered when discussing the properties and wishes for the spaces (AART 2007).

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282. The placement of the house in relation to the position of the sun and the access to the house is investigated and clarified through for example this diagram (AART 2007).

6.5 CONVERGING TOWARDS A COMMON AIM

The program consists of shorter texts, diagrams and pictures that describe the vision of the new dwelling more concretely – for example there are guidelines for the different zones and rooms, definition of target group and flexibility in relation to different building sites, but also more technical considerations of for example how to work with flexibility in relation to orientation in relation to the sun or the access to the house [ill.281-282]. After a presentation of this program by the architects, a workshop was conducted in which a kind of semantic differential table was used to describe each of the spaces in the house [ill.283-284]. This was to keep focus on the architectural values and encourage a use of architectural terms in the discussion. The table was used as an agenda for the discussion and ensured a consistency between what was said about the different spaces. Each of the dwelling's spaces had one large sheet of paper on which the table was printed where it was possible to put other loose thoughts or concrete ideas that popped up during the process of finding consensus. Through the use of the schemes, for example the matter of light was differentiated and specified. In

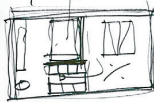
283. The semantic differential technique is used to define the different spaces and make sure that the same aspects (when relevant) are being discussed for each space. In this manner a consistency between the different spaces are reached and the differences between them are visualised. The kitchen-dining area should be open, refined, have lots of natural light etc. There is also room for scribbling down loose ideas and thoughts that pop up along the way on the left side of the large paper (A1 size) (AART 2007).

284. The semantic differential technique is used to differentiate between the different spaces. The main concept of large, open rooms with lots of natural light is clarified and specified through the evaluation of all space one by one. The bedroom, for example, is one of the rooms that are defined as a potential contrast to the main concept; it should be more closed and cave-like than the common rooms (AART 2007).

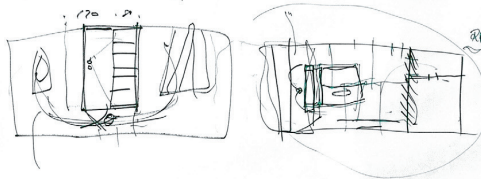
Køkken/alrum

Funktion/aktivitet

- Madlavning
- opbevaring
- Indtægelse
- Fæst
- Daglig des
- Log
- Informations
- Nisde sted
- gennemgang / passage
- tæt på adgang/forhold



- nærliggende vde områder
- direkte adgang til det fri
- vde spiseplads.
- overordnet vde sted



Æstetik



Hjem a/s_aart_Workshop 03_13.09.2007

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Soveværelse / BAD / (PÅ KLÆD.)

Funktion/aktivitet

- SOVE
- Tøj / opbevaring
- (4) for skab

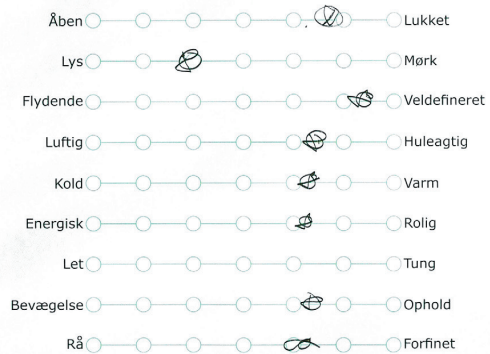
- Bad / vde væn. / hygiejne
- badekar / spa → placert nær det primære dørud
- Pensel / dotti

Se køkken del.



forhold adskilt.

Æstetik



Hjem a/s_aart_Workshop 03_13.09.2007

the main scheme, it was only mentioned that lots of light would enhance the quality of the dwelling. However, during the process of further specification, a differentiation of zones with more light and zones with less need of light was identified in order to make spaces for different functions, actions, and needs. Through the use of the table, it was necessary to describe a wider range of matters than the first that emerge when thinking of such a space, which gives a clearer idea of the unity of the house and the internal relations between the spaces. After this workshop, there seemed to be a strong, as well as clearly documented, common idea, in the development team, of what qualities the dwelling should possess, both seen as a whole, and also in the smaller entities. On this background, the new dwellings were drawn (first *Nova* and later *Largo*), and throughout the next section, there will be an analysis of both the older houses and the newer houses.

6.6 EVALUATIONS OF PROCESS

The creation of a solid foundation for the design process, at different stages, is an important aspect of the development, and by doing that, for example the choice of architects becomes a more qualified process as the argumentation could refer to the documents that define aims and values. It is therefore quite easy to discuss the pros and cons of the different architectural companies, because their values and working methods could be more structurally evaluated than if only the gut feeling would be used. The solid foundation turned up again when initiating the cooperation with *AART*, and the establishing of a common ownership of the project was reached through the study trips, broad discussions, and early conceptual meetings, through which the concept was elaborated. This feeling of ownership engaged all participants to also feel a responsibility towards the project, and thus a sincere interest to perform as well as possible. The graphical documentation of the results of each meeting, or workshop session, was an important means to secure that all group members had the same understanding of the words used in the discussion, which was especially important in the early stages of the design process where the level of the discussion can be quite abstract. The graphical documentation could also have been used earlier in the process when setting up the first values and aims for the project, which could have made this document more concrete. In the later stages, the project material became more concrete in itself, which means that the discussion also became more concrete, and the diagram was not as important a tool anymore. Scales, such as those inspired by semantic differentials, can be a useful tool for structuring a discussion and ensuring that a set of aspects are covered for different areas of the house, as well as giving good opportunities for actually focusing on the architects' vocabulary; lead the non-architects into using this vocabulary and framing a more specific discussion about the words and concepts that are being used. However, a free flowing discussion of impulses and ideas along the

way is just as important for the creativity of a meeting dealing with the development of architectural quality. Therefore, such structural tools should be used as guidelines along the way, but not be considered dogmatic agendas. Interplay between free discussions of creative conceptual development and verbal, diagrammatic and graphical precision of the aims, values and results seems to be fruitful for working with architectural quality and securing a common aim and ownership for a project of this kind. But how did the dwelling actually turn out? In what respects are the houses of *Hjem* strong, and where are they weak in relation to architectural quality? Can it be seen that the working process has changed from the first *Hjem* house, *Uno*, to the recent houses that are results of the cooperation between *Hjem* and *AART*; *Nova* and *Largo*. What can be learned from this in relation to future development of prefab wooden dwellings? In the following section, the three house types of *Hjem* will be analysed in order to answer these questions.

6.7 CLARIFICATION THROUGH EXAMPLES – HOUSES BY HJEM

6.7.1 Hjem: Uno

Structuralism: *Proportion and order, Form and material, Detail and unity*

The floor plan of the larger building volume has proportions that approximately correspond to the golden section ratio [ill.287]. The smaller volume places itself right up to the larger volume, so that one of their longer sides respectively lies in the same plane. In the façade this division is more apparent than inside of the building, as the smaller volume has a flat roof and the larger volume a slanted roof [ill.289]. The building is a wooden framework construction, just like the *ONV house*, and is in the original version of *Uno* clad with larch wood lamellae [ill.292]. In this version and the one with white plaster on the exterior walls alike, there is no differentiation in the material of the smaller and the larger building volume, and they therefore, to a higher degree, appear as one building volume also in the façade [ill.288, 290]. In some versions of the building, however, there are different materials in the larger and the smaller volume, which makes the contrast between them more distinct and leads to a clearer idea of the little box as being an appendix to the larger box [ill.293]. In this instance, the contrast between the two building volumes becomes significant to a degree that you no longer sense the kinship between the two wherefore it appears to be a bit split. The details are simple and pure, and *Uno* as a whole has developed to the better over the years. The façades are more aesthetically strict and coherent [ill.291] in the newer

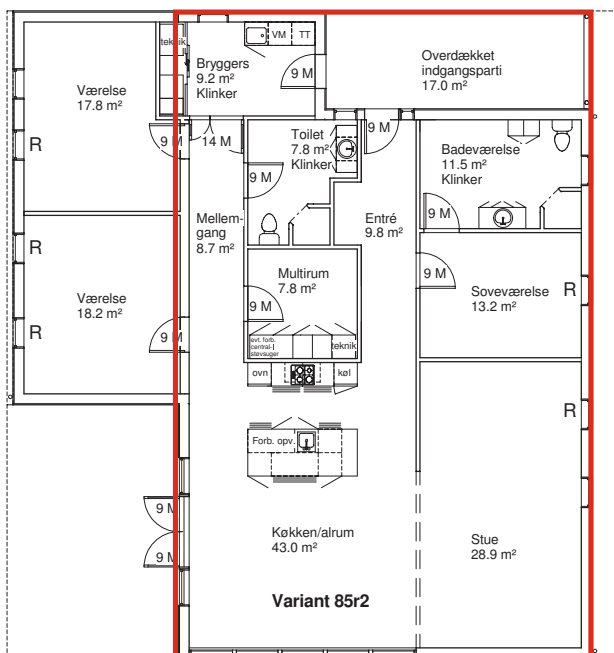


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285. The detailing of the newer versions of *Uno* is fine and sturdy. The wooden lamellae in the canopy ceiling give the house an elaborate and pure expression (Photo: Ida Wraber).

286. The interior ceiling does not seem as sturdy as the exterior ceiling solutions for the eaves and canopies (Photo: Ida Wraber).

287. Floor plan of *Uno*. The red box indicates the large building volume, which approximately match with the golden section ratio (Hjem 2009).

288. In this façade the shift between the smaller and the larger building volume is not very distinguished (Photo: Ida Wraber).

289. In this façade the two building volumes are clearly seen due to the flat roof and the background position of the smaller building volume. The large window area has gotten an integrated sun shade at the top of the windows, in a box that follows the main shape of the façade, which is an improvement in relation to earlier solutions (Photo: Ida Wraber).



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290. All of the façades of the building are clad with white plaster and therefore the smaller and the larger building volumes are experienced as one unity rather than single elements of a composition (Photo: Ida Wraber).

291. The façades are rather different, but get a kinship through the simple design with only a few window types placed in an ordered manner (Photo: Ida Wraber).

292. The original version of Uno is clad with boards of larch wood. There is no distinguishing, with respect to materials, between the smaller and the larger building volume (Hjem 2009).

293. Uno clad with a combination of fibre-cement boards and black wooden boards. There is a clear distinguishing between the smaller and the larger building volume (Hjem 2009).

versions than in the first versions [ill.292-293], which have many different window types that are placed in a considerably less strict system, and this gives a restlessness to the façades, as for example also seen in the *Vanna Venturi house*. In the newer versions, the façades seem considerably better balanced and systematically arranged. The sunlight protection above the large window area is better integrated [ill.289], and the eaves and canopy are clad with strips of wood, which gives a robust and simple expression to the house [ill.285]. These wooden areas also indicate the fact that the building is actually a lightweight construction. In the interior of the house, however, the details are not as fine as in the exterior; for instance, when looking at the ceiling design, the white plaster board cladding does not at all seem as robust as the wooden lamellae of the exterior ceilings, and this solution therefore breaks the otherwise solid and simple expression [ill.286].

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Perception psychology: *Unity and variation, Balance and harmony, Dynamics*

The building contains a variation when moving around the house on the outside. The façades are different from each other, but have a kinship that ensures coherence [ill.298]. Inside of the building, the spaces are large and with much natural light, but only with a smaller difference in the atmosphere between the private rooms and the common spaces [ill.299-300]. Within the framework of the concept of light and airy rooms, it could still be possible to differentiate more between the open common space and the more closed and cave-like private rooms and it could also be possible to work with different materials in the interior to support the different functions. There is, however, a fine balance between the rooms, and the dwelling has a harmonic layout. In relation to dynamics, there are two apparent lines of movement through the house, which both start in the large common room and lead respectively towards the entrance door and the scullery [ill.294-296]. If these two lines were connected, it would be possible to get a circular movement in the dwelling, which gives an easier pattern of movement that does not always lead through the kitchen-dining area. If once again looking at the building from the outside, the sloped roof gives the shape dynamics, and the window layout in several of the façades can also be considered to add dynamics, as there are different window shapes and sizes that are not placed within an obvious rhythm or system [ill.297].



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294. The two corridors from the kitchen-dining area end in the entrance door and the scullery respectively, but they are not linked to make it possible to get directly from the main entrance to the scullery. This could have given a more dynamic pattern of movement to the dwelling (Photo: Ida Wraber).

295. The corridor from the main entrance door towards the kitchen-dining area, seen from the entrance (Photo: Ida Wraber).

296. The corridor from the scullery to the kitchen-dining area, seen from the scullery (Photo: Ida Wraber).

297. Photo in which two of the façades can be seen. The façade to the left is simple both in relation to main form and placement of windows, whereas the façade to the right is more complex in relation to both of these factors (Photo: Ida Wraber).

298. Even though the façades seen on this photo are rather different in their design, there is a kinship between them, which gives a balanced and dynamic expression (Photo: Ida Wraber).

299. The main characteristic of the Uno house is the large rooms with lots of natural light, which can for example be seen in the kitchen-dining area (Photo: Ida Wraber).

300. Even if there is a larger window area in the larger common space than in the private rooms, the character of the spaces are quite alike as their room shapes, materials and colours are very similar (Photo: Ida Wraber).



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Phenomenology: *Relation to cultural/personal framework, Supporting a multi-sensory experience, Relation to context*

Denmark is a country that has a strong building tradition in respect to building with bricks, but when it comes to wooden building there has not been as much building activity for the last couple of centuries. When wood has been used, it has most often been temporary or secondary building such as emergency dwellings in times of crisis, summerhouses, annexes or garden sheds. The common Danish idea of what a *real* house is therefore closely tied to the robustness of a brick wall or other heavy materials that can withstand the rough wind and harsh weather. Scepticism has been, and still is, directed at wooden houses regarding their durability in relation to damp and wind – especially considerations of how and how often the wooden surfaces should be treated or maybe even replaced. Furthermore, a wooden interior is not very common in Denmark but is maybe more related to holiday memories from trips to Norwegian ski cottages or summerhouses. Therefore, it is not very surprising that the *Uno* house



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301. *Uno* with a cladding of fibre-cement boards and black wooden boards combined; there is a splitting of the building into a larger and a smaller building volume due to the application of different cladding materials (Hjem 2009).

302. The original version of *Uno*; there is no distinguishing between the two building volumes with respect to materials (Hjem 2009).

303. *Uno* with a white plaster façade; there is, just like in the larch wood version, no distinguishing between the two building volumes with respect to materials (Hjem 2009).

304. The bathroom is the room in *Uno* that gives the best possibilities for an interesting multisensory experience with its tiles on floors and walls (Photo: Ida Wraber).

305. In most of the spaces of Uno the element that gives the most interesting multisensory experience is the floor, which can either be made of prefab parquet or tiles (in the bathroom, kitchen, and entrance) (Photo: Ida Wraber).

306. The large window areas of the kitchen-dining room can cause rather high temperatures during the summer and the large height from floor to ceiling, especially in the early versions of Uno, contributes to a resounding acoustic environment (Photo: Ida Wraber).

307. The canopy at the entrance door is clad with wooden lamellae, which contribute to the sturdy and pure expression (Photo: Ida Wraber).



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in many ways looks like a house built from heavy materials both in the exterior and the interior. Inside of the house, all wall and ceiling surfaces are, just as in the *ONV house*, clad with white painted boards, which makes the house look like any concrete house, material-wise. The parquet floor that can be found in some of the spaces of the house is not enough to give the spaces a feeling of being a wooden house, even if it obviously gives the rooms some warmth in relation to the artificial materials (such as plastic floor) or hard materials (such as clinker or concrete). The house can be built with wooden cladding, fibrocement boards or plaster on the outside wall surfaces [ill.301-303]. The house can thus also be understood and read in many different ways, and it is difficult to get an understanding of how the house actually is constructed. In some models, the two building volumes are differentiated through giving the large volume a heavy expression (with a cladding of fibrocement boards or plaster), whereas the smaller volume is given a lighter expression (through a cladding of wooden lamellae), which does not give a correct understanding of the construction of the building. The possibility of having different cladding materials in the exterior has the advantage that it is possible to adjust the expression of the building to different contexts such as to make the house harmoniously fit into the surroundings in which it is placed. Additionally, there are a few more possibilities for adjusting the house to the individual building site – the building can for example be mirrored around the longitudinal axis; you can have a carport placed by the house or have a wooden terrace in the angle between the two building volumes. Inside the house, the rooms are regular in their shape, which makes them quite open in relation to how the inhabitants choose to furnish it. The colours and surfaces are also neutral, which makes them fit to a larger group of people, as also seen in the *ONV house*. In the interior there are a few possibilities of adaption to the needs and wishes of the buyers, such as the choosing between having two large or three smaller bedrooms in the children's area and the colours and materials for kitchen and bathroom. In relation to a multi-sensory experience, especially the early houses have a quite resounding acoustic environment in the common spaces, and it can get quite hot behind the large window panes during the summer (in particular when the windows are facing south) [ill.306]. These two factors give the space another character than the function implies – as this should be the space where the family spend most of its time together, alone and with guests, and it should therefore be able to hold many people at all times of the day and all times of the year. Some robust materials that can give a tactile experience are used, such as tiles and clinker in the bathroom and the kitchen area, and wooden floors similar to the *ONV house*. However, the tactilely and visually experientially poor material of painted plaster board dominates in the interior spaces of the dwelling [ill.304-305]. In the exterior detailing there is, as earlier mentioned, wooden cladding underneath the eaves and canopy which is definitely part of giving the house a robust and elaborate expression [ill.307].

6.7.2 Hjem: Nova

Structuralism: *Proportion and order, Form and material, Detail and unity*

Nova, just like *Uno*, consists of two building volumes, which are displaced in relation to each other in the horizontal plane [ill.311]. In *Nova*, though, this seems to be more deliberately used than in *Uno* to create a play in the façades – in three of the façades there is a clear shift in the golden section ratio, which creates a balanced tension in these [ill.312-315]. The smaller building volume is subordinated to the larger one in the horizontal plane, and also partially in the façades, through being lower and having a flat roof, whereas the larger volume has a sloped roof. From the entrance side, however, the two building volumes melt together into one single shape through an integrated carport that fills the angle that is formed between them. In the interior the house has three main axes, which all are both visual axes and lines of physical movement. *Nova's* shape is quite heavy, quite like the *ONV house*, as most of the façades are mainly long and low, but the differentiation in materials between the panels of larch wood lamellae and the horizontal black boards of wood makes the expression of the whole lighter. This also gives a fine aesthetical contrast, which, however, is not actually an expression of a relation between material and form. The simple expression is found both in the overall expression and in the design of the details. Nevertheless, the ceiling of the terrace and in the carport has a cladding of woodcrete panels, which does not at all seem as refined and pure as the other materials and details [ill.308-309]. A solution similar to the wooden lamellae that *Uno* has in the eaves and canopy follows the pure and robust concept better. Two of the façades are simple and pure to a high degree, whereas in particular the façade that shows the side of the large building volume lacks some of this simplicity as an angle has been seemingly arbitrarily put into the design of the roof, which could have been better communicated and explained through a detailing that for example supported the shift between private and common rooms that occurs around this point of the building [ill.315]. At the point where the large window area meets the outer wall, the black wooden wall transforms into a white plaster board, which breaks the idea of the wall as being one surface of a coherent volume and a result of this the otherwise well-functioning flow between the interior and the exterior is ruptured at this point [ill.310].

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308. The ceiling in the carport at the main entrance door is clad with woodcrete boards, which contradict the otherwise pure, simple, and sturdy expression of the house (Photo: Ida Wraber).

