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Modern architecture in a life cycle perspective



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Summary

By confronting the mistakes from the Modern Movement, the ideas of modernistic architecture are under pressure. This paper will summarize the primary architectural mistakes of the mono-functional thinking in planning and building and the non-appropriate environmental dispositions of the big plans from the 60s and will suggest a holistic and broader life-cycle perspective on housing from the welfare society.

On one hand, we care for the strong Modern Movements manifestoes in the form of architectural heritage. On the other hand, 600.000 dwelling-units in Denmark are suffering from degradation and are inhabited by society's most vulnerable people. The housing schemes are directly influenced by the fragmentation of the planning in a divided and segregated city. These 'Modern Cities' have suffered from stigmatization ever since they were built.

A positive development in society is that these living areas are now undergoing huge transformations. Add to the physical change the huge effect transformations as a tool has on the inhabitants' self-understanding and on increasing their feeling of ownership for the changes.

Cases from Denmark will demonstrate, compare and present perspectives of contemporary architectural transformations on city level and on housing level. The transformation goals are to secure the economy and the social and the environmental aspects in the transformation's life-cycle perspective in order to make the buildings and the districts interact with and adapt to society.

The conclusion points out the architectural consequences of prioritizing in the transformation process the social parameters higher than the original rigid architectural theories.

Keywords: Modern Architecture, mistakes, building culture, transformation, qualified expression

1. Introduction

This research is part of the research project 'Sustainable Transformation' at Aarhus School of Architecture. The project deals with the actual transformation of the housing areas of the welfare cities built in Denmark after WWII. The current focus is the conversion of the big plans built in the period 1960 - 1973 representing a relatively homogeneous typology of the housing blocks organized in green parks in the suburbs of the Danish cities. The project involves networking with the owners, the consulting practices, the Nordic RENORD, the Nordic Passive House and others..

1.1 Adaption as main criteria of the research

The assumption of this research is based on the fact, that those cities, their social spaces and their buildings are forced to adapt to the current lifestyle and the environmental evolution in order to create affordable settings for quality life. This means that cities, urban spaces and buildings should, through sustainable transformations, narrate not only their origin but also the contemporary and future stories of inclusive, responsive and secure living spaces.

1.2 Architectural ideas of the Modern Movement implemented into a Danish context

When le Corbusier in 1920s in his book "Towards A New Architecture" foresaw the 'New Architecture' as a mass-production of houses, he was inspired by the new technologies and materials: reinforced concrete as a construction material that could meet the huge demands of providing housing for the new cities. The building process was based on industrialism, and the existing craftsmanship was now considered old fashioned. Modern methods and a non-decorated appearance formed the modern architecture that would match the modern lifestyle. The masses should live in huge living machines in green landscapes, transportation between home and work would require mass-produced automobiles, and the modern life should unfold in cities and houses of modern fashion [1]. The architectural language spoke its own international and strong language, for producing society, repetition and equality was the ideal.

The modern ideas were spread worldwide. The adaption of the modern ideas was typically diluted to a Danish architectural translation where form, construction and materials refer to the local way of anticipating the actual task [2]. This dilution also affects the cases of this research. It was not before 1960 that the idea of a modern architecture was generally realized in Denmark, when the lack of housing for everybody led to a huge demand for new dwellings. 'Montage cirkulæret' was published in 1960 by the Ministry for Housing [3] providing a common foundation for speeding the development of the building sector. Housing organizations together with some of the most skilled architects took responsibility for developing the new field, and the Danish welfare city where born. Skilled craftsmanship was substituted by industrial workers and industrialized systems, and concrete prefab panels and modern building techniques using cranes were introduced.

1.3 Case studies and typology

The image of the Danish suburbs was strongly expressed in the housing areas of the 60s and beginning of the 70s: the buildings were articulated as "modern fashion" [4]. The new development provided a significant influence on the building sector, and this building habit lasted until the first oil-crisis in 1973. The South Jutland Plan as a typology from that time, both regarding the layout of the settlement and the three to four story social blocks is the object of this paper. The modern ideas are here translated carefully in the Danish context by architects Alice and Børge Kjær [5]. The spatial qualities and their interrelated functionality were investigated and shaped into dwellings assisted by the new State Building Institute. This specific building type is widespread in DK and represents 24.000 dwellings [6]. The transformation of this type narrates a characteristic example of the current changes of the welfare buildings of the modern movement.

