

# Vernacular passive houses from Aarhus city

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**ABSTRACT:** Danish landscape and Danish building are inseparable. Aarhus is a beautiful city situated in the western part of Denmark, and the eastern part of Jutland. Long house or one wing house is a traditional type of house that is dominant in Aarhus city, and other parts of Denmark, which goes back to the Iron Age, c.2000B.C. The aggressive effect of wind obliges builder to find a practical solution to combat the negative effect of strong wind. Wind breaks around houses is a widespread tradition for determine a better comfort around house and to save energy. The thermal influence on the built form and orientation of buildings has the strongest influence in the countryside.

**Keywords:** Vernacular houses, thermal comfort, functional essential spaces, intermediary spaces

## 1. INTRODUCTION

In order to understand the influence of climate factors on houses from Aarhus, we must notice that the influence of climate is clear on the conception of habitat space in Denmark. Wind and sun are the most important thermal factors influencing habitat space, form and plan configuration lay out, and orientation in vernacular houses in Denmark.

Temperature rate and lack of insulation meant that these houses most of the year needed to be heated by an open fireplace or oven to keep an acceptable indoor comfort for human beings (20-22°C). Precipitation, rain and snowfall for more than 200 days a year is a significant factor in the tradition for steep roofs (45-60°) all over country. [2]

## 2. SPECIFICATION OF HABITAT SPACES

There are three categories of functional habitable spaces specific for passive house from Aarhus

### 2.1. Functional essential Spaces

#### 2.1.1. Living room (Stue)

Rooms for living, dining, etc. are nearly always orientated to the sunny south facade to get maximum warmth from the sun. We can observe that living spaces in farmhouses can be divided according to two types of spaces of which the first is a large living space that had orientation towards the South, and other small buffer spaces which had orientation towards the North.

#### 2.1.2. Sleeping space (Alkove)

Sleeping space for two or more people formed like a wood panelled closet, often placed close to the chimney. The small space inside the (alkove) only needed a minimum of energy support to keep warm



**Figure 1:** The configuration of habitat spaces

### 2.2. Intermediary spaces

#### 2.2.1. "Udskud"

A narrow extension for storage etc. to the facade in windy direction can give extra protection and save energy.

#### 2.2.2. "Vindfang"

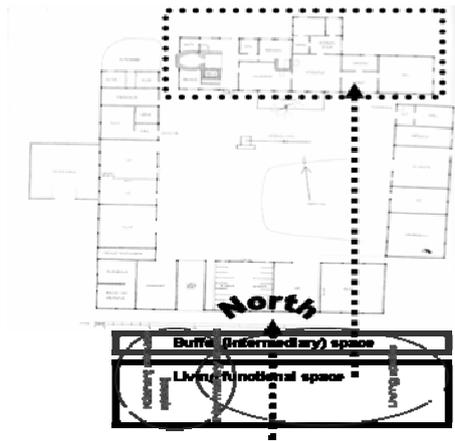
Vindfang is a room to stop the wind – exchange of cool and warm air - between the main entrance and the living rooms to save energy.

#### 2.2.3. Kitchen (Køkken)

Kitchen mostly orientated towards the North facade, the cool side of the house. Store room for food is often situated in the basement to keep a low temperature from the ground (ca. 8°C).

#### 2.2.4. "Solvendt"

In the plan layout the living wing was often placed east / west - (solvendt) - to get maximum sun exposure.



**Figure 2:** The orientation of house functions

### 2.3. Open space

#### 2.3.1. Courtyard (Gaardsplads)

Courtyard is the central courtyard used for practical purposes connected with agriculture. It is in the traditional farm surrounded by wings which can differ from one or two to four depending on local traditions and the size of the farm.

The closed 4-winged farmhouse is the archetype of a Danish "bondegaard". The open gate gives access to the courtyard. The courtyard gives protection against wind from different directions and improves the climate comfort.

### 2.4. Landscape with thermal aspects

In the way the house was placed in the landscape, thermal thinking could play an important role

#### 2.4.1. Leeward (Læ)

On windy places the house was often placed to the leeward of a hill - or dune on the west coast of Jutland.

#### 2.4.2. Windbreak (Læhegn)

Windbreaks around houses is a widespread tradition for determinate a better comfort around houses and to save energy.

### 2.5. Specific architectural elements

#### 2.5.1. Fireplace (Ildsteder / ovne)

Open fireplaces or ovens support the climate comfort in the seasons of the year where extra heat is needed. In the kitchen the open fireplace was used for cooking.