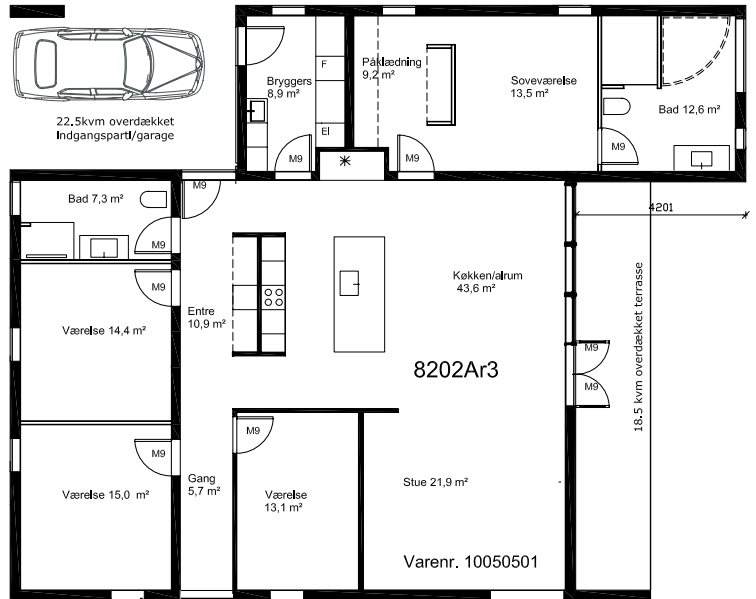
309. Also in the canopy above the terrace the woodcrete boards are used as a less elegant solution in relation to the main concept (Photo: Ida Wraber).

310. Where the window meets the wall, the wall is transformed from a light and varied wooden surface into a massive, white, and homogenous plaster board, which makes the otherwise floating transition from outdoor to indoor less coherent (Photo: Ida Wraber).

311. *Nova*, like *Uno*, consists of two building volume; one smaller and one larger, which are placed beside each other with a displacement that gives some protected outdoor spaces by the house (Hjem 2009).

312. This façade has a shift in the golden section ratio where the smaller building volume and the larger building volume meet (Photo: Ida Wraber).

313. This façade also has a shift in the golden section ratio where there is a notch in the building volume for carport and entrance to the house (Photo: Ida Wraber).



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314. Also in this façade the carport is ended at the approximate point of the golden section ratio (Photo: Ida Wraber).

315. In this façade the golden section ratio is somewhat vaguely marked by the introduction of a pitch in the roof. This meeting between a pitched roof and a flat roof is however not very clearly defined, and therefore seems a bit random. It is not clear which shape that is dominating the composition; the low box shape or the dynamic diagonal roof pitch (Photo: Ida Wraber).



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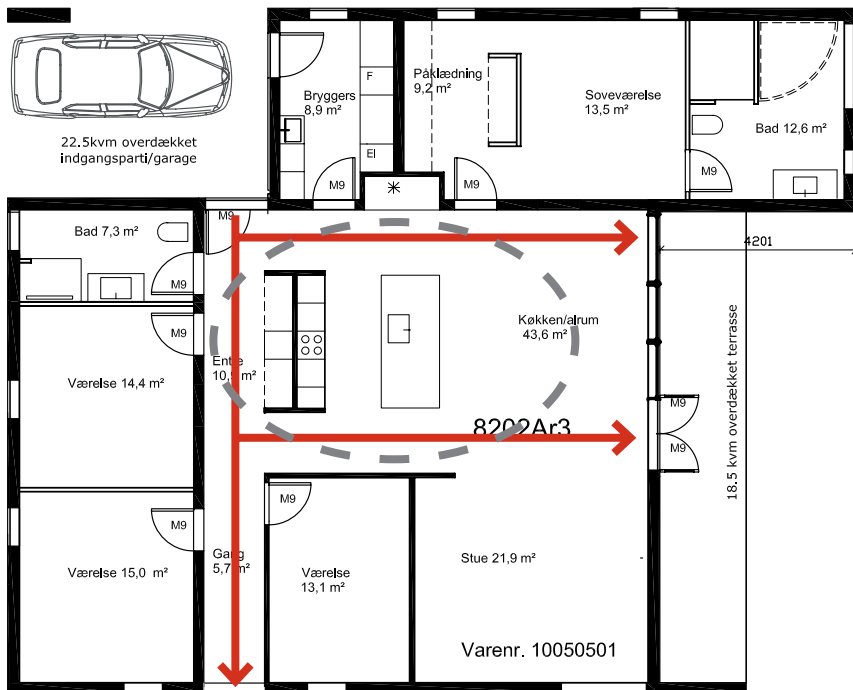
Perception psychology: *Unity and variation, Balance and harmony, Dynamics*

The façades of the building provide a variation as one moves around the house. Just like the spaces in the interior offer a varied sequence of spaces with directional shifts both visually and physically [ill.316]. In the interior, most of the wall and ceiling surfaces are clad with white plaster boards, or the like, whereas the floors are either clinker or parquet, which are simple and relatively neutral solutions. It is instead the sequence of rooms and the light that bring about variation and tension in the spaces [ill.321-322]. In the exterior, there is a fine balance between the two façade materials that creates an invigorating contrast [ill.319-320]. There is a fine play between the large surfaces of the façade and the composition of windows in lamella-clad panels, which generate both dynamics and harmony within the given framework [ill.323]. The slanted roof line also adds to the dynamics of the building, outside as well as inside of the house. Inside of the dwelling, one of the paths of physical movement stops rather abruptly in a cul-de-sac, however, the visual line is extended out through a large windowpane that is placed in the end wall of the corridor [ill.318]. The other two axes are connected as to allow a circular movement through the dwelling, which generates even more dynamics to the house in relation to *Uno* that only has linear patterns of movement [ill.316-317].



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316. The red lines mark the three main axes of the dwelling, whereas the grey dotted line show the dynamic, circular physical connection between the private and the common rooms (Hjem 2009).

317. Perpendicular to the axis leading from the entrance door there are two axes leading from the corridor into the kitchen-dining area. Both of these axes lead towards the large window area in the dining area and together they create dynamics in the house as they connect the private and the common spaces of the house in a circular manner (Photo: Ida Wraber).

318. The corridor from the main door is concluded by a window at the opposite end, which gives light and a prolonging of the axis visually; however physically it gives a peculiar cul-de-sac to the axis (Photo: Ida Wraber).



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319. The combination of two materials in the façades gives a variation that makes the façades interesting; this example is of white plaster and black wooden lamellae (Hjem 2009).

320. One of three possible material combinations; white plaster and oil treated larch wood lamellae (Hjem 2009).

321. In the interior the walls and ceilings are clad with white plaster boards, which stand as contrasting elements to the flooring which can either be made of tiles or parquet (Photo: Ida Wraber).

322. The choice of materials and colours is simple which means that shapes and the play of light and shadow clearly stand out and becomes an important part of the spatial experience (Photo: Ida Wraber).

323. These two façades offer a variation of materials, light, and shadow within a simple main concept, where the openings are framed by the panels with vertical larch wood lamellae (Photo: Ida Wraber).

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Phenomenology: *Relation to cultural/personal framework, Supporting a multi-sensory experience, Relation to context*

Just as in the case with the *ONV house* and *Uno*, *Nova* finds itself in the cross field between the advantages of building in wood and the conceptions of what a *real* house is in a Danish context. This is – as in the *ONV house* and *Uno* – primarily seen in the interior of *Nova*, whereas the use of wood in the exterior is more supportive of the understanding of the house as a light construction [ill.324-325]. Wood is also comprehended as an environmentally friendly material, which at the moment is a buzzword in many circles in Denmark, and in the western world in general, as previously mentioned. Should this potential be fully utilised, it would be an obvious possibility to use wood to form the overall expression to a higher degree than is done today – both in the exterior and in the interior of the house – as to make the house, as a whole, easier to understand as a wooden house, such as seen in the *Boase* dwelling. When it comes to the multisensory experience, the sound in the large room has been muffled in comparison to the early versions of *Uno*, and the windows have gotten an overhang and protruding walls on the sides, which takes some of the summer sun in those cases where the façade turns towards the south [ill.326]. This makes the room more comfortable to be in, and it can support the functions that it should be able to hold better. Just like in *Uno*, the walls and ceilings are clad with white plaster boards that dominate the room with regard to materials, and these do not provide a tactilely grand experience, but in the bathrooms there are still materials that provide a varied

324. *In the exterior the wood is used in such a way that it is possible to immediately understand the house as a wooden construction. The corner detail with a thicker vertical list at the corner supports the simple and sturdy concept (Photo: IdaWraber).*

325. *In the interior the details seem less sturdy and they do not support the understanding of the house as a wooden construction (Photo: IdaWraber).*

326. *The large window area has sunlight protection from a roof and protruding walls on both sides of it (Photo: IdaWraber).*

327. *The division of the master bedroom into a bed area and a walk-in-closet gives an interesting and varied room sequence and play of light and shadow (Photo: IdaWraber).*

328. *In most spaces only the flooring gives a possibility for a tactilely interesting experience, as most other surfaces are white, painted plaster boards (Photo: IdaWraber).*

329. *The bathroom is the most interesting room tactilely with different tiles and clinkers on walls and floor (Photo: IdaWraber).*

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experience to the sense of feeling [ill.328-329]. There are several interesting light inflows and views to the surroundings in the dwelling – for example in the master bedroom and in the bathroom [ill.327]. There are a few possibilities for adjustment in relation to the specific buyer’s needs and wishes and the surrounding environment; it is possible to choose materials for the bathroom and the kitchen, between two or three children’s bedrooms, or whether there should be an office next to the master bedroom. In the exterior, only the combination of materials can be chosen from three possible designs.

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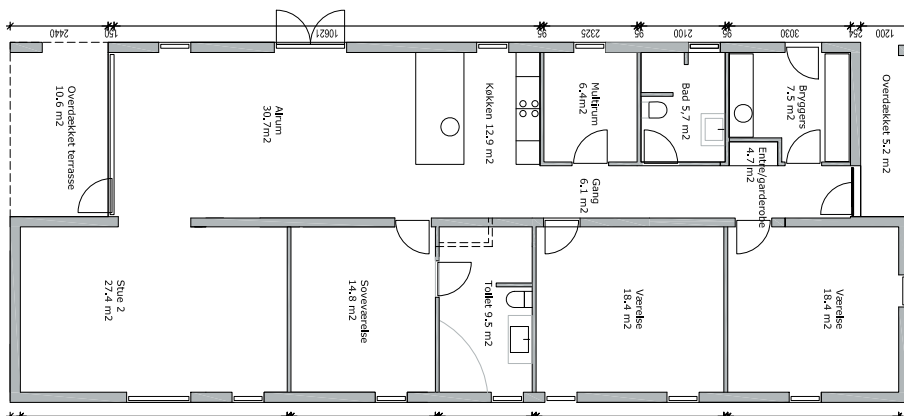
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6.7.3 Hjem: Largo

Structuralism: *Proportion and order, Form and material, Detail and unity*

The *Largo* house has, in relation to the two other *Hjem* house types, a very simple basic shape from which mass is subtracted to create a canopy for the entrance and the terrace, as an alternative to add protruding elements for this cause [ill.330, 337-338]. Windows and doors are, like in *Nova*, placed within the frame of panels, which gives order to the façade [ill.331]. The gable façades are well proportioned in their basic shape, whereas the side façades are quite long in relation to their height, but the sloped roof surface brings balance to the composition when standing in a place where it can be seen [ill.332]. The horizontal orientation of the building is lifted by the tall openings in the façade and the slim, tall windows. Also the panel, in which the windows are placed, lifts the expression in the same manner as they do in *Nova*, as they break the surface of the façade which decreases the visual heaviness of the wall. This also harmonises with the fact that the house is a wooden construction. In the interior, on the other hand, you have no sense of what the house is made from or how it is constructed as the white boards are, again, the dominating material [ill.333-334]. Both the shape and the details are simple and pure, with the exception of the ceiling cladding, inside as well as outside of the house [ill.335-336].



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330. *Largo* has a very simple basic square shape from which material is cut out to form canopies over the terrace and the entrance door (Hjem 2009).

331. The front façade. Windows and doors are placed in panels of thinner wooden lamellae, as also seen in *Nova* (Photo: Ida Wraber).

332. The back façade. The long façades are regular and rather long and low. The red tile roof balances this elongated shape so that the façade seems well proportioned (Photo: Ida Wraber).

333. The exterior wooden wall becomes a plaster board wall where the window meets the wall. This creates a clear separation between the exterior and the interior room. Here seen from the outside of the house (Photo: Ida Wraber).

334. The separation of exterior and interior due to the shift of materials seen from the inside of the house (Photo: Ida Wraber).

335. The board materials used in the interior ceilings do not seem as sturdy and simple as the main concept would suggest (Photo: Ida Wraber).

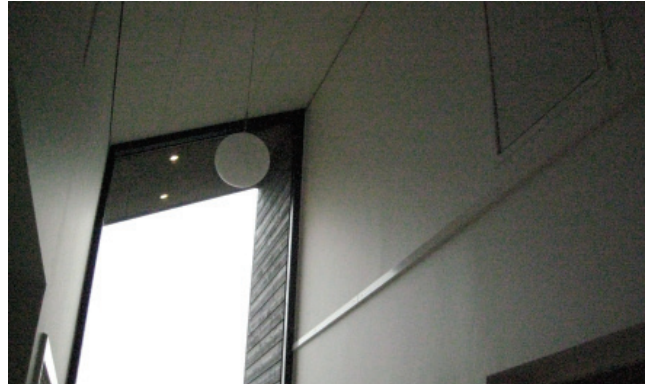
336. The exterior ceiling solutions by the terrace and the entrance are also less sturdy and pure than most of the other detailing (Photo: Ida Wraber).

337. The gable façades get much of their character from the notches. In this façade the notch forms the roofed terrace (Photo: Ida Wraber).

338. In the other gable façade the notch forms a canopy for the entrance door (Photo: Ida Wraber).



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Perception psychology: *Unity and variation, Balance and harmony, Dynamics*

The façades of *Largo* are not as differentiated as in *Uno* or *Nova*, but the cuts into the basic shape create a play in the volume that makes the house interesting – the façades have a clear kinship and are not very loud-mouthed, but in spite of this you feel an urge to get around the corner, to find out what the next façade has to offer [ill.341, 343]. The façades of *Largo* are almost symmetrically composed, but small distortions break what could otherwise have been rigid and boring. In the interior, the room sequence is very simple with only one main axis, both visually and physically; running from the main entrance towards the large window area in the end wall of the kitchen-dining area [ill.342]. From this axis, you can access all the rooms of the house, which does not provide much dynamics in the pattern of movement compared to *Uno* and *Nova*. In the hallway and in the kitchen-dining area, the ceiling goes all the way up to the ridge, which gives a fine contrast between the more dynamic common space and the more private and calm rooms [ill.339-340, 344].



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339. One of the bedrooms; the private rooms are calm in their expression (Photo: Ida Wraber).

340. The living room is, like the private rooms, calm in its expression (Photo: Ida Wraber).

341. Even though the building is rather regular in its basic shape the small variations, such as the notches, gives an inclination to move around the corner to see what is hidden there (Photo: Ida Wraber).

342. The main axis of the dwelling seen from the exterior. It cuts through the interior and creates a visual connection in the full length of the house (Photo: Ida Wraber).

343. The notches of the building create dynamics that draws the viewer around the corner (Photo: Ida Wraber).

344. The slanted ceiling that is visible in the corridor and the kitchen-dining area gives these spaces a more dynamic expression than the more private and clam rooms (Hjem 2009).



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Phenomenology: *Relation to cultural/personal framework, Supporting a multi-sensory experience, Relation to context*

The basic shape of *Largo* is strongly related to what we understand as the archetype of a house. In this respect the double-pitched roof plays a major role. However, the basic shape has been altered in such a way that the house is also comprehended as more contemporary – and in this respect the notches in the basic volume and the panels holding the windows are important factors [ill. 345-346, 352-354]. The use of wooden lamellae in the façade is also contemporary, but it is, however, combined with concrete roof tiles that look like traditional undulating clay tiles, which gives a fine play between the rootedness in the Danish context and the use of contemporary means [ill. 348]. The house can therefore be read and understood as a contemporary suggestion to a wooden dwelling. The same is applicable to the interior – with the exception of the materiality – but apart from this the spaces are contemporary, light and airy within the framework of a traditional basic shape. The inflow of sunlight (and heat) and the acoustics have also been improved in *Largo* compared to the early versions of *Uno*, and the common spaces can therefore appropriately act as frame for the planned functions. In *Largo*, as in the two other houses by *Hjem*, the dominating material is the white plaster board, which is a tactilely poor material, whereas the bathroom stands for the most tactilely interesting experience, as also seen in the other *Hjem* houses and the *ONV house* [ill. 347, 349]. In the bedrooms, there are fitted carpets and, as also seen in *Kubeflex*, this gives those rooms a softer character and generates a more distinct contrast between the large open common space and the smaller and calmer private rooms than is seen in *Uno* and *Nova* [ill. 350-351]. There are, also in *Largo*, a few possibilities for adjusting the house to the specific site and the buyer. The floor plan can be mirrored around the longitudinal axis, but otherwise it is quite static in its design, apart from the possibility of choosing materials for the bathroom and the kitchen, as in the other *Hjem* houses.

345. Even though *Largo* is traditional in its basic shape, the detailing is contemporary and the simplicity permeates both unity and detail – especially in the exterior. In this picture the meeting between window and façade cladding is seen; it is very simple with only a thin metal strip to cover the sensitive end surfaces of the vertical wooden lists (Photo: Ida Wraber).

346. The footing solution is very pure and simple in its design, which underlines the main expression and the corner detail with the thicker wooden list at the corner supports the understanding of the house as a wooden construction (Photo: Ida Wraber).

347. The board materials used for the ceilings – both in the interior and in the exterior – seem less sturdy than the other facing materials and details (Photo: Ida Wraber).

348. The notches contribute to the contemporary expression of the house, whereas for example the traditional tiles of the roof root the dwelling in the Danish building tradition (Photo: Ida Wraber).

349. The bathroom offers the most tactilely interesting and characteristic surfaces in the interior of the house with its tiles and clinkers on the floor and walls (Photo: Ida Wraber).

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350. There is a fine contrast between the airy and bright common spaces and the smaller cave-like rooms; the picture shows a view from the kitchen-dining area towards the entrance door (Photo: IdaWraber).

351. One of the bedrooms; the private rooms are more cave-like in their character than the common spaces (Photo: IdaWraber).

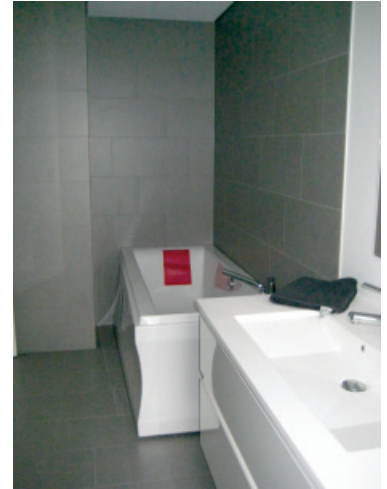
352. Largo is a mix of the traditional and the contemporary – the façade at the entrance shows this through being a simple and symmetric gable with a traditional doubly pitched roof, which is detailed with a significant notch that creates a canopy for the entrance and is furthermore cut in two by a window in the full height of the house at the entrance door (Photo: IdaWraber).

353. The mix between traditional and contemporary building is also seen in the composition of the rough horizontal wooden board cladding and the finer wooden list cladding, which meet through a thin metal strip (Photo: IdaWraber).