1.4 Life cycle perspective - definition

Through history, several stylistic periods can be identified in our building culture: the narratives of this evolution are important as a cultural treasure of living and working-life in Denmark. This ethical building-cultural manifestation challenges the technical definition of the term 'life cycle': the term was first applied in biology, but has gradually penetrated into research within cultural aspects [7].

Life cycle as a term is here treated as a cultural research terminology [7], where the housing schemes are holistically evaluated for their ability to adapt to contemporary demands for livable cities and housing for people. Cultural aspects are commonly considered impossible to measure, but will here be discussed as human and sensible qualities within this humanistic research.

1.5 User character and social efforts

The public housing associations own approximately 600.000 dwelling- units in Denmark. This part of the housing market is public subsidized. Housing associations organize all business and building developments, they organize economy and retrieve subsidizing loans from the state.

This segment of housing is intended for all people who need an inexpensive flat. A growing group of inhabitants are among the society's most vulnerable people; people who are directly influenced by the fragmentation of planning in a divided and segregated city. Society's stress factors are often seen in these parts of the city.

Once a year these types of schemes are evaluated by means of a government list of the most

socially challenged settlements: the list is based on social factors and results in the so called 'ghetto list' [8]. The list points out housing areas that heavily need housing- social interventions in terms of upgrading both housing quality and image, and the overall layout of the site situation. Figuring on this list results in various economic subsidizes aimed in changing the current status. The goals are retrofitting and raising the value of the overall housing schemes. It obviously cannot be denied that the effort to avoid this list is a driver for more transformation activities.

2 Methodology

This paper takes its departure in the profane buildings of the 60s and 70s from the 20th century and presents two comparable retrofittings of the same building type, i.e. namely The South Jutland Plan (Sydjyllands- planen).

The methodology used will review the architectural heritage and confront the cases with the actual demands for integration and adaptability. Likewise, the author has interviewed owners and tenants from the public housing movement in Denmark.

The case studies will be analysed and compared: it will be discussed how a range of important parameters concerning the architectural expression and the functional values provide foundation for the choices of the transformation design.

Through the paper it is investigated to what extent the ideas of the Modern Movement are respected. How is the architectural heritage treated? How is the validation and preservation dealt with to sustain future identification and livability in the social community?

3 Mistakes in Modern Architecture for a Sustainable Transformation

In the recent 10-15 years, many attempts have been made to identify the mistakes of the housing schemes from the mentioned building period. The analysis of the actual degenerated conditions of individual projects is often mentioned and documented at conferences and in literature.

3.1 Planning parameters at city level

These housing areas are situated in the suburbs outside the compact city. The layout of the settlement plan is designed according to the modern movement's ideas, but in a Danish context the architectural ideas are thinned. The design parameters are expressed with responds to air and sun and green areas and are expressed in the three and four story blocks situated in a park landscape. The traffic is differentiated: the periphery is reserved for cars, and people can move freely between the blocks, institutions and shops without crossing car roads. The results of this strategy can be described technically as a meta-roundabout with 'dead end' roads ending in parking lots. In theory, this protects the pedestrians and the soft traffic users, but in practice this arrangement leads to a risk of violence and vandalism. When applied to large scale settlements, there is an increased risk of creating unsecure areas, and the plan is therefore not sustainable.

It is also important for the planning to secure the internal path and road connections to other parts of the community, in order to make the city system transparent and to invite outsiders inside the modern settlements [9].

We often see that the areas are from the outset designed without shops, institutions or places for recreations in a diluted way caused by lack of funds. Mono-functionality characterizes the housing area.