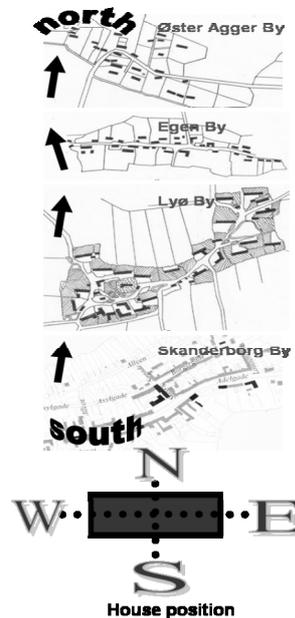
#### 2.5.2. Chimney (Skorstenethe)

Fireplaces and ovens are connected to chimneys placed in the middle of the house as a part of the wall system and open to the air above the roof. The chimney is often placed in a plan strategic way, so it could serve more than one room. In bigger houses up to three or four chimneys was necessary to warm up the whole house.

## 3. VERNACULAR AARHUS HOUSES

### 3.1. Specific urban texture

Urban texture specific for Aarhus is with buildings placed to end, as row houses, to make long, continuous walls that define both the streets and the collection of private open spaces opposite them. The walls of the building not only describe the boundary between public and private, but at the same time they also physically and perceptually define the public streets and squares, the spaces in which the community lives its collective life. Those walls create a clear physical boundary between these two; the urban, hard-edged and social world of the streets, and the natural, soft, private and semi-private world of backyard and garden.



**Figure 3:** Aarhus urban texture

Thus there are two significantly different house plans- one with entrances on the north side, directly from the street, and one with entrances on the south side, through the garden- and three different kinds of gardens-one with public access through its full length, one with public access through a portion near the house (the side access houses), and one in which the garden is completely private. Because of access requirements, the row of houses along east-west streets may be of any length, but there can only be two such rows between the streets.

Rows of houses along the north-south streets can only be two houses wide, but there can be any number of such rows between cross streets.

To achieve due-south orientation for all houses, streets must run north south or east west; diagonal or significantly curving streets will not work. As a result, the lay out of streets must be, at least schematically, a rectilinear grid. Again, the varying physical relationships between houses, garden, and streets mean that the relationship of the particular household

to its neighbors, and to the more public life in the streets, depends on its particular location. Streets are narrow and cobbled, and through they are in a general way laid out to form a grid, in fact each street is different from any other street. The two sides may not be quite parallel; the line of the street may not be quite straight or quite lined up with compass points.

### 3.2. Specific habitat plans

Houses plans in Aarhus had a *retimorphic* plan (in network form) which has the close form characteristic and loop where as reason for relation of unvoiced isn't possible. The proprieties of these structures will be putted in evidence on the land of architectural domain. This shows repartition of living spaces in the form of network.

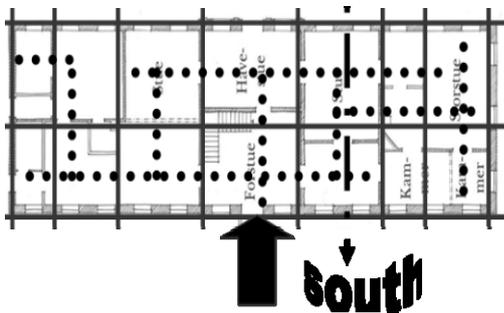


Figure 4: House plan specific

### 3.3. Specific habitat volumes

House form in Aarhus was concept on basis of illustrious volumetric form, tied by geo climatic conditions, which was formed by a graduate of building volumes, starting from that roof with little slope till pointed roofs. [1] The roofs are covered, as a rule with tiles, scales, sieve, shingle, wood board, and sometimes with thatched. Needed to occur an internal thermal comfort that can be occurring by inclinator roof, that intersect in the top (place where accumulates warm air)

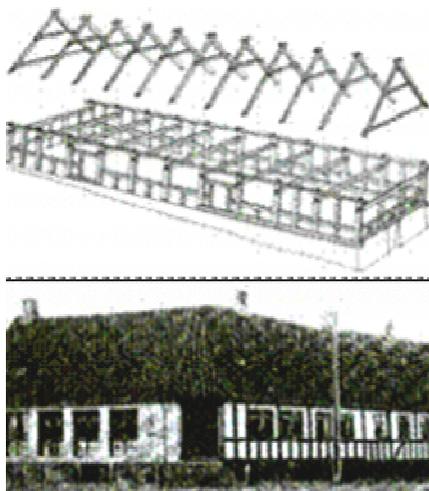


Figure 5: House volume specific

## 4. CONCLUSION

The basic functional structure, construction and materials was nearly the same all over Denmark but could be mixed with local traditions, different materials, and detailing from district to district. The thermal influence on the built form and orientation of buildings has the strongest influence in the countryside. In vernacular houses there is, especially in windy places, local tradition for thermal thinking in using the landscape possibilities; screening from trees, hills and dunes, to save costs from heating. Vernacular houses from Aarhus were built to get better the thermal comfort in the house.

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