354. The corner detail is also pure towards the roof with a simple gutter and a metal barge board (Photo: IdaWraber).



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6.7.4 Summary on the analysis of the dwellings from Hjem

The analysis of the *Hjem* houses can be summarised as seen in the table below. The table can be read in several ways, as mentioned before; one can compare the different house types to each other, which solutions are more or less suitable in the different dwellings, or one can discuss in which areas the houses are generally well elaborated in relation to the three defined clusters of theories of architectural quality, and where there generally might be room for some improvement or further tooling. Both of these comparisons are interesting and relevant in order to create an overview of the advantages and

	STRUCTURALISM: <i>proportion and order</i> <i>form and material</i> <i>detail and unity</i>	PERCEPTION PSYCHOLOGY: <i>unity and variation</i> <i>balance and harmony</i> <i>dynamics</i>
UNO	Beautiful proportions, such as the golden section ratio, are mainly seen in the floor plan, but also to some extent in the façades. Uno can be built with many different kinds of cladding materials – and even when it is clad with wood, the house looks like a heavy construction. In the interior it is also difficult to see that the house is a light wooden construction. The details have been developed quite a bit from the first Uno houses to the later ones, and they are now much more in line with the pure and simple concept of the house – first and foremost in the exterior.	Seen from the outside Uno is experienced as a united whole, but at the same time the variation between the façades seems satisfying. In the interior, on the hand, the variation is not so obvious. The house though seems harmonic and balanced both in the exterior and the interior. The pitched roof adds dynamics to the both seen from the inside and the outside. In the interior there are two parallel main axes. These are connected through the kitchen-dining area, but are not connected at the other end, which gives a more linear than dynamic pattern of movement.
NOVA	Both the floor plan and the façades are well proportioned and composed. Nova appears more as wooden house than Uno, for example because of the panels with vertical, thin lamellae that lighten the otherwise rather horizontally oriented façades. In the interior the light wooden character can however not be sensed, but Nova is instead comprehended as a traditional heavy construction. As a whole the expression is simple and pure, and especially the details in the exterior underline this – with the exception of the woodcrete boards in the exterior canopies.	The building is immediately comprehended as a solid concept with an elaborate variation. In the exterior this is seen in the façade compositions of shapes and materials. In the interior the materials and colours are neutral, whereas the sequence of spaces and light inlets creates tension, variation and dynamics. There are three main axes through the house, of which one runs perpendicular to the two others, which gives a dynamic pattern of movement and gives the possibility of circular connection between the spaces of the building.
LARGO	The basic form is simpler than seen in the other houses from Hjem, as the concept builds on a more direct symmetry. The floor plan and the long façades seem rather elongated, which in the façade is balanced through the red roof surface that lifts the composition. The panels with vertical lamellae, just as in Nova, also lighten the façades and underpin the light construction and its character as a wooden house. The details follow the pure and simple main concept, with the exception of the woodcrete cladding in the canopies and the ceiling solutions in the interior.	There is not very much difference in the façade compositions when looking at them in pairs (long/long and gable/gable), but still enough to create a curiosity about what happens around the corner. The façades are not composed as perfect symmetries, but minor distortions in the placement and design of the openings create a discrete tension in the composition. In the interior the pitched roof gives a dynamic corridor and kitchen-dining area that stands in balanced contrast to the smaller private spaces with fitted carpets. The interior pattern of movement is linear and very predictable, which does not add tension to the experience.

disadvantages of these specific prefab wooden dwellings in relation to architectural quality. If first looking at the column to the left, the structuralist perspective, it can be seen that the houses in general are well proportioned, even if the *Largo* house is rather long in relation to its height. There has been a constant process of development from the first *Uno* to the newest versions in which the façades have become better structured with regards to window sizes and placement, which has given a stricter order and more unambiguous proportions in the external expression. In relation to the coherence between form and material all of the three houses are quite vague seen

PHENOMENOLOGY:

relation to cultural / personal framework
supporting a multi-sensory experience
relation to context

Uno is a light construction, but the form and the use of materials are rather similar to a traditional Danish heavy construction. The multisensory experience is interesting both visually and tactilely from the outside, whereas the experience of the interior is more flat, as most surfaces are white painted plaster boards. The acoustics and the comfort, which are also important parts of the multisensory experience, are improved when comparing the older Uno houses to the more recent. Uno can be adapted to the context through several different façade claddings, carport and terrace solutions, and be adjusted to the user with respect to interior materials – mainly in kitchen and bathrooms.

Nova is more obviously than Uno designed as a wooden house – seen from the outside. In the interior this could be more articulate, which could also add the feeling of care for a healthy indoor climate, and the environment, as wood is often connected to such aspects at the moment. The acoustics and the comfort in the large room is well functioning and support the function as well as the experience, whereas the materials are generally tactilely poor in the interior. The strongest room, with respect to multisensory experience is the bathroom, where several of the surfaces are clad with tiles and clinkers. The house can be adapted to the context through a mirroring of the floor plan, but it has only few choices of materials composition in the exterior and in the interior the choices of materials are, as in Uno, mainly connected to kitchen and bathrooms.

Largo is very close the archetype of a house in its basic shape – especially the doubly pitched roof and the unified shape and compact shape support this. However, Largo also have a more contemporary detailing, which makes the house appear as both rooted in the Danish building tradition and a suggestion to a contemporary dwelling. Contemporary features are for example the large notched at the house's entrance and terrace, and the use of wood together with strips of steel. Just as in the other houses from Hjem the light and sound conditions in the kitchen-dining area are adjusted to the function, however many of the used materials are tactilely poor. The fitted carpets in the bedrooms and the tiles and clinkers in the bathrooms are though positive features with respect to the multisensory experience. In relation to customisation to context and user, there are only few possibilities – primarily a choice of materials in the exterior and in the kitchen and bathrooms.

from the inside, as the houses give an impression of being more a heavy construction than a light wooden construction, as also seen in the case of the *ONV house*. *Nova* and *Largo* have, seen from the outside, a more readable expression than *Uno* in relation to understanding the constructional logics of the building as being a wooden house. All three houses have a simple, pure and robust expression, which is underlined by many simple and elaborate details. The interior ceiling solution in all three houses does not, however, fit into this framework and seems considerably less fine than the rest of the house, and the woodcrete panel solutions in the canopies and overhangs of *Nova* and *Largo* also fall into this less sturdy category of details. The wooden lamellae cladding of the canopy and eaves in *Uno* seem significantly more consistent with the overall concept and expression [ill.355-356].

If moving on to the middle column, which contains the perception psychological perspective, it can again be concluded that the houses are all quite well composed, and



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355. The woodcrete boards in the ceiling by the terrace in Nova break with the otherwise consistent use of black wooden boards and larch wood lamellae in the exterior design. The woodcrete has an undefined colour and an unclear surface structure, which do not go very well together with the long and thin lines of the used wood and therefore gives this space a somewhat incoherent character (Photo: Ida Wraber).

356. The wooden cladding in the ceiling of the entrance in Uno seems refined and sturdy, which gives the space a solid and elaborate character (Photo: Ida Wraber).

357. In Uno the pitched roof contributes to a dynamic expression (Photo: Ida Wraber).

358. In Largo the roof is doubly pitched and is therefore part of a symmetry which gives a more calm expression than seen in Uno (Photo: Ida Wraber).

359. In Largo the smaller, private rooms have fitted carpets on the floor, which creates a more distinct contrast to the airy common spaces (Photo: Ida Wraber).

360. In Uno the character of the private rooms and the common spaces are more alike – bright and airy (Photo: Ida Wraber).

361. Example of a common room – the living room of Uno (Photo: Ida Wraber).

that they clearly appear as solid and harmonic houses without becoming static or boring as they all contain some kind dynamics. The pitched roofs generally contribute to the dynamic expression, in both the interiors and exteriors in *Uno* and *Nova*, whereas in *Largo* the dynamic expression is mainly seen from the inside of the house as the double-pitched roof is part of a clear symmetry seen from the outside which makes the two diagonal lines part of a rather calm and harmonious composition [ill. 357-358]. *Largo* is, seen as a whole, more calm in its expression than the other two houses from *Hjem* as a result of the symmetry that can be seen in all façades. Nonetheless, small distortions, such as the notches in the main volume, work as counterweights against the strictness and make the façades more interesting to look at. In the interior, *Largo*, on the other hand, has a fine contrast between the large common space and the smaller private rooms – this is achieved through the considerably smaller size of the private rooms, and the fact that they have fitted carpets that generate a more cave-like atmosphere compared to the airiness of the large common space. In *Uno* and *Nova*, there is no such characteristic difference between the private and the common rooms [ill. 359-361]. On the other hand, these two houses have more dynamic room sequences than *Largo*. Especially *Nova* appears to be quite elaborate with physical and visual experiences and connections that seem dynamic and interesting. Light and shape compositions create this dynamics, whereas materials and colours are played down, which gives a balanced experience of the whole.

In many ways, the final column, which contains the phenomenological perspective, has a broader and more intangible content that does not only relate to the composition, as a visual object, but also includes the specific context – the area, the site, the inhabitants

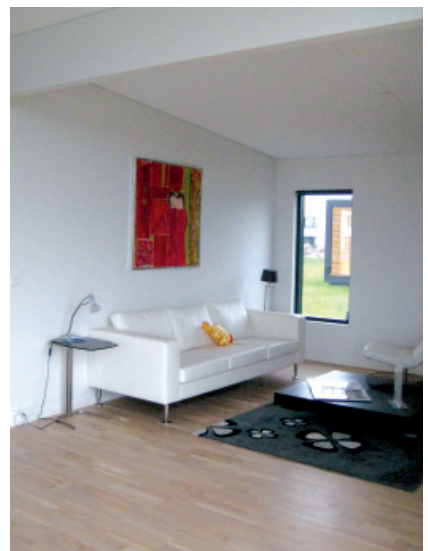
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of the house, and the broader architectural experience of what we can not only see, but also smell, hear and feel. Generally, all of the three houses can be discussed with regards to their being as wooden houses. In the exterior, both *Nova* and *Largo* can be read as light constructions whereas *Uno* appears to be heavier in its expression [ill.362-363]. In the interior, none of the houses stand out from what we ordinarily understand as a traditional Danish heavy construction house. Tactilely, the houses are all stronger in the exterior than in the interior [ill.364-365]. On the outside, pure materials are used – wood, which is warm and rough, steel and concrete that are cold and hard. On the inside, the white plaster boards dominate, followed by prefabricated polished parquet floors, that neither give any wooden scents to the room nor a very intriguing tactile experience. The positive features with regards to the tactile experience indoors



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are mainly the tiles and clinker in the bathroom (and sometimes in the entrance and kitchen area) and the carpets in the bedrooms in *Largo*. When it comes to the potential adjustments to the user and the site, the possibilities are most plentiful in *Uno* and most scarce in *Largo*. The stiffer frames, however, have the advantage that it is easier to keep the character and intention of the architecture intact both spatially and in relation to materials, at the same time as the potential of the prefab process can be maximised, whereas the more open frames, such as seen in *Kubeflex* and *Espansiva*, of course have the advantage of being adjustable as to who the future inhabitants are and what area and what site the house should be placed in. This is maybe one of the key issues in the field of prefab architecture; how much flexibility can be allowed before beginning to lose the actual potential and advantage with prefab production as well as compromising with the architectural intention – and how little flexibility can be allowed in order to have a product that can fit to suitably large group of people and contexts? Whereas the variations of materials in *Uno* might be a bit too broad in relation to keeping a clear architectural intention, its possibilities of placing different additions such as carports and terraces by the house is a good idea – hereby it is possible to alter the house in relation to a site without it losing its basic character. The possibilities for choosing exterior materials in *Nova* and *Largo* seem more balanced than in *Uno* as they offer an opportunity to choose materials in relation to the context, but within a clear framework that can secure the retention of the architectural character. The possibilities of choosing materials for kitchen and bathrooms are also contained within a given framework that ensures the architectural unity.

If looking at these analyses on an overall level, all the *Hjem* houses are well composed visually – maybe with the exception of some of the very early *Uno* houses, which, due to the combination of materials in the exterior and the less systematic window compositions, can seem a bit fragmented. They are solid and harmonious in relation to form, without becoming static in their expression. A point that could be further developed in all of the houses is the choice of materials for the surfaces, especially in the interior. This is discussed both through the structuralist keywords of *material and form* and *detail and unity* and through the phenomenological keywords of *supporting a multi-sensory experience and relation to personal/cultural framework*. By spending some extra time and effort on choosing materials and elaborating on the details, it is therefore possible to frame several of the core issues of architectural quality – both the concrete, visual and compositional aspects and the more abstract ones concerning the communication of the values, the logics and the construction of the house. These matters can all be related to the *experience of form, logics, and material*, which is picked out as an important factor for prefab wooden dwellings in chapter 5. The other important issue from chapter 5 is the *flexibility*, which might also be a bit more elaborated with respect to the user and

362. *Nova can more easily than Uno be read as a light construction as the panels of vertical larch wooden lamellae break the façade and cut holes in the otherwise heavy basic shape (Photo: IdaWraber).*

363. *Uno is more massive than Nova in its design and is therefore more difficult to understand as a wooden construction (Photo: IdaWraber).*

364. *In the exterior the materials are generally pure and sturdy, and give the possibility of fine tactile experiences (Photo: IdaWraber).*

365. *In the interior the materials are generally more tactilely poor than the materials of the exterior (Photo: IdaWraber).*

the context. If, for example, comparing with other examples mentioned in this thesis, *murermesterhuset* (the classical Danish brick house) could be mentioned as a typology that is similar to the houses of *Hjem*; both of them providing a relatively unchangeable floor plan, but with the opportunities of making smaller changes in relation to the context and user, such as façade colour or cladding material. However, a difference between them is the method of production; *murermesterhuset* is standardised only because it is built again and again, and the experiences from this repetition makes the process more efficient and predictable, whereas *Hjem* build larger elements in a factory and then use only a short time on the actual building site joining these elements into a complete house. One of the potentials of such a factory production could be the possibility of working with a library of modules, such as seen in *Espansiva* and *Kubeflex* – and this potential is not yet utilised in the house production of *Hjem* and *ONV*, as seen in the previous chapter. A modular thinking in these houses – within the framework securing the basic architectural quality – could give them a bit more flexibility in relation to the surroundings and the users' needs. In for example *Nova* and *Largo* the panels holding windows and slim wooden lamellae could be an opportunity for implementing such flexible areas, as these are a part of a strong and characteristic conceptual framework. However, as seen in the examples of *Espansiva* and *Kubeflex* flexibility must be carefully considered, as too much flexibility makes it difficult to secure the compositional aspects of architectural quality. *Murermesterhuset* is, in contrast to *Espansiva* and *Kubeflex*, still a very attractive house typology, as mentioned in chapter 1, and this shows that a simple and robust concept can keep its usability for almost a century. This house, however, also has some possibilities of adjustment in relation to where to put the entrance, window number and placement, and the possibility of adding balconies, terraces and entrance canopies quite freely – and it is therefore a good learning opportunity both in relation to *flexibility* and *experience of form, logics, and material* of standardised houses. The plan and façade have to be characteristic and robust, and the good craftsman quality should shine through in construction, details, and the handling of materials. This seems to be a cocktail that gives houses that stay popular for a long period of time. Therefore, a very important factor seems to be to define ways of working with wood in order to create a sense of wholeness and robustness in the same manner as *murermesterhuset* has achieved with bricks. *Hjem* and *ONV* do this quite well in the exterior, while the interior might as well be a heavy construction dwelling, whereas *Boase* extends the use of wood also to the interior, which gives a more whole expression in relation to logics of materials and construction. *Kubeflex* and *Espansiva* on the other hand show the light character of the building through exposing the wooden frames. Utzon's house in Hellebæk uses wood in a similar matter. However, here the wood stands in contrast to the heavy brick walls, which seems more interesting tactilely than the boards used in *Espansiva* and

Kubeflex. Also in *Villa Mairea*, the wood is used for columns, but, additionally, in this case wood is used as cladding on the more organic elements of the house (or maybe the elements become organic as a result of the use of wood?), and these elements are complemented by harder materials, such as stone and brick, which gives a varied multisensory environment – for example in comparison to the *Boase* dwelling unit. The meeting between heavy and light materials can therefore work very well, but in the cases of the houses of *Hjem* and *ONV*, the connection between form, constructional logics, and material is not clear, and this creates a split between the interior and the exterior, which is not seen in Utzon's house in Hellebæk or *Villa Mairea*. These two therefore provide interesting learning opportunities in relation to the *experience of form, logics, and material*. For future development of prefab wooden dwellings in a Danish context, it is therefore suggested that it would be a good idea to focus on *flexibility and experience of form, logics, and material* in order to reach more whole, adaptable and durable constructions and compositions that can be part of the architectural reclaiming of the constantly growing market of single family dwellings.

6.8 CONCLUDING REMARKS

- It is suggested that the communication about architectural quality between architects and non-architects in the early stages of a design process becomes clearer, and can thus form a more coherent background for the further project, if graphical material such as diagrams, drawings and photos are used to underline the verbal communication.
- The communication and understanding of architectural quality can also be promoted if all parts feel ownership of the project and have common reference points, which can for example be achieved through common study trips/visits or inspirational presentations.
- It can be seen that there has been a refinement of *Hjem*'s houses (*Uno*, *Nova*, and *Largo*) over the years – the newer versions seems more coherent, and the possibilities for adjustments seem more deliberate, as for example seen in the development of cladding materials and combination, which have become simpler and more consistent with the main concept of the dwellings.
- In all three houses, the exterior is more refined than the interior when it comes to the experience of *form, logics and material*.
- In relation to *flexibility*, all three houses are quite closed systems which make it difficult to adjust the dwellings according to the specific site and needs of the users. However, the advantage of a closed system is that the main concept and its formal and compositional qualities are not muddled through different adjustments.



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7 CONCLUSIONS

7.1 SUMMARY

7.1.1 Introduction

The single family house is the top of the dwelling hierarchy in Denmark, and the suburban areas, where the majority of these houses are being built, make up the fastest growing urbanity in the country. However, this typology is very seldom drawn by architects, and, when looking historically at the Danish single family house, it can be seen that architects have, at different stages, tried to enter the area, but for a variety of reasons, this has not been very successful. One of the first strong architectural – and actually very successful – initiatives was the garden housing movement in the 1920s, which brought several appreciated Danish projects with it, such as *Grøndalsvængekvarteret* [ill.366] (Copenhagen) by Poul Holsøe and Jesper Tvede, and *Bakkehusene* [ill.367] (Copenhagen) by Ivar Bendtsen and Thorkild Henningsen. The subsequent outbreak of World War II entailed years of stagnation in the Danish building sector due to high building material costs and therefore also a worn down and inadequate building stock. The Government therefore decided to encourage and support companies and private individuals to build new houses quickly and efficiently. In the decades following the war, there was a focus on attached houses, and there are plenty of fine examples such as Utzon's *Kingohusene* [ill.368] or Viggo Møller-Jensen's *Atelierhusene* [ill.369]. Around 1950, architects still drew about one third of all single family dwellings, but already in the early sixties, this share had gone down to only a few percent. This is mostly due to the sudden rise in the total number of built single family dwellings. New actors entered the market; house building companies selling catalogue houses that could be built quickly, at a good

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366. *Grøndalsvænge* in Copenhagen, Poul Holsøe and Jesper Tvede 1914-20 (Photo: Ida Wraber).

367. *Bakkehusene* at Bellahøj, Copenhagen, Ivar Bentsen and Thorkild Henningsen 1921-23 (Photo: Ida Wraber).

368. *Kingohusene* in Helsingør, Jørn Utzon 1958-60 (Photo: Ida Wraber).

369. *Atelierhusene* by Utterslev Mose in Copenhagen, Viggo Møller-Jensen 1942-43 (Photo: Ida Wraber).