We often see a lack of public spaces such as city squares and indoor and outdoor open common spaces and recreational areas. But it is common architectural knowledge that cities need to contain spaces for necessary activities, such as paths for moving from A to B, spaces for optional activities, and spaces for social activities. In a local city plan these three aspects shape the design-solution aimed at creating wellbeing for people and provide opportunities for meeting people unexpectedly [10]. These unexpected meetings are an extremely important parameter for wellbeing.

3.2 Architectural parameters at building level

3.2.1 Architectural heritage versus weathering and lack of comfort

The architectural heritage from this period is extremely clear and strongly articulated and has seen a growing public interest in these years. But the buildings have weathered very poorly, being built from imprecise panels, not assembled in a robust way, and renovated in the 90s in a very poor manner. The original constructing material is reinforced concrete, which through the years has weathered to a poor appearance, and is also constructed as an imprecise and thin layer covering the reinforcement. The surfaces are damaged by frost and have visible rusted areas. The retrofitting was done in the period of post-modernism with lousy materials and with a very low degree of insulation [11]. The results were a very bad indoor climate with thermal bridges, cold indoor surfaces, humidity and mould damages, which made the buildings unhealthy to live in. The assembly of the panels causes noise problems between dwellings.

3.2.2 Dwelling quality

The spatial design expressed in the dwellings is well organized, they were built upon the knowledge of functional ideas and are carefully studied in details regarding daily life. A flexible and robust building system makes it possible to change the indoor functionality to nice and modern dwellings [12]. Both praxis and written sources describe the dwellings as meeting contemporary demands [13]. It is proven that very simple rebuilding can change the specific home to a more open and modern spatial concept, which means that the building system is to a moderate extent flexible.

3.2.3 Facades and appearance

Solving the obvious issues with the surfaces, the poor insulation and the indoor climate challenges requires a technically efficient wrapping strategy [14]. But to wrap these houses also demands a reflected attitude to the architectural heritage of our suburbs. These two points of view may seem contradictory.

When le Corbusier described his future ideals in his five points of modernity [15], he included the potentials of the free facade: a wish to allow the façade to elaborate freely and with no boundaries the transitions from the inside to the outside, and also relate to and celebrate the view and the beautiful sight. This demand to the modern building in this housing typology resulted in a structural system for the panels, where the entire loadbearing system is established indoors as either columns or as transverse walls perpendicular to the facades. As a result, we see how the whole facade is free to be renewed to a modern standard [16]. The only obstacle is the responsibility to the architectural heritage: it is in this "design space" that the current architects have to find their answers to transformation.

Already in the 90s we saw the first renovation of the facades and glass covering of the balconies in order to hide the "diseases" of the poor building techniques: the cold bridges were not eliminated, but weakened by thin layers of insulation on the facades. The buildings were supplemented with glass cladding to the south or west balconies. The style of the covering was often influenced by the postmodern movement expressed by decoration and bright colours, yellow, blue and green.

In the construction of the facades lay the appearance of the complicated climate screen.

3.2.4 Energy efficiency and co-benefits

In the period 2004 to 2010, the energy question developed into extensive discussion: the EU demanded reductions of energy consumption to a "nearly zero energy" level for all the member states [17]. Unfortunately, the energy reduction in the building screen is not highly prioritized in Denmark in relation to these renovations. This is argued by the restrictions on financing and the decisions taken to fulfil the actual building code and not pushing the innovation forward towards an optimal solution. In this perspective one might foresee a new renovation in the perspective of this restriction.

However, the questions of qualified indoor comfort and the tenants' views on the aesthetics and the sustainability will play a huge role for the decisions makers. In every single case the discussion

about transformation is taken depending on the client, the tenants and the consultants. It is not a professional question about which strategy or how to respect the Corbusien expression as a fundamental attitude to the renovation. The question is reduced to a technical challenge and at the same time to creating a design of long lasting materials and detailing within an economy, the tenants can afford and appreciate.

4. Sustainable Transformation: case studies and evaluation

4.1 Same building system – different architectural approach.

Based on the origin of these buildings, the housing organisations decided to standardize and mass-produce dwellings in order to secure good quality and reasonable prices. The dwellings were spacious and had nice, huge balconies. But the layout of the city plans quickly became a subject of debate. The city scale was larger than the existing city scale and this differentiation was not popular [18].