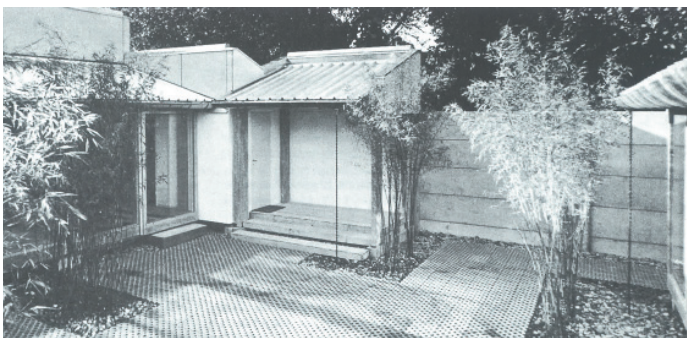
price, and through a simple and easily understood procedure. All of a sudden around 75 houses were built each day – for nineteen years. The typical single family dwelling from this time is made of red or yellow bricks, and has a standardised floor plan built up around a dark pistol-shaped corridor. The Architects’ Society obviously reacted to this and formed the *Arkitekternes Typehuskontor* (The Architects’ Standard House Office). Their standard house was simple, rational, and had fine details, but it never became very popular – probably because the high degree of complexity in the buying process [ill.370]. The next interesting architectural approach came in the 1970s on the initiative of two of Denmark’s most renowned architects; Arne Jacobsen and Jørn Utzon, who each presented a suggestion for a modularised and partly wooden dwelling: *Kubeflex* [ill.371] and *Espansiva* [ill.372]. These two are generally considered to be architecturally successful; however, none of them became a commercial success. As *Espansiva* and *Kubeflex* seem to be architecturally interesting projects, they are subsequently used in this thesis in the clarification and discussion of architectural quality in Danish prefab wooden dwellings in chapter 5. During the 1980s and early 1990s the single family house building stagnated, but in the recent years, the sector has again accelerated and many new house producing companies have emerged – some of them have even introduced houses drawn by architects; *M2* with high-end standard houses drawn by



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some of the most well-known architects in Denmark [ill.373], *ONV* and *HP3* started producing the *ONV house* [ill.374], and *Hjem* have presented two new houses drawn by the young architectural office *AART* [ill.375]. The *ONV* and *Hjem* houses are both wooden houses, with respect to the bearing construction, but the *ONV house* is built as 3D modules at a factory, whereas the *Hjem* houses are constructed from factory built 2D elements. Both of these companies' houses are also further discussed later in this thesis in order to analyse the contemporary Danish prefab wooden dwelling. Prefab building can therefore mean many different things; and most building projects today use prefabricated elements to different extents. In this thesis, the focus will be on projects that are prefabricated to a high degree, i.e. large 2D and 3D prefab systems and buildings of different character in relation to their openness towards changes. However, before starting the discussion of the architectural quality of this dwelling typology, it is necessary to form a theoretical platform for such a discussion, and define what the concept of architectural quality contains.

370. *Simple and well detailed – the standard house from Arkitekternes Typehuskontor (the Architects' Standard House Office) (Lind, Møller 1996).*



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371. *Kubeflex by Arne Jacobsen, a proposal of a prefab dwelling from the late 1970s (Triapholt 2009).*

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372. *Espansiva by Jørn Utzon, a flexible prefab building system from the late 1970s (Espansiva-Byg A/S 1971).*



373. *Contemporary prefab detached single family house by M2: Flower house, 3XN (M2 2008).*

374. *Contemporary prefab house constructed by 3D elements: The ONV house (M2 2008).*

375. *Contemporary prefab house constructed by 2D elements: Nova by Hjem (Photo: Ida Wraber).*

Architectural quality has been vividly discussed lately – especially during the last decade where also Governmental advice in relation to the quality of architecture have emerged; in Great Britain, a design tool (DQI) for ensuring the quality of public buildings etc. has been developed, and in Denmark, an architectural canon, describing the most important and fine examples of Danish architecture, has been launched. The discussion has also spread to other groups than the traditional group of architects, which has meant that the discussion has been sharpened and elaborated. However, architecture is traditionally a master-apprentice profession in Denmark, which means that much of the knowledge is not verbally documented but is tacitly inherent in the works of the great masters. With the widening of the discussion of architectural quality, however, architects need to verbally express the qualities of architecture to other groups of people, who do not have the same background and tacit knowledge. During the last century, more theories than ever have been at play at once, and many currents and styles have emerged and passed by; and the question is if it is possible to find any consensus among these theories and define a model for analysing architectural quality that enhances the main elements of this matter. Through the presentation of different perspectives on architectural quality, it can be seen that there are not only different theories – the theories can also be related to completely different categories of ontology; natural scientific, social scientific and humanistic. This might seem logical as architecture is a matter related to the concrete technical aspects of construction, the matters of how we act and interact, and the more abstract matters of art and poetics. But even if narrowing down to the aesthetical and experiential matters of architecture – what the roman builder Vitruvius defined as *venustas* – there are different views on how to investigate, describe and work with the qualities of architecture according to the three mentioned ontological currents. One can either look at architectural quality as a part of a universal order, like the renaissance architecture relating it to the mathematical relations of musical harmonies, or a result of our body and brain substances reacting to different stimuli and therefore initiating specific feelings biologically, or as a more poetic and subjective matter of interaction between human beings and the phenomena of the world. The theories that are presented are sorted into three clusters, defined by those three perspectives, and the clusters are, in this thesis, named *classicism/structuralism*, *perception psychology*, and *phenomenology*. In chapters 3 and 4 these are further described and compared to each other, but first it is necessary to define the methodological approach to the project in order to ensure that the chosen theories, methods, and collected data, can give the answers to the questions asked in the introduction of the thesis.

7.1.2 Methods

The field of architecture is, as mentioned, a complex matter, and the ontology, strategy, and tactics for a research project can therefore vary widely. When starting such a project, it is therefore important to define clear goals and research questions in order to become qualified to choose a suitable ontology, strategy and tactics. In this thesis the main themes are set to be:

- 1) Architectural quality is commonly used in architectural discourse, but it does not seem to be a well defined concept. Is there a core of elements that form a general definition of architectural quality?
- 2) Prefab dwellings often seem to be looked upon as a lower class of dwellings – should it not be possible to build prefab dwellings of high architectural quality?
- 3) Wood is increasingly often seen in contemporary Danish building and is used as a cheap, strong, light and environmentally friendly material, but what about the aesthetical values seen in relation to the Danish tradition of building in stone and heavy materials? How can we build contemporary wooden dwellings in a Danish context?

These three questions are all mainly related to description and interpretation, and the project therefore mainly contains qualitative research and is placed within a humanist framework. The next step is to define a strategy for how to get from the research questions to the aims of the project in a systematic way. In this thesis, the main aims are to improve the reader's ability to:

- 1) Understand and discuss architectural quality in a more varied manner
- 2) Identify the most common pitfalls in relation to architectural quality in prefab single family housing
- 3) Consider wood as a material that can contribute to architectural quality in respect to many different aspects (not only technical)

With this in mind, partial goals are set for the sub-themes of the thesis. These are defined through a starting point, a *constant instance 1*, a goal, a *constant instance 2*, and

a tactics, which specifies how the *constant instance 1* is transformed into the *constant instance 2*. The first subtheme is the investigation of the multiplicity of architectural quality and is defined as

Constant instance 1: *an unstructured mass of theories of architectural quality*

Constant instance 2: *a structured overview of the existing primary theories of architectural quality*

Tactics: *state of the art – review of previous research and literature*

Through this loop, (1) the body of theory in the subject of architectural quality is outlined and structured in order to create an overview and solid foundation for the analysis of the architectural quality of prefab wooden dwellings. Main theories, debates and problems are identified and described, but as the field is quite complex and does not immediately seem to have a clear direction and consensus, the theories are further reflected upon and organised in a model in the next loop (2):

Constant instance 1: *a fragmented set of views and parameters complicating the discussion of architectural quality*

Constant instance 2: *a coherent set of views and parameters substantiating the discussion of architectural quality*

Tactics: *logical argumentation*

This leads to a first model for analysing architectural quality, but it is subsequently necessary to challenge this in different ways as the logical argumentation strategy in itself does not contain any testing. In this thesis, case studies, or comparative studies, are used to both challenge and clarify the model, as these give opportunity to apply the model to specific buildings and thus get a more concrete idea of its usability. In the first of the loops (3) of applying the model to buildings, the aim is to develop the model, rather than evaluating the architectural quality of the analysed buildings – but through analysing dwellings that are considered to be of high architectural quality, it is also an aim to collect references for the later analyses of Danish prefab wooden dwellings – which means that the loop (3) could be described as:

Constant instance 1: *initial untested model for describing architectural quality*

Constant instance 2: *tested and refined model for discussing architectural quality*

Tactics: *comparative studies*

This loop (3) and the loop (2) are run through a few times before moving on to the next loop (4) which has the intent of actually analysing the architectural quality of different Danish prefab wooden dwellings and is thus defined as:

Constant instance 1: *random and fragmentary discussions of wood in Danish wooden dwellings*

Constant instance 2: *guidelines for a focused and coherent discussion of contemporary Danish prefab wooden dwellings*

Tactics: *comparative studies*

The fifth, and last, loop is aimed at the practical matters of working with architectural quality in a prefab house development process. The idea is to try some theoretical tools and ideas in practice to get an understanding of the usability of such methods – and the loop (5) is defined as

Constant instance 1: *a theoretical model that not yet been applied to the practical reality of an architectural development process*

Constant instance 2: *a clarification of the possibilities of application of the theoretical model to a concrete development process*

Tactics: *case study*

In this manner, it is attempted to create a thread through the thesis and tie the aims, ontology, strategies, tactics, and results together to a whole.

7.1.1 Architectural quality

In chapter 3, the model for analysing architectural quality is described through a definition of three theoretical clusters – *classicism/structuralism*, *perception psychology*, and *phenomenology*. The idea is to draw up different ontological approaches to what architectural quality is, and thereafter clarify and compare these through a comparative analysis of different dwellings that are generally considered to be of architectural quality. The aim is not to define an absolute or mathematical model, but rather a discursive model that can assist a discussion of the different perspectives and aspects contained in architectural quality. This is thought of as a possible support for a communication and discussion between architects and other trade groups – a clarification of some of the unspoken matters that have been developed through generations of master-apprentice practices. From each of the theoretical clusters three keywords of particular significance are chosen as basis for the model of analysis. They are chosen as to represent the general and strongest concepts of the theories included in a cluster – however, by no means do they cover the whole spectrum and aspects of the theory clusters.

These structural theories of architectural beauty all discuss the matter of a composition's dimensions and the interrelationship between these dimensions – that is the harmony and complexity of *proportion and order*. The classical architects and theorists do this very concretely and precisely whereas Venturi, Thiis-Evensen, and Unwin include it more implicitly and handle it more freely in a mix with other aspects. Furthermore Vitruvius', tectonic theory, Venturi, Thiis-Evensen and Unwin all mention the interaction between *form and material*, whereas the renaissance theorists primarily focus on form and composition as such. Common to them all is the idea of the interaction between microcosm and macrocosm – how everything is connected. The Renaissance man inscribed in a square and a circle is a sign of this particular matter, Venturi through his example of the temple, and lastly Thiis-Evensen and Unwin as themes through their book constantly jump between *detail and unity*, while discussing what effect they have on each other.

Keywords: *Proportion and order, Form and material, Detail and unity*

In perception psychology the most fundamental issue lies in the balancing of *unity and variation*; too much unity will bore us (to the limit of hallucination), and too much variation makes us over-stimulated and tired. But it is not enough to find the happy medium between boredom and chaotic impressions; human beings also respond to elegance, which can be described through *balance and harmony*. These two are not always better achieved by a perfectly symmetric balancing of elements, but can also indeed be accomplished through more complex compositional systems. This might be related to one last very important factor – dynamics. Perfect symmetry and rigid systems might be harmonic and balanced, but our eyes are also drawn to items that express some kind of *dynamics*. A dynamic composition makes our eyes wander across the piece of art and keeps us occupied and interested for a longer period of time than a static composition. It simply seems more exciting.

Keywords: *Unity and variation, Balance and harmony, Dynamics*

Attempting to sum up on the phenomenological, quite abstract, ideas of how we are in the world – and interact with it – it is first important to underline that according to phenomenology, all experience and perception of the world is a subjective matter which is related to a *cultural and personal framework of understanding* that has been formed by memories and earlier experiences. Secondly, many phenomenologists emphasise the importance of understanding perception as *a multi-sensory experience* where eye, ear, nose, skin, tongue, skeleton and muscle work together to form an impression. And, thirdly, when speaking of the things in the world and how they appear, the main essence of the objects in the world is to reveal aspects of different phenomena – through the connection of earth and sky, divinities and mortals, as Heidegger puts it. Therefore, the *relation to the context* is paramount, and an object is actually nothing – it has no qualities – unless it is seen in relation to something else.

Keywords: *Relation to cultural/personal framework of understanding, Support of a multisensory experience, Relation to context*

It is clear that the three clusters have quite different approaches to what architectural quality is. For perception psychology, the concept is seen, and investigated, as a purely visual matter, whereas in phenomenology, the visual impression is only a small part of a multisensory experience. In classical and structural theories, logics and universal laws such as harmonious proportions and orders are important, whereas every architectural experience is considered to be a subjective and thus non-universal matter in a phenomenological perspective. The idea in this thesis is not to discuss which of these different keywords are more *right* or *important*, in general – but rather to show that a use of many theories gives a fuller result in relation to architectural quality and thus encourages a discussion of, and interplay between, as many perspectives as possible. Therefore, three dwellings that are commonly considered to be of architectural quality are analysed through this model in order to see how the different perspectives and keywords manifest themselves in concrete works of architecture, and hereby clarify and compare the theories and keywords. The analyses should, as previously mentioned, also form a frame of reference for the discussion of architectural quality in prefab wooden dwellings in chapter 5 and 6. They are chosen in order to cover different perspectives,

theoretically and stylistically with Utzon's house in Hellebæk⁸ [ill.376] representing the logical aesthetics and fine balance between material and form, *Vanna Venturi house*⁹ [ill.377] representing a rather strictly visual composition, and *Villa Mairea*¹⁰ [ill.378] representing the multisensory and context related phenomenological view. The analyses show that all of the buildings can be said to be of architectural quality as they fulfil several of the keywords from the three theory clusters. Through the analyses it is clear that perception psychology only relates to the concrete compositional and visual matters of architecture. However, when speaking of architecture, it is not specifically relevant to discuss the aesthetics as a completely isolated unit, as the deeper meaning of architecture is to house some functions, to be a framework for different activities, and to be a durable construction in relation to for example use and climate. If architecture does not relate to function and construction – *utilitas* and *firmitas* – it loses an important part of its essence and rather gets a character of the more figurative kind, such as painting or sculpture. When relating a piece of architecture to a function, we will always put ourselves into the given frames and imagine how we would act in these frames in relation to the assumed function or activities; and even though the functionality does not seem very well accomplished, we might think that the rooms are aesthetically beautifully proportioned and in perfect harmony with its use of materials, textures and colours – we just cannot see the seemingly relevant activities taking place here. These kinds of values will both be tied to the place, the time, and the person, and the more of those factors we try to define and cover with a theory, the more complex it gets, and thus also less operational or manageable. It is suggested that instead of trying to draw up a complete theory or definition of architectural quality as a generic set of values, it is necessary to outline a working field through defining a set of specified values of for example typology, time, style, material or context. In order to open up the issues of the specific working field, it is necessary to use as many of the relevant theories or perspectives as possible in order to cover the *objective/universal experience*, *subjective experience* (personal abilities, needs, dreams, memories and associations), and different *contextual factors*, such as culture, style, economics, society, technology and site (common abilities, needs, dreams, memories and associations). The dwellings analysed in this chapter are built for specific persons and specific sites, which means that they have a good offset for being able to incorporate objective, subjective and contextual factors. This is not necessarily the case, however, for prefab wooden dwellings, as they are drawn for a customer and site unknown to the architect. It is therefore interesting to move on to this category, at this point, to investigate how different types of prefab dwellings handle these unknown factors in their designs.

⁸ Jørn Utzon – 1952

⁹ Robert Venturi – 1962-64

¹⁰ Alvar Aalto – 1938-39

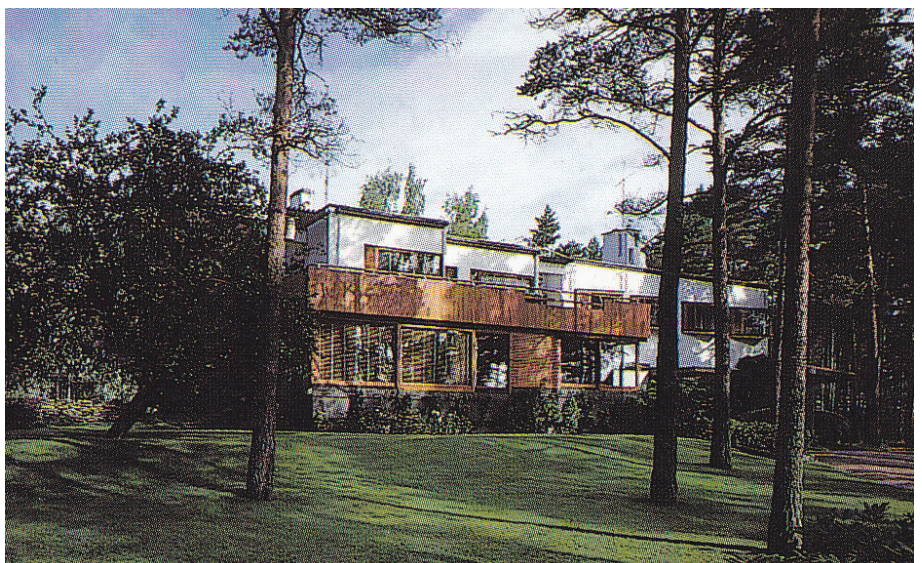


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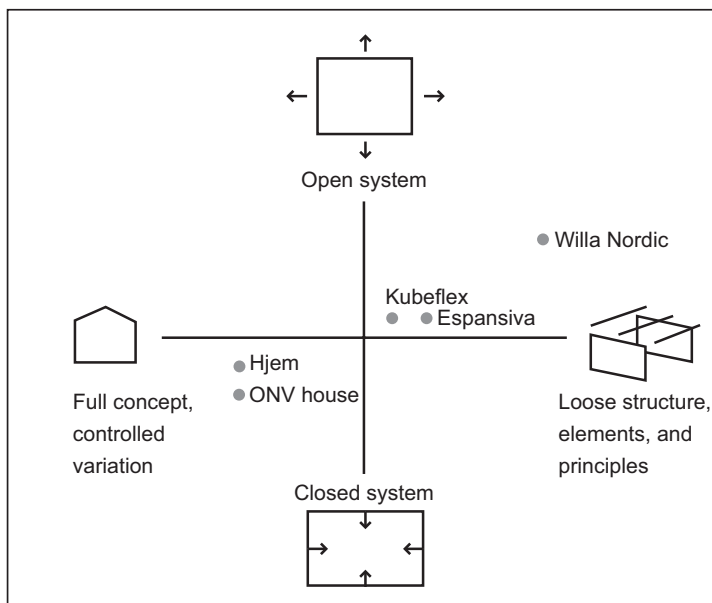
376. *Utzon's own house in Hellebæk, Jørn Utzon 1952 (Weston 2002).*

377. *Vanna Venturi house, Robert Venturi 1962-64 (Schwartz 1992).*

378. *Villa Mairea, Alvar Aalto 1938-39 (Pallasmaa 1998).*

7.1.2 Prefab wooden dwellings

In chapter 5, Danish prefab wooden dwellings are analysed in order to investigate what factors are particularly important when working with this building typology. The dwellings are chosen in order to represent a wide spectrum of both different methods of prefabrication – and thus there are both opened and closed systems, and constructions built from 2D and 3D elements, or combinations of these [ill.379]. Jørn Utzon's *Espansiva* is a wooden framework building system with both 3D pavilions of different sizes and a wide range of 2D panels that can be combined according to the customers'



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needs and wishes. Arne Jacobsen's *Kubeflex* is built on a simple three dimensional wooden framework as well, but only available in one size and with the possibility of placing seven different panels into the wooden framework. Both of these are from the 1970s, and even though they are often mentioned as examples of prefab dwellings of high architectural quality, none of them reached further than to the prototype, maybe because they simply were ahead of their time. Examples of more recent prefab buildings that are also analysed are the *ONV house*, which is a 3D module building that has actually gained ground on the Danish market and been rather popular during the last few years, and the *Boase* project which is a more experimental project focusing on environmentally friendly and cheap city dwellings built from 2D elements mounted on stilts above a pollution cleaning willow forest. In the *Boase* project, the use of wood is much more extensive and experimental than in other Danish prefab projects, and it is therefore interesting in this context. These projects are analysed according to the

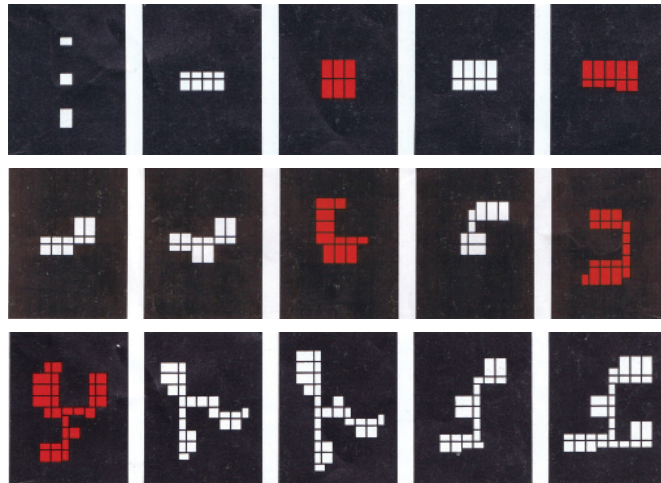
379. Prefab houses can be constructed from 2D or 3D elements, or combinations of these two, but they also be more opened or closed towards changes in the design in relation to the specific site and user (Basic graphics from (Mikkelsen et al. 2005)).

380. Utzon's *Espansiva* building system can be used to create numerous different designs and it is not possible to secure specific qualities in relation to proportion, order and composition through the element library of the system (*Espansiva-Byg A/S* 1971).

381. In Utzon's house in Hellebæk the materials are varied and interesting to more senses than vision. Bricks and wood are used differently according to where they are situated and what purpose they should fulfil in that particular place (Møller 1989).

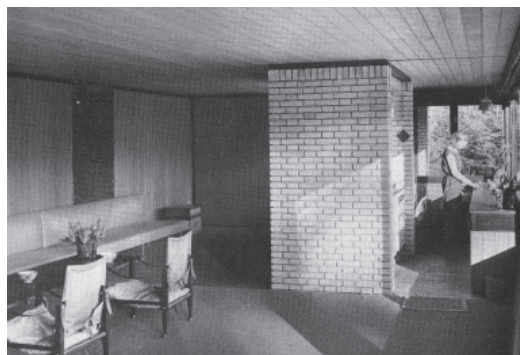
382. The matters of form and material, and support of a multisensory experience are not very explicit and elaborate in *Kubeflex*. The materials seem industrial and without depth in relation to other senses than vision. It is possible to see the constructional logics of the house, but the wood is painted green, which does not support a clear experience of the form and the material as a unity (Trapholt 2009).

model defined in chapter 3 and are subsequently compared in order to find the pros and cons of the different prefabrication methods in relation to architectural quality and define the specific matters of architectural quality that are particularly important when developing prefab wooden dwellings. It is concluded that *flexibility* and *experience of form, logics, and material* are the most crucial aspects in relation to the architectural quality of prefab wooden dwellings. Flexibility in the building system is an advantage when it comes to the potential adaption to a specific site or customer (*relation to cultural/ personal framework* and *relation to context*), but it can become a problem if the result is not controllable in relation to matters such as *proportion and order, balance and harmony* etc. – as seen in Utzon’s *Espansiva* system [ill.380]. *Form, logics* and *material* also relate to several of the keywords and are important factors when discussion the architectural quality of the dwellings in chapter 4 – especially Utzon’s house in Hellebæk [ill.381] and Aalto’s *Villa Mairea* – but the interplay between these three is not as visible and varied in the analysed prefab dwellings [ill.382], which makes them less interesting and clear in relation to especially the keywords of *form and material* and *supporting a multisensory experience*.



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7.1.3 Case study - Hjem

These analyses are followed by a more detailed case study of the prefab house producer *Hjem*, which is also a cooperation partner in this project, and in chapter 6 there is a description and discussion of the development process of a new house at *Hjem* in cooperation with the architectural office *AART*, and an analysis of the three houses in the repertoire of *Hjem*. This should initiate a reflection on how it is possible to work practically with architectural quality in such development processes and subsequently see how the architectural quality is experienced both in the dwellings developed before the beginning of this cooperation (*Hjem* and *AART*) and the in the dwellings developed through this cooperation. Through this case study, some tools for converging towards a common understanding of architectural values and aims of a project and thus forming a solid foundation for the process are described and discussed. It is suggested that it is fruitful to use words combined with graphical documentation, such as scales of bipolar words [ill.383], diagrams and photos [ill.384], as this gives a more precise definition of the words that are used in the communication between architects and non-architects. Study trips to interesting buildings and discussions of specific architectural examples give a common frame of reference which is also an advantage in such cooperation. Diagrams and scales are not only good as documentation but can also act as an agenda of a workshop and thus make sure that all aspects are remembered in the creative process, such as in the case with the tables of semantic differentials in this particular process. Furthermore, it is important to create a feeling of common ownership for the project, which gives all participants an interest in reaching the goals and a feeling of responsibility in relation to the project. In this project, this is reached through a common study-trip, inspirational presentations from people outside of the project, and common creative workshops. The question is, of course, if these efforts can be seen in the final dwellings. The three *Hjem* house types are therefore analysed in order to see if there has been a development of the architectural quality during the years and also to see in more detail how architectural quality can be handled in a concrete prefab house building company. It is concluded that there have been quite notable improvement of the architectural quality in the dwellings [ill.385-386]. This could partly be a result of the fact that it is the same fundamental concept that has been used for all houses, which has created an opportunity to learn from and improve on the actions from earlier processes. The more recent houses – *Nova* and *Largo* – are more coherent and refined than the first house type – *Uno* – which can for example be seen in the compositions and possible material combinations in their exterior [ill.387-388]. However, in all three dwellings, the detailing and use of materials are more robust and refined in the exterior than in the interior; in *Uno*, this can be seen in the ceiling solutions, that have a simple and pure cladding of wooden boards in the exterior, which in the interior are replaced

383. Scales of bipolar words are used during the process to clarify the meaning of different words and concepts (*AART* 2007).

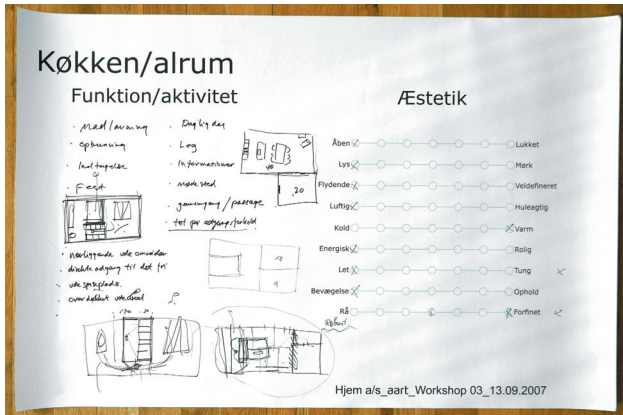
384. Diagrams are used to visualise the abstract matters that are discussed during the early phases of the design process (*AART* 2007).

385. One of the first versions of *Uno* – the two building volumes have different cladding materials and there are many different window types and sizes in the façade compositions, which together give a complex and slightly incoherent appearance (*Hjem* 2009).

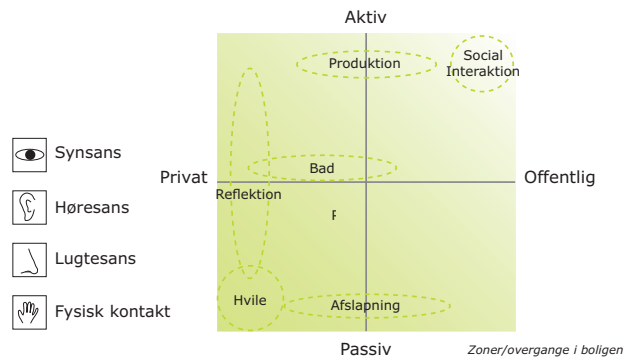
386. One of the later versions of *Uno* – the two building volumes are treated equally in relation to materials and there are fewer window types and sizes, which give a more coherent expression than seen in some of the earlier versions of *Uno* (Photo: *Ida Wraber*).

387. The possibilities of choosing and combining exterior cladding materials are not as many in *Nova* as in *Uno*. This gives a possibility of keeping a more constant character in between the different version. This picture shows a version of *Nova* with black wooden boards and larch wooden lamellae in the panels framing the doors and windows (*Hjem* 2009).

388. *Nova*, like *Uno*, has a version with white plastered exterior walls combined with black lamella panels, but the main composition of shapes and the play between wall and panel are so strong in *Nova* that a clear kinship can be seen between this version and the version clad with black wooden boards and larch wood lamellae (*Hjem* 2009).



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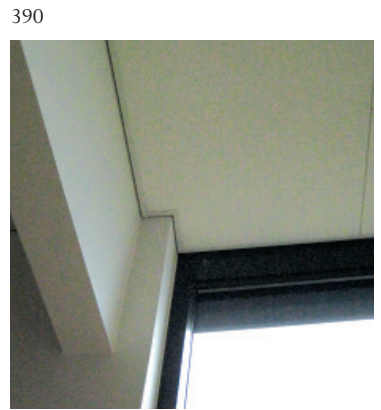
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by tactilely poor and less robust plaster boards [ill.389-390]. In the interior, it is not possible to sense that these houses are light constructions or wooden buildings, but, rather, they look like any contemporary heavy construction dwelling, whereas this can be better sensed in the exterior – especially in *Nova* and *Largo* [ill.393-394]. These problems are all related to the earlier defined matter of *form, logics and material*. The other aspect – *flexibility* – is also relevant in relation to the houses of *Hjem*. The houses can primarily be customised through the choice of cladding materials; for the bathroom and kitchen floors, the exterior walls etc. The balance can be difficult to find, and, in *Uno*, there might actually be too many possibilities when it comes to the exterior cladding, as the house distinctively changes character when for example comparing a white plastered dwelling to one clad with oil treated horizontal larch wood boards [ill.391-392]. *Nova* and *Largo* have more balanced possibilities of choice in relation to keeping the architectural character. The opportunities of changing the layout of the floor plan (for example the placement of the entrance) or the façade composition is, however, very limited in all three house types. This is one of the strengths of one of the most popular single family housing types in Denmark – the *murermesterhuset* (traditional standardised brick house), which is also mentioned in chapter 1. It has the possibilities of varying the window sizes and numbers, the placement of the entrance, and it even allows additions of balconies, canopies and terraces within a given framework without losing its architectural character [ill.395]. This is an apparent learning opportunity for the development of contemporary prefab dwellings. This house type also has a strong connection between form, logics of construction, and material and is therefore considered a robust house built on solid craftsmanship, which also makes it a good example of a standardised house. Now the point has been reached when it is time to answer the final questions of this thesis; what has been learned through all this, and how could this research be further developed? Have the research questions been answered and what further discussions remain to be explored?



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389. The exterior ceiling solution of Uno – solid wooden boards give the space by the entrance door a sturdy and refined expression (Photo: Ida Wraber).

390. The interior ceiling solution of Uno – neutrally white and tactilely poor materials are used, which give a less sturdy expression and a less interesting space (Photo: Ida Wraber).

391. Uno can be clad with many different materials and this version with white plaster on the façades is heavy and massive in its expression (Photo: Ida Wraber).

392. Uno can also be clad with horizontal larch wood boards, which give a lighter expression than the white plaster in ill.391 (Hjem 2009).

393. Largo is in the exterior comprehended as a contemporary wooden dwelling, as it has the traditional shape of a dwelling with doubly pitched roof, but uses the wooden cladding in a contemporary manner. The construction is understood as a light construction due to the large holes that are cut in the façades, but also due to the panels that frame the windows and doors and break the massiveness of the rather long and low wall areas (Photo: Ida Wraber).

394. Nova is also understood as a light construction due to the panels that are inserted into the walls, and therefore lightens the otherwise quite heavy basic shape (Photo: Ida Wraber).

395. Murermeisterhuset (the master constructor house) can be built in many different versions, but the main pattern is so strong, that there is still a clear kinship between the houses even though their entrances might be placed differently and the colours and facing materials might not be the same (Photo: Ida Wraber).



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7.2 CONCLUSION

As mentioned earlier, the aim of this thesis is to improve the reader's ability to:

- 1) Understand and discuss architectural quality in a more varied manner
- 2) Identify the most common pitfalls in relation to architectural quality in prefab single family housing
- 3) Consider wood as a material that can contribute to architectural quality in respect to many different aspects (not only technical)

This is achieved through a systematisation of theories and keywords, which form a model that describes architectural quality, a subsequent testing and clarification of this model, and, finally, an application of the model to a selection of Danish prefab wooden dwellings and a case study of the house producer *Hjem*. The idea is to supply the reader with a theoretical understanding of aspects relating to the architectural quality of Danish prefab wooden dwellings, but also to give a more concrete frame of reference for future work with this building typology. The theoretical aspects are presented and discussed mainly in chapters 1-3, whereas the exemplification and concrete matters are primarily located in chapters 4-6 – however, the division is not so clear, of course, and the concrete and the abstract matters are to some extent interlaced along the way. The progression of the PhD builds upon a sequence of loops, where each chapter represents one loop and has a starting point and a goal, which are described in chapter 2, dealing with methods. In this way each section is part of a superior order that lead towards the final aim and conclusions.

The first loop deals with the literature review and the theoretical state of the art of the subject. It is shown that the discussion of architectural quality has roots leading all the way back to the Roman Empire and the first known architectural theorist Vitruvius, but during the last century there has truly been an abundance of different currents of theories and styles at play that seem to point in widely different directions when it comes to the description of what the concept of architectural quality contains. The second loop of this thesis therefore contains the structuring of the main theoretical currents from the last hundred years in order to define a model for analysing architectural quality in Danish prefab wooden dwellings, and subsequently give suggestions to future work with this building typology. Three theoretical clusters with different approaches to how to describe architectural quality are identified; *classicism/structuralism*, *perception psychology*, and *phenomenology*. Many theorists, however, have mixed approaches to architectural quality; Thomas Thiis-Evensen and Simon Unwin, for example, both have

structural descriptions of architectural quality with roots in a phenomenological thinking, and the phenomenologist Pallasmaa has also written texts of a more structuralist character, describing the mathematical relationships in the art of composition. This is, in books on architectural methods, such as those of Linn Mo (Mo 2003, Groat, Wang 2002) and Linda Groat & David Wang (Mo 2003, Groat, Wang 2002), described as important when working within the field of architecture. More theoretical layers give a deeper and wider understanding of the architectural issues at hand, they suggest. This is also a line that this thesis aims at following. Therefore, the earliest constructed models that aim at – in a reductionist manner – defining which elements (light, context, composition, openings etc.) architectural quality consists of are soon replaced by models trying to define different *beholdings* through which central themes of architectural quality manifest themselves (through the logics of mathematics, through the logics of biology, or through a poetical unveiling of phenomena etc). This proved to be a more interesting, but also a more complex, road to follow, as the words did not only need to be registered and statistically counted, but also to be understood within their specific contexts – for example the element of *composition* can be interpreted as the matter of universal proportion and order, the matter of the human response to balance and harmony, and the interaction between a specific design's interaction with its context, users and observers. Through chapter 3, dealing with architectural quality, the theoretical clusters are further explained and in order to make them useable as a model for clarifying and analysing architectural quality in concrete dwellings, three keywords, representing the distinct themes from each of the theory clusters, are picked out. In this manner a model is formed and in the first comparative studies in chapter 4, which represent the third loop of this thesis, the aim is to clarify the differences and commonalities between the theoretical clusters and to see if there are any general aspects that can be concluded on this basis. It is seen that the themes, or keywords, on a more general level can be ordered into three categories; *objective/universal experience*, *subjective experience* (personal abilities, needs, dreams, memories and associations), and different *contextual factors*, such as culture, style, economics, society, technology and site (common abilities, needs, dreams, memories and associations). Covering as many of these aspects as possible can heighten the architectural quality of a building. However, the case of *Vanna Venturi house* also illustrates that an extreme fulfilment of a specific architectural intention or style can also make a house generally appreciated as being of a certain architectural quality – but then probably mainly within the same stylistic or theoretical cluster. The three analysed dwellings, Utzon's house in Hellebæk, *Vanna Venturi house*, and *Villa Mairea*, are not only used as a tool for discussing the model of describing architectural quality more concretely, but they should also form a frame of reference for the analysis of Danish prefab wooden dwellings in chapter 5 and 6 that are thus analysed with the same method as the first

three dwellings. The analyses of prefab wooden dwellings are split into two sections; a general part, discussing the different methods of prefabrication and use of wood in Danish prefab wooden dwellings (loop 4) and a specific part discussing the particular case of the Danish house producer *Hjem* (loop 5). The idea with this division is to cover both the general aspects and the more specific aspects of actually working with architectural quality in a development process. Through the first and general section, it is concluded that the most problematic areas of the prefab dwellings, compared with the earlier analysed dwellings, are *flexibility* and *form, logics and material*. Flexibility is both a problem if there is too much of it and if there is too little of it; in *Espansiva*, for example, it is difficult to make sure that all possible combinations will result in a well proportioned and harmonious building, as the flexibility of the system is very high, whereas in the *ONV house* there are very few possible ways of adjusting the dwelling to a specific site or user, which is problematic mainly in relation to the phenomenological perspective. The relationship between form, logics of construction, and material also cover several keywords and spread across the theoretical clusters. It can be seen that this factor is very well elaborated in, and part of the architectural concept of, two of the buildings analysed in chapter 4 – Utzon’s house in Hellebæk and *Villa Mairea*. In the prefabricated dwellings in this context, it is much weaker, and the care for the detailing of the materials is not at all as specific and sophisticated. However, it is later seen in the analysis of the houses of *Hjem* that they actually do quite well on the detailing in the exterior, for example by adding robust and simple boards of wood in the ceiling of the canopy and the eaves of their house *Uno*, which shows that this is a possibility also in prefab houses. In relation to the material of wood, there is not only *one* logics that can be communicated as easily as in for example the case of a brick, which comes, more or less, in one module and can take compression but not tension; therefore it is good for building walls, vaults, and arches which are constructions with primarily compression. Wood, on the other hand, comes as small shingle cladding modules, stabilising plywood boards, traditional boards and construction timber of whole pieces of wood, large gluelam beams etc. This means that the logics of wood can be interpreted in many different ways, which is also seen in the analysis of the Danish prefab wooden dwellings. In *Espansiva* and *Kubeflex*, the wood is used according to its constructional logics, as a framework for holding a light envelope of panels of different kinds [ill. 397-398], whereas in the houses of *ONV* and *Hjem*, it is mainly used according to its smaller modules of weather protecting cladding boards or shading lamellae [ill. 399], and in the *Boase* project, it is used as the whole multipurpose, light and strong, plywood boards that protect and provide floors [ill. 400], but also according to a constructional logics, as there are large visible columns attached to the corners of the dwelling unit, where the detail makes it clear how these two different logics are connected. Therefore, the *Boase* dwelling is the most complex

396. Wood is used in a varied and interesting way in *Villa Mairea*; here in an untreated and sturdy construction of the sauna (*Pallasmaa 1998*).