Table 1 briefly informs about the two cases [19], which are constructed using exactly the same loadbearing system (Fig. 1), all panels are module based, even the kitchens and other cabinets are designed using furniture modules of a very high quality.

Table 1 Overview of two transformations

	Year of original building	Year of latest transformation	Amount of dwellings	Dwellings rebuild	City plan + activities	Institutions
Gyldenris- parken	1964 – 66	2008 – 12	432	Merging the number of smaller flats	Square Upgraded paths	Kindergarden + Childrens house Nursening home Supermarket
Langkær- parken	1968 – 73	2014 - 16	783	Rebuild for elderly	Square + Rambla Upgraded paths	Community house

The two transformation cases offer challenges and an ideal opportunity to show diversity in the choice of design answers for highlighted renovation designs. Both renovations represent the wrapping transformation strategy at building levels and are also chosen because of the different types of layouts. The demonstrated negotiations, decisions and design choices lead to several basic findings, which can be addressed in future conversions of housing areas.



Fig. 1 Layout- principle, original entrance and gable and balcony facades from a hiring brochure

4.1.1. Gyldenrisparken

The scale of the housing area is large, and the community has the opportunity to relate and interact with the city Amager/Copenhagen which is optimal. The transformation is here combined



Fig. 2 Gyldenrisparken- layout, entrance and balcony facade, facade close-up

with a housing social effort in the form of a Social Master Plan. The influence of the ghetto list in practice is obvious [20]. The transformation strategy of the blocks tells the story of a concrete panel house, rebuilt in an aesthetic and responsible way from structured panels, repeating the nudges, which are covered by the wrapping. Institutions appear in other materials and create differentiated city spaces and the whole scheme has a very inviting appearance.

4.1.1 Langkærparken



Fig. 3 Langkærparken- layout, Rambla and square, entrance

Langkærparken is nearly twice the size of Gyldenrisparken and does not have a close relation to the dense city but to the suburb with lots of institutions and a mega shopping centre nearby. As seen in table 1. the housing area is almost mono-functional, and new impressions of city relations have been a very important parameter for the design. The scheme is divided into smaller quarters through three different facade materiality's. A Rambla for pedestrians crossing the central car road just where the new appealing and spacious city square is designed has lifted the impression and given the whole plan a central meeting place for several generations.

4.2 Findings

4.2.1 Planning at city level

The scope of the two transformation cases is comparable. Gyldenrisparken represents a large scale parcel surrounded by centripetal main traffic-roads, supplemented by dead-end parking spaces. A typical city structure of housing block structure transparently frames a green common park furnished with institutions and recreational areas.

Langkærparken originally had a circular traffic distribution and a central distribution street in the middle. Green court yards make up the structure surrounded by housing blocks with few common facilities.

Through the transformations, the degree of variety of the perception of the city has increased, connections to common recreational spaces have been activated and spaces for unexpected meetings have been given high priority. The infrastructural diversity is qualified and you perceive a greater difference and hierarchy when moving around the quarter.

4.2.2 Mono-functionality versus multi-functionality seen in an architectural perspective

The experience of mono-functionality has disappeared, partly because of the mentioned infrastructural intervention in which the city spaces and the building scale narrate diversity. In Gyldenrisparken the diversity of the buildings creates this overall expression, while the mono-functionality in Langkærparken is broken down into smaller quarters by means of material and colour diversity around the local courtyard; also a central square has brought variation to the common areas.

In both cases, the new connections and the differentiated atmospheres of the public spaces create a predominantly safe area.

4.2.3 Building typology and the contemporary transformation

In respect to the desired demographic diversity, a number of small flats in Gyldenrisparken have been merged into new and larger flats with good variety.

As mentioned the flats are spacious and meet the contemporary demand for dwellings. As a solution to the demand for diversity, some flats in Langkærparken have been rebuilt and reserved for the elderly. The access is secured by lifts, and the flat itself is handicap friendly. Smaller changes are designed in the kitchens and bathrooms in order to renew the interior.