397. In *Espansiva* the constructional logics of wood is clearly visible – especially in the interior where the wooden frames are an important part of the architectural expression (*Espansiva-Byg A/S 1971*).

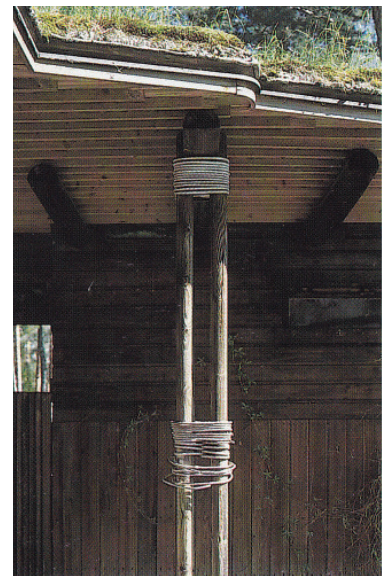
398. In *Kubeflex* the constructional logic of wood is also used to form frames that can hold the light enveloping panels (*Trapholt 2009*).

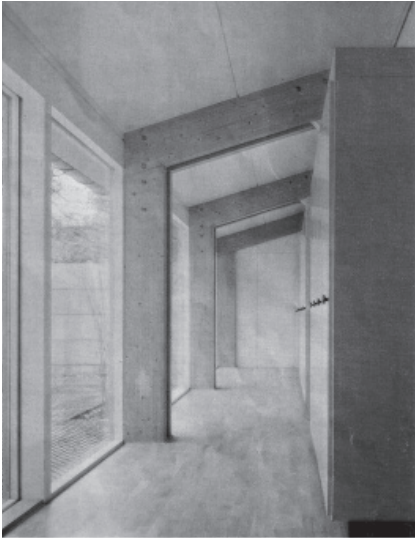
399. In the *ONV house* wood is mainly used for exterior cladding (*M2 2008*).

400. In the *Boase dwelling* wood is both used for constructions and surfaces, both in the interior and in the exterior (*Force4 Architects 2009*).

401. In *Villa Mairea* wood is also used in a more elegant and refined way, as seen for example in this handrail (*Lahti, Jetsonen 2005*).

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and most interesting in relation to its use and exploration of wood, but when compared to Utzon's house in Hellebæk and *Villa Mairea*, the treatment of the material in the *Boase* project is quite monotonous; there is no differentiation in the materials according to what functions or impacts they are exposed to. In Utzon's house in Hellebæk, the bricks are treated differently according to where in the house they are situated; glazed in the bathroom, more thoroughly burned in the flooring near the fireplace etc., and in *Villa Mairea* there is both raw and polished, treated and untreated wood, which gives a variation in the visual, tactile and scent experiences [ill.396, 401]. However, both of these dwellings also use wood together with other, heavier materials, which gives them both variation and harmony between heaviness and lightness, openness and closedness, as it underlines the properties and architectural qualities of the materials

in isolation, as well as in combination with each other. Through the case study of the working process of developing a new house at *Hjem* in chapter 6, it is described how the matter of architectural quality is handled in the early stages of a concrete working process. It shows how the foundation for such a development is attempted to be created, how architects are chosen and how the cooperation between house producer and architectural office is initiated. This case study shows that it is good idea to create a common ownership for all project participants, and a fruitful discussion with basis in a common set of references (either from pictures of interesting projects or small study trips). This creates a good foundation for mutual understanding and responsibility of the project's aims and values. In the discussions and creative workshops, it can be a good idea to use diagrams or other graphical material as an agenda that can keep the eyes and brains on the track while also allowing for free thoughts and loose ideas to land on the paper – however, making visible that every aspects has gotten attention or has been valued as relevant or irrelevant, as seen in the case of the use of semantic differential tables for one of the first joint creative workshops in the process of *Hjem* and *AART*. This creates a mutual interest and refined definition of the architectural quality and leads the non-architects onto the vocabulary of the architects in addition to giving the non-architects a possibility to inquire more specifically into, and getting a more clear explanation of, the specific words that are habitually used by the architects. In this manner, and with such tools, it is suggested that it is possible to lay out the foundation for a fruitful cooperation between architects and house producers in a prefab house development process.

The single family housing sector is still growing in Denmark, and the share of prefab wooden dwellings is increasing as well. It is a good idea to build prefab houses in order to avoid construction errors and secure reasonable and foreseeable building costs for the buyers, which through the last hundred years has been proved to be an important factor when choosing a producer for one's new dwelling. Wood is a cheap material that is easy to handle and has good environmental properties; therefore it has become more interesting during the last century, as environmental consciousness in Denmark has increased. And it will probably not stop here as it makes sense to build cheaply, efficiently and as environmentally friendly as possible, both in relation

to economic and natural resources. Therefore, it can be assumed that the themes of this thesis will continue to be important, at least for the next couple of decades, and, as can be seen through the discussions and analyses of this project, it is important that the architects intentionally enter the sector of prefab wooden dwellings and create productive cooperation with house producers in order to communicate the values of architectural quality and produce reference projects reflecting the qualities of both the prefabrication process and the material of wood. The hope of the writer of this thesis is that many new Danish prefab wooden dwellings will be produced in the near future with special care given to the two most challenging matters of this typology; *flexibility* and *form, logics and material*.

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9 APPENDIX

9.1 A DISCUSSION OF THE ARCHITECTURAL QUALITY IN PREFAB HOUSES

The paper was presented at the conference *Architectural Quality* at the Welsh School of Architecture in Cardiff July 4-6, 2007.

A Discussion of the Architectural Quality in Prefab Houses

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Abstract

Prefabrication has been a basic idea in architecture, since the rise of modern industry in the late 19th century. With industrialism new materials and techniques, such as iron as an independent building material, are introduced. At first the new techniques are used to achieve new constructions and spaces, as seen in for example Crystal Palace in London, or the early skyscrapers in America. Later, in the decades following the Second World War, prefab building is massively used to replace the buildings lost in the war, but architects are often not included in the building processes and therefore the technical rationality of prefab is the main determinant for the buildings in terms of shapes, materials and details. As a result of this, many people - and architects - today see prefab building as a lower class of building, that is unvaried and of poor architectural quality, but as the early innovative industrial buildings indicate, this is not necessarily true. In this paper the term architectural quality in prefab houses is discussed. First the concept of aesthetics in architecture is discussed through a phenomenological perspective and thereafter, on the basis of this discussion, a model for analysing architectural quality is proposed. Lastly the use of this model is exemplified through the analysis of a prefab house.

Introduction

Prefab houses are nothing new. The concept has existed for several centuries and the first known production is a wooden panel house which is shipped from England in 1624 to provide shelter for a fishing fleet [Arieff 2002, p.13]. After this modest start, the demand for immediate housing solutions grows as a large number of colonies and settlements occur all over the world, especially during the nineteenth century. In the early years of the twentieth century, the modernist architects experiment with industrial building [Davies 2005, pp.8-9], as seen in Le Corbusier's DOM-INO House (1914), which is a framework house, made of steel and concrete, without bearing walls, or Gropius' Building Blocks (1923) – a standardized housing system, Jørn Utzon's Espansiva building system (1970), Charles Eames' Eames House (1945-49), and Frank Lloyd Wright's Usonian Houses (1930s) [Arieff 2002, p.15]. Parallel to this, come the World Wars with massive destruction of the housing stock in Europe and thus a subsequent need to build rapidly, cheaply and efficiently [Arieff 2002, p.13] [Davies 2005, pp.8-9]. In relation to the amount of built dwellings and the technological standard of these, industrialisation is a success for post-war society and the building sector, but along the way the architectural qualities are neglected. The prefabricated houses are commonly criticised for being too large and monotonous, the flats are designed for a standard human and a standard family, which in reality probably do not exist [Temagruppe 7, 2000]. In the eyes of many architects the failure of the early modernist projects are proofs of the fact that the building sector, by definition, is not suitable for prefabrication [Davies 2005, pp. 8-9]. Prefabricated building is still to many people, connected to something negative – boring, monotonous and grey –

probably as a result of the numerous large scale plans of concrete block buildings erected during the fifties and sixties [Lund et al 2005, pp. 15,19] [Stang 2003, p.59] [Hesselgren 1967, p.211]. In order to change the image of prefabricated houses, as being aesthetically boring and dissatisfying, it is interesting to investigate the subjective experience of architectural quality, to clarify what aspects of a building that makes us feel architecturally entertained and satisfied. The creation of architecture is built on the idea that every single situation demands special treatment in relation to for example time, place and users [Smith 2003, p.4]. Prefabrication, on the other hand, is built on the presumption that a large amount of the customers' needs are general and can be identified on beforehand, and thus it is meaningful to optimise some solutions, and give many people possibility to buy them to a reasonable cost [Lund et al 2005, p.6]. Prefabrication and architecture thus seems to be contradicting concepts, and the question is, if they at all can be combined. This paper contains a discussion of architectural quality in prefab houses. Through presentation and discussion of existing phenomenological theories on architectural quality, an understanding for the concept is formed and upon this foundation a model for analysing the experience of architectural quality is defined. Hereafter this model is used to discuss three examples of modern prefab houses, in order to identify possible pitfalls and suggest how architectural quality can be used in prefab houses in the future.

Architectural quality - phenomenology

Architectural quality is a concept which has been described and discussed for thousands of years. The first known definition is written down by the architectural theorist Vitruvius, who is a builder in ancient Greece. He divides architecture into

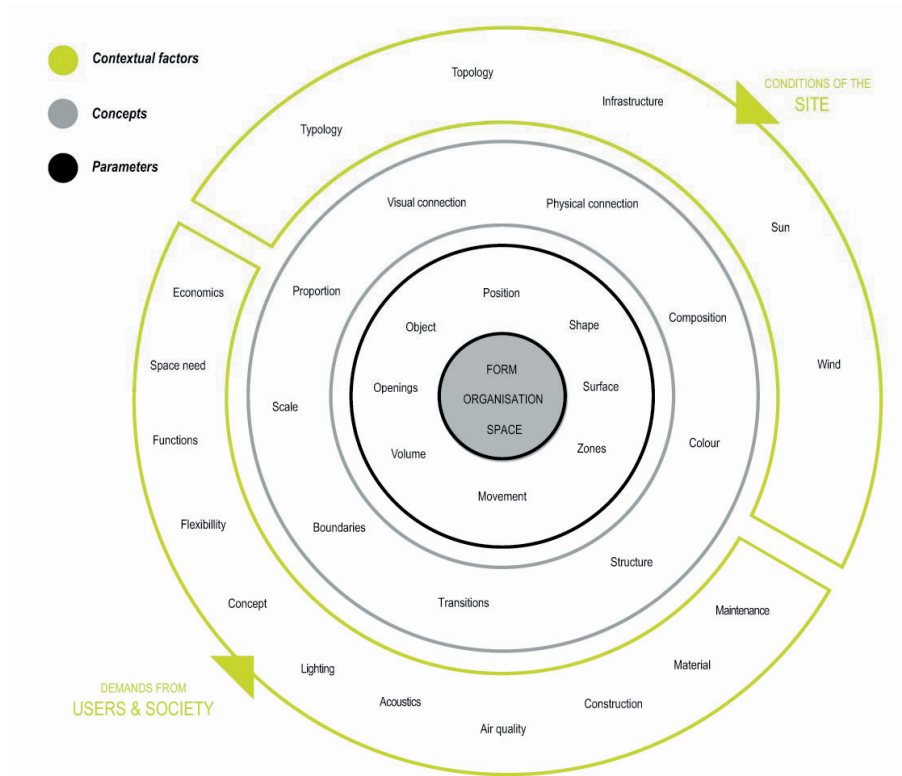
three inextricably connected parts – *firmitas* (strength), *utilitas* (utility), and *venustas* (beauty) [Kruft 1994, p.24]. Many, if not all, modern theories of architecture have roots in this triad, and it is thus still relevant and useful to keep in mind. When speaking of prefabricated building, *firmitas* very seldom seems to be the problem, but it is more often *utilitas* and almost always *venustas* that are accused of being neglected. The technical, and to some extent the functional, aspects can be held up against different standards and recommendations, but the aesthetic aspects is more difficult to measure. Architecture is produced by ordinary people and for ordinary people and therefore it should also be comprehensible to ordinary people [Rasmussen 1966, p.14]. Despite this, it is difficult; if at all possible, to explain architecture – in order to understand architecture, you have to experience it. There is a difference between being able to classify the style of a building, by looking at its particular characteristics, and truly understanding a piece of architecture – it is not enough to see; you have to use it and feel it as a solution to an era's specific events, ideas and rhythm of life [Rasmussen 1966, p.33]. Gaston Bachelard describes the architectural space as a matter of the creation of comfort and security for human beings. The symbol of security and the foundation of the architectural space is the corner – the corner is our hiding place in the world and thus the most original concept of the image of the house [Nylander 1998, p.77]. But what is the meaning of architecture, or the art of building? The German phenomenologist Heidegger says that the intention of art, and thus also architecture, is to convey the truth. Art should be revealing the truth of the context, in which it is created, and the purpose, which it should fulfil. The concept, which Heidegger relates to when speaking of the truth, is the concept of the Greek *aletheia*. This

word is a composition of *a-*, meaning not, and *lethein*, meaning hidden. Thereby truth, in this context, is seen as the not hidden – that which has been revealed [Heidegger 1994, p.14]. In relation to a piece of architecture the truth which is revealed might concern, the society, the specific site on which it is built, the character of the users, or the intention of the construction. According to another phenomenologist, Christian Norberg-Schulz, the most primary need of human beings is to gain a foothold in a world that is in constant transformation. By finding a standpoint from which the world that you interact with seems constant and meaningful – we *understand* the world and this gives us a feeling of security [Norberg-Schulz 1997, p.15]. In architecture and in the world in general, there are many things that can not be comprehended by use of sight only, such as the heaviness of a church door, the coldness of an Italian marble floor, the sound reducing properties of a soft wall cladding or the smell from a newly washed wooden floor [Pallasmaa 2000]. According to Juhani Pallasmaa the qualities of any object can be explained by use of verbs rather than nouns – i.e. the touching and eating of the apple, the looking out of window and the opening of a door; not the apple, the window and the door in themselves [Pallasmaa 1996]. Quality can thus be described as the nature or essence of an object [Norberg-Schulz 1997, p.15] and the creative process is the challenge of unveiling this essence – through mastery of a specific language, such as the architectural language, to reveal something that already *is* [Norberg-Schulz 1997, p.17]. Architecture can therefore be seen as matter that is experienced as a whole with all the sense organs working together to form the impression of it – a unity consisting of numerous parameters that are inextricably connected. In the following section an example of a model, through

which it is possible to discuss and clarify the concept of architecture and architectural quality is suggested.

Model for analysing architectural quality

Through a project by two M.Sc.-students at the Department of Architecture and Design at Aalborg University, Denmark, literature on the subject is scanned for words and concepts relating to the matter of architectural quality and hereafter a structure of these concepts is constructed [Stær et al 2007]. First the words that cover the same concepts are identified and gathered in groups. Three main clusters are identified; contextual factors, concepts, and parameters (Ill.1). The contextual factors are defined by different external actors and conditions and relate to subjects such as climate, acoustics, air quality, functions, infrastructure, building site etc. These factors form the framework for the project as a whole. The contextual factors are divided into two groups; the first group contains the matters that concern the site and the second contains the demands and wishes set by the future users and society. The second category relates to the abstract interpretation of the contextual factors and main ideas of the project; f x scale, proportions, composition, colour, visual and physical connections, whereas the last category relates to the concrete design with issues such as unity, movement, shape, volume and surface.



III.1 Model for analysing architectural quality. The unity of form, organisation, and space is shaped by input from contextual factors that are translated into the concrete parameters through the more abstract concepts [Stør et al 2007]

In the centre of the hierarchy lie form, organisation and space. These three will generally contain the parameters and thus describe the unity of the building – first, from a distance, you experience the general form of a building, then you are presented and lead into and through the building by its organisation, and last you experience the single spaces and their interconnections. The nine parameters are described individually through text, photographs and diagrams, as shown in Table 1.1-1.2.

	CONCEPT	EXAMPLE	DESCRIPTION
POSITION			<p>Architecture is highly connected to the site, on which it is built, and it will thus always be comprehended in relation to the context, it has been placed in. The buildings position in relation to the ground shows how the building relates to the site - does it rise above the ground as an independent shape or does it merge into the ground as an organic part of the specific site? The position does not unambiguously tell the story of whether or not a specific building is well integrated in its context, but it does tell something about the relationships between the built environment and the specific site. The pictures to the left shows three buildings with similar shape but with different positioning.</p>
SHAPE			<p>The shapes, or the mode of expression, is very important for the understanding of a building. The shapes can mime or contrast surrounding shapes and patterns, and thus also strengthen or weaken the spirit of the site and place. Here it is important to find the point of harmony between both building and landscape, and simplicity and complexity. Associations, symbols, proportions and scale are also crucial factors in the comprehension of shape and expression.</p>
MATERIAL			<p>The character of the surface is very important to the expression of a shape, as the shape cannot be concrete until a material, and thus a surface, has been defined. The material and the surface can strengthen or weaken the expression of the shape and can indicate variations within a shape or volume.</p>
ORGANISATION			<p>The inner organisation is essential to a person's behavior and perception of the dwelling as a whole. The dwelling should thus work as a framework for the different states of its inhabitants and visitors, in relation to the dwell-function and the most primary needs and demands that one could have to such a building. The spaces, zones and functions should be organised in such a way that the movement through the dwelling is natural and that a well-functioning rhythm of life is achieved.</p>

Table 1.1. The nine parameters that together form the concept of architectural quality is described through pictures and text

	CONCEPT	EXAMPLE	DESCRIPTION
MOVEMENT			<p>The internal distribution of the zones is crucial to the state of each space. It is essential for the state of the space if there is a movement through it or if the movement is concentrated outside of it. When a movement is lead through a room it adds dynamics to it, whereas when a movement ends in a room it strengthens its expression of enclosure and the space will thus be more static. Some spaces or functions will gain from a dynamic expression and some will gain from a more static expression and thus it is important to consider the movement between and within the zones of a dwelling.</p>
VOLUME	<p>III. 7. Forskellige proportioner indikerer forskellige typer af ophold eller fremmer en bevægelse</p>		<p>The dimensioning and the relationship between the height, breadth and depth will result in different spaces that can indicate different actions and atmospheres. Spaces can be articulated by making changes in the proportions, and thus create smaller spaces in a room for different activities.</p>
OPENINGS	<p>II. 5. Størrelsen på åbningerne påvirker de rummelige forhold eller rumindretningen</p>		<p>Apart rom letting light into rooms, openings define the transition between different spaces and between the internal and the external, and thus they are crucial for the existens of spaces. Openings make both physical and visual interaction between spaces possible. Size and position are most important to the characteristics of openings.</p>
SURFACE		<p>Woods House, 1936</p>	<p>Changes in the structure, colour and material can indicate different actions and atmospheres. Especially the choice of material and the finish of the surface is essential to the experience and comprehension fo a space. By applying changes in the surface's materiality it is possible to create varying atmospheres.</p>
OBJECT			<p>The detailing of the spaces is also important. Not only proportion of volume, openings, light, surface and material are important factors for defining a space, but integrated objects that indicate specific qualities or attach specific usability to a space are significant. These objects must not suppress the inhabitants possibilities of influence the character of the spaces and their functions, but should only form a suitably flexible framework for the daily life in a dwelling.</p>

Table 1.2. The nine parameters that together form the concept of architectural quality is described through pictures and text [Stær et al 2007]

Clarification of architectural quality in prefab houses by examples

It is clear to see that all of the parameters are closely interacting with at least one of the others. Therefore it is important to discuss and evaluate all of the categories together as a whole - the table can support such an evaluation and indicate a discussion structure. Through the use of the table it is possible to unveil strengths and weaknesses in particular buildings. In order to clarify the use of the model, a prefab house model from the Danish company Hjem A/S is shortly described in a table through the nine parameters (Table 2.1-2.2).






	EXAMPLE	COMMENT
POSITION		In all of Hjem A/S' houses, the volumes are placed directly on the ground. This is typical for similar detached houses and it will thus presumably blend in with the surrounding and neighboring houses. This position gives a sharp transition between landscape and building and the border between outdoors and indoors will be clear.
SHAPE		The main distribution consists of two compact shapes that meet and merge together rectilinearly at one of their corners. Their expressions are similar to each other, but one dominates over the other with a larger volume and a break of the box shape by a slanting roof. This creates an understanding of where the common and the private rooms respectively are situated.
MATERIAL		There are several different combinations of materials, and thus the main expression varies from house to house. The smaller volume is always clad with larch wood, but the larger volume can be clad with grey fibre cement, white plaster or larch. The expression is very different in a totally homogenous choice of material or a contrast between white plaster and larch wood.
ZONER		The functions are the same as in a traditional detached house. Office, dressing room and multiroom is added as the dwelling grows from the smallest to the largest version. The central room is the kitchen and dining room. There is a clear distinction between common and private as well as parent and children areas.
MOVEMENT		The physical connection between the inner spaces is concentrated in two corridors which opens up into the kitchen and dining room. The entrance is at the end of one of these corridors through which one is lead past the private rooms into the common rooms from which you can go further on to the second section of private rooms.

Table 2.1. The prefab house of the company Hjem A/S is analysed through the nine parameters of the earlier described model [Stær et al 2007] [www.hjemas.dk].










VOLUME		The differences in volume is not only an exterior feature - the kitchen and dining room have a larger height than the private rooms. The common spaces are divided into two main sections which is partly defined by the slanting ceiling. In the higher section is the livelier spaces, kitchen and dining room, whereas the cosier living room for relaxation is in the lower part.
OPENINGS	  	The common room with high activity has a large window area covering the end wall, while the private rooms and the common room for relaxation are more cave-like with thin strips of glass in the walls. The private rooms are separated from the common room with ordinary doors while the two common rooms are separated by a larger opening indicating their level of privateness.
SURFACE	  	All wall and ceiling surfaces are plasterboard that are painted white. On the floor there are different choices of materials and colours and they can therefore be adapted to the function or activities that are to take place in the room. There is therefore very little differentiation between the different spaces in relation to the atmosphere created by surfaces.
OBJECT	 	There has not been used objects to define spaces, atmosphere or activities in the house. A slight indication of a spacecreating object is the wardrobes in the corridors, but else both illumination, sun-shades and fireplace is thought of as extras and thus they are also architecturally seen as applications to the main form.

Table 2.2. The prefab house of the company Hjem A/S is analysed through the nine parameters of the earlier described model.

In this specific example, it is clear to see that the weakness lies in the materials and surfaces, as they are not articulate in relation to shape and atmosphere. Furthermore the architectural connection to the particular site lacks as the house in itself draws a sharp line between house and context and there are no possibilities to alter the design in order to indicate a connection between house and context. These are all matters that are connected to the problems mentioned in the introduction, concerning prefab houses – the lack of sense for the site and the lack of personal adjustment to user needs and wishes. Therefore one can conclude that even in contemporary and architect drawn prefab houses the problems are still similar to those of the prefab houses of the last century, and further work is thus needed in this area.

Conclusion

In this paper the matter of architectural quality in prefab houses is discussed. It is clear that the art of building and architectural quality are highly complex concepts that cannot easily be defined or described. Every experience of architecture is multi sensory and the qualities lies in the meeting or interaction between the human body and the building or space. Through reading of texts dealing with architectural quality it is however possible to detect some key parameters of the concept; position, shape, materials, zones, movement, volume, openings, surface, and object. It is suggested that the poetry of architecture arises through the interaction between these parameters. In a contemporary prefab house, such as the detached house from Hjem A/S, the primary lacks seem to be related to the adaptation to a specific site and a specific user at a specific time. This can both be seen in the positioning of the house as well as in the vague use of materials and differentiation of surfaces. A challenge in prefab housing industry thus seems to be to make adaptable architecture without letting go of the architectural intention and to integrate possible additions in such a way that they do not appear to be strangely attached objects. In the further research work, the possibility of quantifying the concept of architectural quality will be investigated. Furthermore, an investigation of how wood could be used to create strong architectural intention and atmosphere in prefab houses will be conducted this autumn.

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9.2 A DISCUSSION OF THE NEED OF A NEW FRAMEWORK FOR DESCRIBING ARCHITECTURAL QUALITY

The paper was presented at the conference *Architectural Inquiries* at Chalmers Technical University in Gothenburg April 24-26, 2008.

A discussion of the need of a new framework for describing architectural quality

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Abstract

Architecture is a field that lies on the border between the scientific and technical skills of the constructor, engineer, and mathematician, and the more intuitive field of the artist, sculptor and painter. This meeting between science and art – between the earthbound and poetic matters – is what gives architecture a complexity that is unique amongst the range of fine arts. There are some parts of architecture that clearly can be measured and evaluated – such as the minimum need of space in relation to functionality, the lowest temperature in a room on a cold winter's day, or the deformation of a column. But there are other parts – the more poetic and artistic matters – that have traditionally been passed on from master to apprentice, from generation to generation, and that also play an important role when speaking of architectural quality. Many have tried to discuss the term architectural quality, however, from different points of view and often from a subjective perspective. In this paper the multi-faceted character of architectural quality is investigated and clarified through a comparison of three different theories from the 20th century – early modernism, perception psychology and phenomenology. This is done through using the specific perspectives of the three chosen theories in an analysis and discussion of three buildings from the same time span as the theories. As a result of the investigations it is suggested that rather than trying to define a set of generic values for architectural quality, it is more relevant to clearly specify the architectural quality in relation to a specific working field with fixed contextual values, and to use as many relevant theories as possible in the uncovering of the issues of the defined working field.

Introduction

Through the last decades of the 20th century and onwards there has been a certain focus on quality and values of our physical surroundings and, as a result, the discussion and the used terminology have been sharpened and nuanced, and the discussion of architectural quality has spread to a wider group of actors, than the traditional narrow group of architects (Jensen, Beim 2006). In Denmark an architectural canon has been created on an initiative from the Danish Ministry of Culture (Juel-Christiansen et al.) and in Great Britain another approach has been taken with the introduction of DQI (Design Quality Indicator), which is an architectural design tool that is used to structure design processes and make sure that the right values are emphasized in the product (Construction Industry Council). Despite, or maybe due to, these efforts the question of whether it is possible and desirable to capture the values of well functioning and poetic architecture remains. The content of this paper is an initial investigation for a PhD project about prefab wooden dwellings and the aim is to point towards a method for working with the concept of architectural quality in such buildings.

Already in the times of the Roman Empire Vitruvius defines architectural quality as a matter consisting of three intrinsically connected aspects – *utilitas*, *firmitas* and *venustas* (commodity, firmness and delight) (Kruft 1994). *Firmitas*, and to some extent *utilitas*, can be held up against different standards and recommendations, but aspects concerned with *venustas* is more difficult to measure and therefore the matter of architectural quality is divided into objective and subjective matters – the measurable and the immeasurable. The Renaissance theorists are quite impressed by Vitruvius. Alberti and Vasari are especially fascinated by his elaboration of *venustas* through a division of the matter into six sub-categories and they subsequently build their theories on the same principles, with emphasize on concepts

such as order and proportion (Scruton 1979). This tradition is also present in the 20th century in the Modernist theories; which can for example be seen in Le Corbusier's *Modulor*. (Scruton 1979). Later in the 20th century order and proportion is also used by another school of thought – perception psychology. However, the focus of the perception psychologists is less on the particular house or the working process of the architect. Instead they focus on the mind of the human being; on the matter of how the brain and chemicals in our bodies react to stimuli from the outside world (Lund 2001). According to perception psychology the aesthetic values are generic and objective. Hermeneutics and phenomenologists on the other hand claim the opposite; that the experience will be different for different persons because of different historical, cultural and personal horizons (Lawson 2001, Norberg-Schulz 1963). These three theories represent a wide span of formal and aesthetical approaches; Modernism, and in particular the early Modernism, strives towards the pure lines and shapes, with as little impact as possible from the used material, whereas phenomenology is very concerned with different aspects of materials and materiality – early Modernism focuses on sight whereas phenomenology spread out on all the different senses. Later Modernism and Functionalism moves towards the Phenomenological view, and the play between shape and materiality gets increasingly important. In this paper the early Modernism will thus be used as a contrast to the Phenomenological school, and the later Functionalistic and Modernistic movement will be mentioned within the framework of Phenomenology. The three theories will be used to analyse pieces of architecture, which represent the spirit of the theories respectively, in order to clarify and exemplify similarities and discrepancies between them. This analysis will subsequently be discussed in relation to the idea of operationalising architectural quality.

Theoretical foundation

The logics of architecture – early modernism

“Harmony, unity.

The lime is one of our most noble trees.

The harmony in its canopy we rediscover in the strings of the leaves.

Unity.” (Author’s translation from Danish) (Le Corbusier 1945)

Le Corbusier is one of the most exposed and radical architects of Modernism. He builds his theory on the rationalistic European tradition, which has its origin in the Greek mathematics and building and is brought up to the 20th century by the Renaissance architects (Zevi 1978). The challenge for the architects working in the first decades of the 20th century lies in efficiently rebuilding Europe after the first World War (and subsequently also the second) and cutting loose of the restraining doctrines of style and thus create an architecture that fulfils the needs of modern man without having to devote to a specific type of decoration (Cornell 1968, Frampton 1992). The mission of Modernism is thus both an aesthetical ideal and a social program (Cornell 1968). This is for example well demonstrated in Le Corbusier’s series of Puritan Villas in the suburbs of Paris, of which the last, and maybe finest, is Villa Savoye. Furthermore the introduction of a fourth dimension in architecture means that the inflexible rooms of classical buildings, which are seen from one perspective, are replaced by floating and undefined spaces that are to be experienced from many different viewpoints and as a continuous series of experiences (Zevi 1978). One of the most refined examples of this kind of floating spaces can be seen amongst Mies van der Rohe’s works; he uses one single element – the slab – as roof, floor and wall, but by using different materials in combination with each other amazing effects of poetic and fluid spaces are achieved, such as seen in his Villa Tugendhat in Brno (Cornell 1968, Frampton 1992, Zevi 1978). Here the walls and windows

are not distinguishable as in classical architecture, but are rather seen as necessary screens that partially defines an indoor space, but just as much indicates the relationships and connections between the inside and outside spaces (Cornell 1968).

Keywords: *clear proportion and order, aesthetical and social program, architecture as a dissolving frame*

The perception of architecture – perception psychology

In perception psychology aesthetics is not seen as an innate quality of artefacts, but something added or formed by the human mind (Arnheim 1974, Smith 1979). By means of psychological experiments two different aspects have been established as central in the human experience of space – unity and variation. Human beings need variation in order to be satisfied; the amount of variation that is satisfying is individual, and the challenge is to find the level that satisfies the majority. The matter of unity is seen when the different parts in a house, a work of art or a piece of music seem entirely interlaced as one single united body. The balance between the two matters of unity and complexity can for example be seen in smaller and older towns, where the houses are not identical, but the overall expression forms a unity. The variation within a certain framework of unity is probably why these small towns are so appreciated (Hesselgren 1977). There are four levels of aesthetics sensibility, but common for them all is that they relate to balance and harmony (Smith 1979). Balance can be described as the state where no change seems possible – nothing further can be added or subtracted without destroying the unity of the whole (Arnheim 1974, Smith 1979) – whereas harmony is a state of at least two entities that are neither exactly identical, nor different to an extent that one dominates over the other. However, if balance and harmony were the only parameters, then the preferred art would

be perfect cubes or evenly stained canvases (Arnheim 1974). Since this isn't the case, there has to be something more in the equation – there has to be some tension or dynamics. However, in architecture nothing actually moves physically and therefore the concept of dynamics has to be metaphoric. (Arnheim 1974). There are no clear examples of architecture which has been developed on the perception psychological theory as such. However the Postmodern movement, which is contemporary with perception psychology, also focuses on form and is not founded on technical and practical reasoning (Lund 2001). A typical example is the house for Vanna Venturi in Chestnut Hill, which is regarded the first Postmodern house, and subsequently also the first house in which Robert Venturi's clearly demonstrates and explains some of the aesthetically founded Postmodern principles.

Keywords: *Unity and variation, balance and harmony, dynamics*

The experience of architecture – phenomenology

Proportion of shapes, and between shapes, is a fundamental parameters in architecture. As in music, there seems to be some geometrical proportions that are more pleasing to our mind than others (Rasmussen 1966). However, the rules of harmony or disharmony in architecture are not as simple as in music, and a shape, that in itself seems strangely proportioned, can through repetition or combination with similar shapes form a larger well proportioned composition through the concept of rhythm (Rasmussen 1966) Quality is, from a phenomenological perspective, seen as the nature or essence of an object (Norberg-Schulz 1963) and the creative process is the challenge of unveiling this essence – to reveal something that already is through the mastery of the architectural language, (Norberg-Schulz 1963). In order to reveal something in a distinct and understandable manner, it is

necessary to create conformity between the components and the whole (Norberg-Schulz 1963). Nothing appears as an isolated object, but everything is defined through the relationships to the surroundings through the four fundamental contrasting relationships: up-down, forward-back, heavy-light, and static-dynamic (Norberg-Schulz 1963). However, there are many things that can not be comprehended by use of sight only, such as the heaviness of a church door, the coldness of an Italian marble floor, the sound reducing properties of a soft wall cladding or the smell from a newly washed wooden floor (Pallasmaa 2000). When seeing an object we thus immediately try to understand it from as many different perspectives as possible; we see, listen, smell, touch, or maybe even taste it in order to connect the sensations of it into a unity that we, with help from memory, can recognize. Our experiences of the surroundings are thus multi-sensory and architecture should support this by consciously involving sound, smell and texture in the composition of spaces. Many of the later Nordic Modernists have used this philosophy of multi-sensuousness in their works, among these are Alvar Aalto often mentioned as one of the most prominent. His Villa Mairea is an experimental project that is elegant and rational at the same time as it is emotional, organic and romantic in its mix of hard white plastered brick walls and finely detailed and undulating constructions in wood (Lahti, Jetsonen 2005).

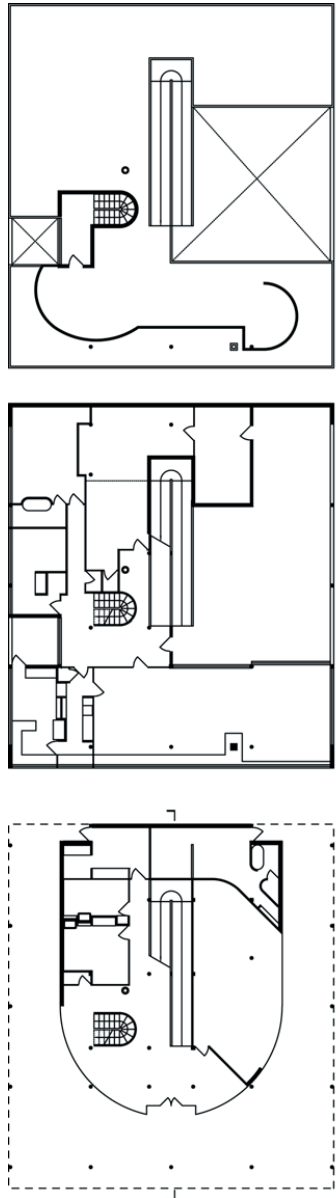
Keywords: *Rhythm and contrast, supporting a multi-sensory experience, detail and unity*

Clarification by examples

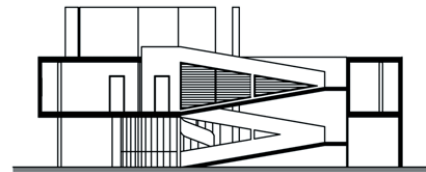
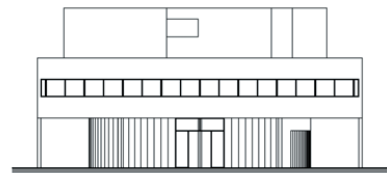
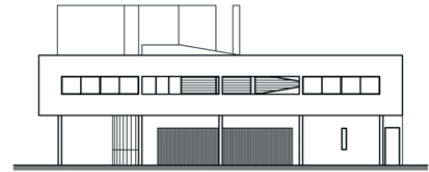
In order to exemplify the similarities and discrepancies between the three theories, the following section will contain analyses of three buildings, which have all been mentioned earlier in the paper. The scale and use of the buildings is the same in order to decrease the differences as much as possible in the offset of the analyses. As

the analyses are very short the small scale and relatively simple program of a single family detached dwelling is chosen. First is chosen one of the icons of modernism – Villa Savoye by Le Corbusier; second a house with a focus on visual

perception – the Vanna Venturi house by Robert Venturi and John Rauch; and third one of the first houses that breaks the general spirit of modernism and moves into the specific, the local and the tactile; Villa Mairea by Alvar Aalto.