4.2.4 Surfaces/facades: how did the architect deal with the design-space?

Two very different attitudes are used in these two designs: Gyldenrisparken has been true to the expression of the panels and the nudges in-between, although the facade is not the actual concrete panel. The fibre concrete is a replacement of the former appearance, the surface has even been given a new and more prestigious treatment with a wave-structure. Add to this that several bay-windows create profiles in the facade: the expression has been raised from the poor, very profane concrete patina, and now creates a more noble visual impression.

Langkærparken's facade responds to the original horizontal window-bands, but expresses the facade as a single mass in black slate, grey zinc or white glass, in order to create diversity between the courtyards. Behind these facades lies a climate screen which is airtight, and the architects have chosen to express this in a homogeneous facade [21].

Neither of these designs succeeds in bringing the facade back to its original expression: both work seriously with creating a new and functional facade. It is debatable to which extent the two are true to the original ideas of the functionalist period.

The balcony facade is treated as open and closed; there is no doubt the open balconies dress the buildings well, but the closed balconies are a strong wish from the habitants.

4.2.5 Energy efficiency:

Both housing areas meet the respective building codes of their time: this is argued by the limitations of the building economy.

The first transformed block in Langkærparken was a mock-up made in order to test a nearly zero-energy renovation. The resulting one to one transformation of twenty-one flats resulted in a more economic model for the rest of the blocks.

In this respect, Gyldenrisparken has been transformed based on a low energy ambition and Langkærparken based on a higher ambition. Both schemes praise their individual decisions, which in Gyldenrisparken are argued in a slim design respecting the building culture, and Langkærparken by a strong and thick energy-saving solution supplemented by the production of energy from photovoltaics on the roofs.

4.2.6 Co-benefit

We are told that allergic people's wellbeing is better now in the Langkærparken than before the transformation.

4.2.7 Users involvement

In both cases the users/inhabitants have been very active in the decision processes and have taken ownership of the retrofitting. The users have been very patient during the building process. At least in Langkærparken, the users lived inside the flats when retrofitting was carried out.

4.3 Discussion

To compare two transformation cases will narrate what the context and the original planning and housing scheme represent in terms of quality and inexpediciencies; the comparison will identify the mistakes of the interventions origin, and will inform new designs related to new knowledge respecting contemporary knowledge in both planning and architecture. The discussion is summarized in three main programmatic interventions:

At the city level, a great effort has been identified:

- the inner spaces of the settlement have been recreated
- the relations to the other parts of the city have been considered, but have been effectuated on a smaller scale than expected
- attempts have been made to create diversity within the settlement's frame

At the building level, the focus is on:

- different ways of handling the climate screen
- the facades narrate, in one case what can be found behind the surface: the story of the concrete panel facades are told with new materials and challenged by nicely designed bay-windows and quality materials. In the other case, the design has found its own expression.
- the entrances express, in both cases, care for a more soft design. This intervention invites the visitor inside and provides contacts to flats at higher levels closer to the pedestrian paths and provides spaces for unexpected meetings.

The picture of the current second generation of renovations is very broad and can, regarding this investigation, be characterized by the following two attitudes:

- repetition of the panel house story, showing the elements and the nudges, although it is obvious that the story is not genuine!
- rebuilding a new industrial system delivery, airtightness, superinsulation and delivering a montage "just in time" from the production place. In this way appearance shows an honest and fully functional energy facade in lightweight materials in order to be true to the new building technology and the wrapping terminology.

Taking the findings from both cases into account it is shown that within a narrow design field and a limited economy a wide range of design decisions have been taken in order to achieve quality that will make the housing scheme sustain an improved life cycle.

4.2 Conclusion

According to the amount of buildings from the period 1960 to 1973, we know that although of second generation transformations have already been realized, many more transformations will follow in the next years because of the huge number of housing schemes and thereby housings from the 60s. But the answer to the architectural design in respect to the architectural heritage is not settled at this moment.

This paper has been worked out under the impression that a huge range of mistakes were made in the early industrial period, and not all are mentioned here. We as building managers are forced to search more for the answers in order to respect the treasures from the past.

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