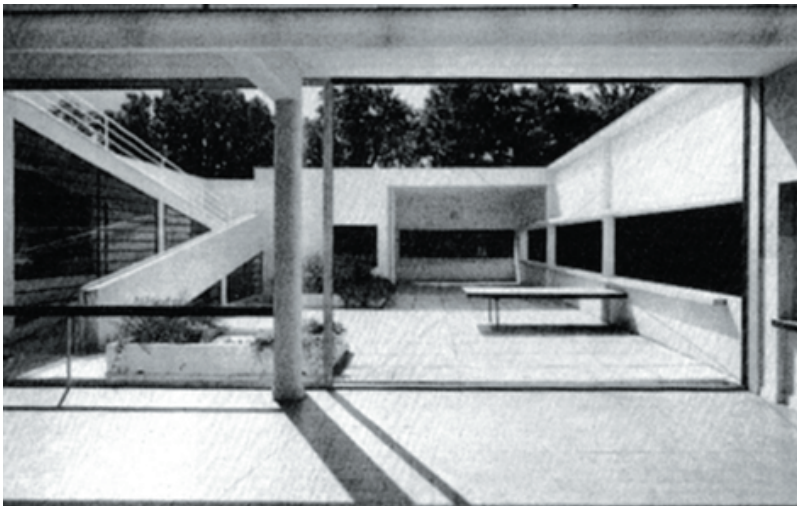
Top: Second Floor Plan, Middle: First floor plan, Bottom: Ground floor plan (Davies 2006)



Top: Northwest elevation, Middle: Southwest elevation, Bottom: Section A-A (Davies 2006)

Le Corbusier: Villa Savoye, 1931 (Davies 2006, Frampton 2001, Sbriglio 1999)

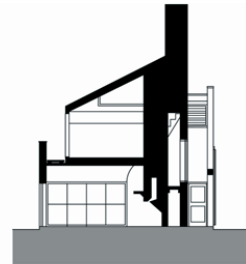
<p>Early Modernism -clear proportion and order -aesthetical and social program -architecture as a dissolving frame</p>	<p>Perception Psychology -unity and variation -balance and harmony -dynamics</p>	<p>Phenomenology - rhythm and contrast - supporting a multi-sensory experience - detail and unity</p>
<p>Villa Savoye has a simple geometry consisting of a box, sized in relation to the maximum gradient of a pedestrian ramp and the minimum radius turning circle of a car. There is not a perfect symmetry in the plan, but in the screens of the facades both symmetry and the Golden Section are used. Le Corbusier's five points are perfectly demonstrated in the villa and it thus reflects the purist and modernistic aesthetic values. It also reflects the modern idea of how dwellings should function as a machine for living. The floating together of spaces is for example seen in the ramp that slowly let the visitor float from one space to another (see section A-A, p.5), and in the relationship between interior and exterior on the top floor where the two of them melt together and the sky and the trees are invited to be part of the architectural experience (see picture below).</p>	<p>The white box of the first floor is a strong element, as it is the main theme and the visually stable core of the façades' composition. It floats on top of the light construction of the ground floor, which adds a tension to the facades. The undulating walls of the roof terrace are adding a striving upwards and contain in themselves frozen dynamics. Balance is reached through deliberate use of symmetry and the Golden Section together with a more dynamic balance in for example the round walls that are found on both the top and ground level, but in different materials (see drawings, p.5), or in the lightness of the protruding first floor that is kept down by the concrete walls of the roof terrace (see section A-A, p.5).</p>	<p>The play of contrasts; light and shadow, rectilinear and undulating, light and heavy, is one of the main features in the villa. These are exposed as polarities through the use of simple and abstract materials – mainly the reflecting and transparent glass and the massive and smooth plastered surfaces. The surfaces thus seem abstract, almost as if in a graphical drawing or painting. The building seems quite machinic and in some ways even impersonal, which probably also is a result of the dogma of the 'living machine'. The Villa is indeed designed down to the smallest part and there is built-in furniture, especially tables. The clean and simple style, or non-style, is seen in every detail of the house as well as in the facades and the overall plan of Villa Savoye.</p>



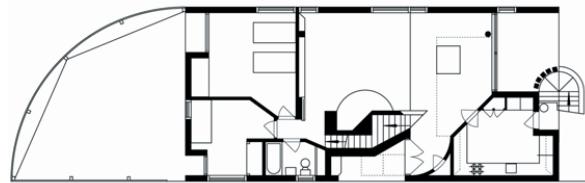
The floating border between interior and exterior in Villa Savoye (Frampton 2001)



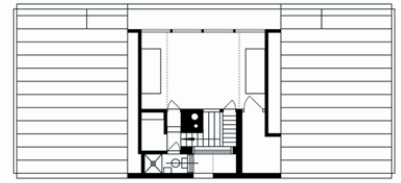
Long section (Davies 2006)



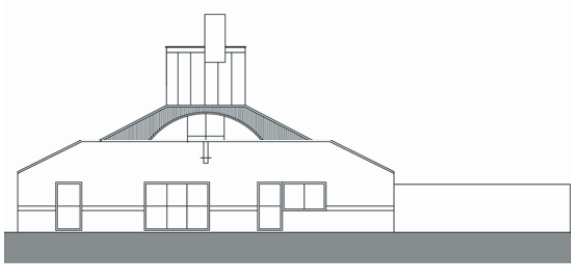
Cross section (Davies 2006)



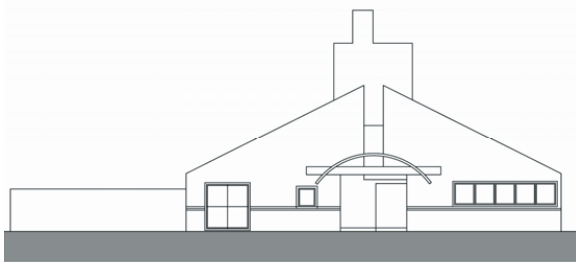
Ground floor plan (Davies 2006)



First floor plan (Davies 2006)



Rear elevation (Davies 2006)



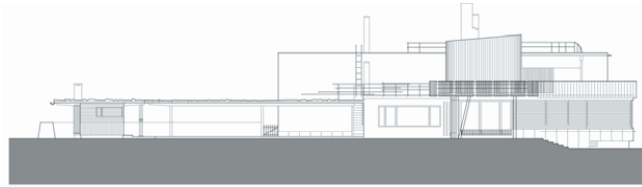
Front elevation (Davies 2006)

Venturi and Rauch: Vanna Venturi's house in Chestnut Hill, 1962 (Davies 2006, Venturi 1966/1977, Scully, Venturi & Rossi 1992)

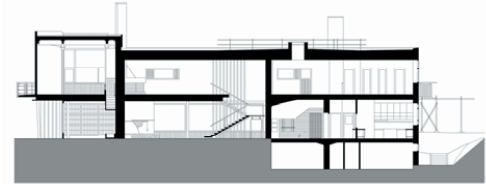
<p>Early Modernism -clear proportion and order -aesthetical and social program -architecture as a dissolving frame</p>	<p>Perception Psychology -unity and variation -balance and harmony -dynamics</p>	<p>Phenomenology - rhythm and contrast - supporting a multi-sensory experience - detail and unity</p>
<p>In this house the architects have not tried to be unambiguous and consequent, but have rather striven for complexity and contradiction. There is a clear order in the façade; it mimes the archetype of a house with the shape of the roof and the chimney, but the order is disturbed by for example the window placed at the centre of the chimney-like element (see front elevation, p.7). The Golden Section can be seen in parts of the composition, although it is veiled by other compositional principles. The building is an experiment of shapes and architecture in itself rather than of the relationship between architecture and contextual matters. The building is not an example of architecture with floating spaces; it is rather the materials and shapes that form the spaces, that are in focus.</p>	<p>The play of unity and variation seem to be a main theme in the building. The overall concept is clear theme of the exterior – the archetypal dwelling with sloped roof and oversized chimney (see drawings, p.7) – whereas on the inside the single elements such as the fireplace and the stairs are seen as individual formal elements (see picture below). On an overall plan balance is reached through a play between a smaller dense area and a larger open section (see floor plans, p.7). Even though the main exterior theme relates to the symmetry and order of classical architecture, the building contains a large portion of dynamics. In all elements there seems to be a movement. This is reached through the use of diagonal lines and symmetry and balance between similar, but not identical, elements.</p>	<p>There is a definite play of contrasts in the building. In the façade there is a play between the heaviness and lightness; the splitting of the archetypal house mass and the floating of the massive chimney (see front elevation, p.7). The house does in some ways support multi-sensory experiences by using different materials on the floor for different functions and areas, which can be argued of course visually, but also acoustically and tactile. The relationship between detail and unity might be the total denial of a need of congruity between detail and unity, which is one of the corner stones in Postmodern architecture. Every line, object, surface or volume is there for its own sake and is a part of a composition, but not in a way through which the likeness is manifest, but rather in a way through which contrast and contradiction is appearing.</p>



The fire place and the stairs seen as individual elements in the interior space (Scully, Venturi & Rossi 1992)



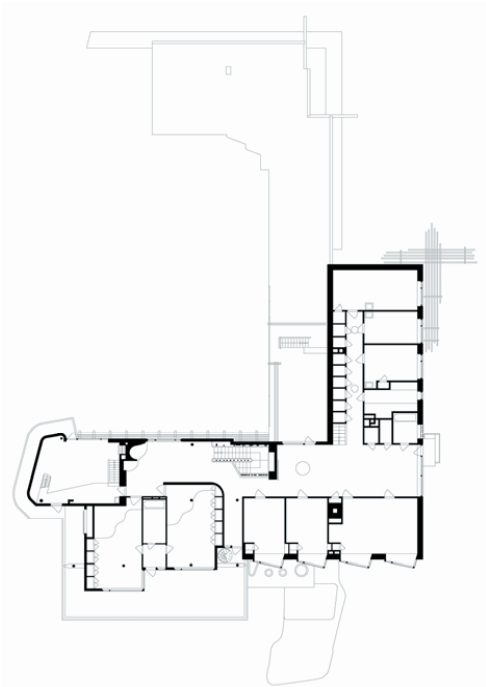
Southwest elevation (Davies 2006)



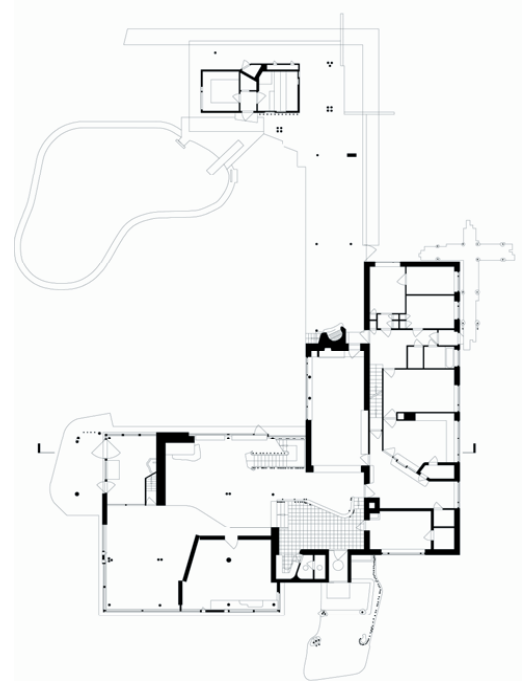
Section A-A (Davies 2006)



Southeast elevation (Davies 2006)



First floor plan (Davies 2006)



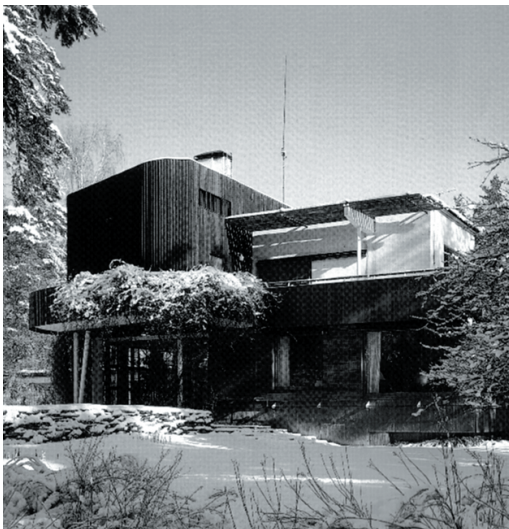
Ground floor plan (Davies 2006)



The bay windows indicates a rhythm (Lahti, Jetsonen 2005)

Aalto: Villa Mairea, 1938-1939 (Davies 2006, Gullichsen et al. 1998, Lahti, Jetsonen 2005)

<p>Early Modernism -clear proportion and order -aesthetical and social program - architecture as a dissolving frame</p>	<p>Perception Psychology -unity and variation -balance and harmony -dynamics</p>	<p>Phenomenology - rhythm and contrast - supporting a multi-sensory experience - detail and unity</p>
<p>There is no clear proportion or order when looking at the facades of Villa Mairea (see elevations, p.9). However, the plan is quite simple in its composition; it has a simple L-shape, with a central entrance hall and the larger square for the family rooms and the smaller for staff, offices and guests (see floor plans, p.9). The Villa both relates to different architectural traditions – the Finnish, the Japanese and the Modernist – but it also has a foundation in Aalto’s rationalist manifesto from 1930 <i>Our Housing Problem</i>, which is in particular seen in the flexible spaces of the ground floor. The spaces are delicately interconnected through materials, flows and well elaborated transitions between inside and outside, private and public.</p>	<p>The materials; the wood, the white plaster and the tiles, and the play between the sharp and the undulating shapes are the main themes in Villa Mairea and this is also what define the unity and the variation (see drawings, p.9 and left picture below). In every element, as well as in the total experience, there is a play of contrast. In the exterior there are the angular boxes that tie the building to the ground and the softly curved northwest wall that lifts the building and adds to the dynamics (see left picture below). In the interior this can for example be seen in the shaping of the fireplace (see right picture below) or the composition of the stairs. This constant, but delicate, play between contrasts gives the building its dynamics, and variation, but within a certain field which makes Villa Mairea seem well balanced and harmonic.</p>	<p>There are many kinds of repetition and rhymes, which give the façades rhythm and order; for example the bay windows (see picture, p.9) in the larger scale and the vertical wooden cladding, in the smaller scale, that break the white and smooth plastered surfaces with soft, but yet firm rhythms. When moving closer to the building, even the plastered surfaces have a rhythm that they inhere from the underlying bricks from which the walls are built. The materials are used for giving character to the different spaces. They have so many details and embedded structures that you feel the urge to get closer – or farther away – to move around and experience it with more senses than just your eyes. The main themes are elaborated, in the details as well as in the total experience, and thus it seems as a strong and coherent unity.</p>



The undulating wooden wall and the plastered box (Gullichsen et al. 1998)



The fireplace contains both angular and organic form elements (Lahti, Jetsonen 2005)

Through these overall analyses it can be seen that all three buildings contain a high degree of architectural quality, as they fulfil the complete set of keywords for at least one of the theories. Though, none of the buildings fulfil the demands of all three theories. From the perception psychological view, all three buildings are considered of to be of high architectural quality, whereas from an early Modernistic point of view neither Villa Mairea nor Vanna Venturi's house is of high architectural quality, and from the phenomenological point of view neither Villa Savoye nor Vanna Venturi's house is reaching the demands. Is perception psychology then the lowest common denominator, or is it a perfectly objective way of looking at architecture? When it comes to the matter of pure aesthetics and how human beings respond to different shapes, colours and spaces, perception psychology provides a solid basis, but only one of Vitruvius' three points – *firmitas*, *utilitas* and *venustas* – is taken into consideration. It is thus necessary to relate to other matters in order to get a full overview of the architectural quality of a piece of architecture. Some of these can be found in the Modernist and the Phenomenological theory. In the Modernist theory the matter of the connection to society, the context and the user is crucial, whereas in phenomenology personal experience that draws on all senses as well as association, culture, history and memory is a corner stone. However, both of these theories contains parts of the perception psychological view – seen in these analyses are for example order and proportion in early Modernist theory, and rhythm and contrast in phenomenology, but they are combined with an overall perspective relating to matters that are outside of the concrete composition of spaces, shapes and colours. These wider perspectives cause architecture to expand and place it in larger context than the one of pure aesthetic composition and evaluation. But at the same time, the field of aesthetics is shrunk, as the theories also promote a *specific* kind of aesthetics; Modernism by, for

example, introducing the concept of architecture as a dissolving framework, and Phenomenology by suggesting a support of multi-sensory experience. This kind of statements relate to a specific stylistic movement which the theory of perception psychology does not have. This might be the reason why there are no examples of perception psychological architecture. It is possible to use perception psychology as a tool for analysing the basic compositions of spaces, shapes and colours. However, in order to make it useable in the sphere of architecture it is necessary to add more to the analysis in order to get a full overview of the architectural quality. On the other hand it is important to be aware of the stylistic statements in the theories that include more subjective matters. These might be able to give a different perspective of the quality of a building, but the identified qualities might then reflect momentary values related to a specific time, place, or group of people. In order to then understand the full quality, it is also necessary to build an understanding for those specific times, places or groups of people. A full overview of the architectural qualities of a piece of architecture is thus not possible to present. What is important is instead to clearly identify the point of interest and then elaborate on that specific field with use from as many relevant theories as possible in order to open up the wider perspectives hidden inside that delimited field. Within this elaboration should be covered the matters of *objective/universal experience*, *subjective experience* (personal abilities, needs, dreams, memories and associations), and different *contextual factors*, such as culture, style, economics, society, technology and site (common abilities, needs, dreams, memories and associations). Universal architectural quality is therefore not a realistic measure as the reduction to objective statements will, inevitably cut away for example subjective association and cultural heritage. On the other hand an attempt to define a more subjective system of measurement will involve an evaluation

dependent of time, place, technology and culture, which are variables and thus momentary.

Conclusions

The concept of architectural quality is as old as architectural theory. The first known written definition is the one of the Roman builder Vitruvius, whose main idea lies in the triad of *firmitas*, *utilitas* and *venustas*. Through the last centuries the conditions for architecture have changed, for example through the processes of industrialisation and globalisation. These processes have supplied a breeding ground for multiple theories of what architecture is, where the values and qualities of architecture can be found, or how those can be defined. This widening of the theoretical field has also led to focus on quality in our surroundings and daily environment, spanning from household product to city planning. The discussion has spread to new groups of people; the user are now discussing the matter of quality whereas earlier this discussion has, more or less, only been present within groups of architects and designers. In this paper the diversity and multi-layered character of the matter architectural quality is discussed through the perspectives of three theories from the 20th century, which are quite different in their approaches to where to find the matter of architectural quality; early modernism, perception psychology and phenomenology. The three theories are subsequently compared through analysis of three buildings with help from chosen keywords from each of the theories. Through the analysis it can be seen that the buildings are being evaluated quite differently when using the three different theories as offset. All of the building can be said to be of architectural quality, as they fulfil all the keywords for at least one of the theories, but none of the buildings fulfil all of the theories' demands. Perception psychology, however, accepts all houses as being of architectural quality. But the quality described by perception psychology has only focus on the visual aspects of architecture – that is, architecture is seen as a pure aesthetic

matter. However, when speaking of architecture it is not specifically relevant to discuss the aesthetics as a completely isolated unit, as the deeper meaning of architecture is to house some functions, to be a framework for different activities, and to be a durable construction in relation to for example use and climate. If architecture does not relate to function and construction – *utility* and *firmitas* – it loses an important part of its essence and rather gets a character of the more figurative art, such as painting or sculpture. When relating a piece of architecture to a function, we will always put ourselves into the given frames and imagining how we would act in these frames in relation to the assumed function or activities ('I could not imagine that it would be a good experience to sleep in such a glass box; it would be too warm, and I would feel as if I were living behind a display window', or 'this room seems too small for being a ceremonial hall; it will quickly seem crowded and claustrophobic'). At the same time, we might think that the rooms are aesthetically beautifully proportioned and in perfect harmony with its use of materials, textures and colours – we just cannot see the seemingly relevant activities taking place here. These kinds of values will both be tied to the place, the time, and the person, and the more of those factors we try to define and cover with a theory, the more complex it gets, and thus also less operational or manageable. It is suggested that instead of trying to draw up a complete theory or definition of architectural quality as a generic set of values, it is necessary to specify a working field through defining a set of specified values of for example typology, time, style, material or context. In order to open up the issues of the specific working field it is necessary to use as many of the relevant theories or perspectives as possible in order to cover the *objective/universal experience*, *subjective experience* (personal abilities, needs, dreams, memories and associations), and different *contextual factors*, such as culture, style, economics, society, technology and site (common

abilities, needs, dreams, memories and associations). In the further work within the field of architectural quality in prefabricated wooden dwellings there will be put focus on what specific factors that could be relevant to analyse this specific typology in a Danish contemporary context. First prefabricated, and thereafter wooden, dwellings will be analysed. This will lead to a discussion of what architectural quality is *in relation to* prefabricated wooden dwellings in a Danish contemporary context, but trying to define what the architectural quality of such buildings are in relation to any generic method, theory or definition is not found to be a rational and manageable aim for this project.

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